Contextual and design factors that influence the use of consumer technologies for self-management of stress by teachers.

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Thesis submitted for the Degree of Doctor of Philosophy

University College London

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Declaration

I, Julia Manning, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

The following work was carried out at University College London, under the supervision of Professor Ann Blandford (Department of Computer Science) and Professor Julian Edbrooke-Childs (Evidence-based Practice Unit, UCL and Anna Freud Centre).

The thesis has not been submitted, in whole or in part, for any other degree, diploma or qualification at any other University. My work was funded by a grant from the Engineering and Physical Science Research Council.

This thesis does not exceed the limit of 100,000 words specified by the degree committee.

Acknowledgements

This research could not have happened without the inspiring teachers who talked to me about their experiences of stress. I am so grateful to them for their time and willingness to courageously discuss personal experiences. Teachers are at the frontline throughout their working day and their sacrificial service is humbling and a testament to their commitment to our children. The exceptional circumstances of the pandemic demonstrated this further. One teacher in particular, my husband Clive, assisted tirelessly throughout this research. I am in awe of his outstanding commitment to enabling young people to thrive regardless of their circumstances and despite the enormous pressures placed upon the teaching profession. His constant support for me during the years of this PhD has been phenomenal. He has added so much joy to this journey and I am more grateful than I can say.

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I believe in the potential of digital to improve health outcomes, but that we should empower people without exploiting their data and create connections without cutting contact. One learns with a PhD, if not already known, that we see through a glass darkly. Life is complex and enigmatic, but awesome and fascinating. It is an extraordinary privilege as a mature student to be able to take time away from the workplace and read, research, analyse and contemplate. I will be eternally grateful. I have loved every moment.

Abstract

Persistent psychosocial stress is endemic in the modern workplace, including amongst secondary school teachers in England. There is intense interest in the potential role of digital technology such as apps, wearables and online programmes to support stress management but insufficient understanding of how the contexts of teachers' work influence their use.

Using a constructivist paradigm, a series of qualitative studies was conducted to understand the influence of these contextual factors. First semi-structured qualitative interviews with teachers were thematically analysed to reveal the physical, social and cultural contextual constraints on teachers' stress management.

Then to enable teachers' choice of consumer technology for the longitudinal study, an analytical study generated a populated taxonomy of self-management strategies for stress with digital support options. This was presented in workshops to enable some informed choice.

Finally, the qualitative longitudinal summer term study explored eight teachers' experiences of using their chosen technology in their daily lives. The pandemic meant interviews were online and teachers were mainly working from home. The study was extended with six participants into the autumn term when all teachers had returned to school premises. Cross-case analysis revealed the teachers' experiences of using technology for stress management included the explanatory power of contextually mediated data, generating awareness, permission to self-care and empathy. The findings suggest implications for self-determination theory (SDT). Thematic analysis revealed facilitators and barriers to using the technology in the school context. There are associated implications for school wellbeing support and designers, and considerations for the Unified Theory of Acceptance and Use of Technology (UTAUT).

This thesis' main contributions include unique insight into teachers' experiences of consumer technologies for workplace stress management and the technology features that facilitate self-care. Stress awareness derived from interaction with the

technology and personal data gave teachers permission to self-care. Facilitators included brief, discreet interactions and contextually relevant prompts and information. Barriers to use included insufficient technology instructions, and contextual constraints of the relentless work culture, social stigma and lack of privacy. This thesis also documents an innovative process for developing and populating a taxonomy to facilitate technology selection, including specifically for teachers managing stress. Finally, it makes recommendations of interest to designers, school leaders and policy makers seeking to improve teachers' ability to digitally support their stress self-management.

Impact Statement

The findings of this interdisciplinary thesis have impact both within and outside of academia.

Within academia, the work presented in this thesis is relevant to researchers working in human-computer interaction, health and education. This thesis contributes knowledge on the influence of contexts and design factors on the use of consumer technologies for stress management. Specifically, it contributes an understanding of how and why secondary school teachers were or were not able to use digital technologies to support their stress management strategies. It improves our understanding of the different contextual levels of influence on user experience, and how contexts mediate engagement with data and technology. This is relevant for both designers and those working to reduce occupational stress. These contributions are transferable.

Outside of academia this thesis is relevant to technology innovators, educators and those working in healthcare. The principles for generating taxonomies for other sector and conditions could be a springboard for enabling informed personalised choice of digital health technologies.

The work presented in this thesis has begun to be disseminated through the publications and presentations listed below. Starting from Chapter 2, for each relevant chapter I note the publication to which that chapter has contributed. Some work has also been written in relation to my research and work presented here but has not been incorporated into this thesis. This work was funded by an EPSRC Doctoral Training scholarship UCL EP/R513143/1.

Contributing Publications

Manning, J.B., Blandford, A., Edbrooke-Childs, J., Marshall, P. (2019). Stress and wellbeing: Qualitative exploration of senior secondary school teachers' symptoms, management and use of digital support tools. CHI'19 Glasgow, Scotland, UK 4th Symposium on Computing and Mental Health. (Poster Presentation)

Manning, J. B., Blandford, A., Edbrooke-Childs, J., & Marshall, P. (2020). How Contextual Constraints Shape Midcareer High School Teachers' Stress Management and Use of Digital Support Tools: Qualitative Study. JMIR Mental Health, 7(4), e15416. https://doi.org/10.2196/15416 (Journal paper)

Manning J.B. (2020). Understanding contextual influences on mhealth support for senior High School Teachers' stress management. Nordichi'20 (Doctoral Colloquium)

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Publications and presentations relating to Thesis

Manning, J.B. (2018) Can digital technology really work for patients? Westminster Health Forum. (Presentation)

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Manning, J. B. (2020). Who helps the helpers? Why teacher wellbeing is vital. Article for Times Educational Supplement. https://tinyurl.com/yc3ecr7d (Article)

Manning, J. B., & Jeon, L. (2020). School Resource Teacher Stress and Second-Hand Trauma: Supporting Teachers During Re-Entry (Issue August). Johns Hopkins Institute for Education Policy. https://tinyurl.com/ycy4ft7d (Policy Paper)

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Julia B. Manning developed the process of creating and populating the taxonomy ahead of presentation to teachers in a stress study workshop in consultation with all the authors. Julia B. Manning drafted the manuscript with revisions from Ann Blandford and Julian Edbrooke-Childs. All authors approved the final version of the manuscript for submission.

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List of abbreviations

ACT   Acceptance and Commitment Therapy

CBT   Cognitive Behavioural Therapy

DBCI   Digital Behaviour Change Interventions

DC   Digital Companion

DHI   Digital Health Intervention

DHSC   Department of Health and Social Care

DTAC   Digital Technology Assessment Criteria

EREF   Expert Review Evaluation Framework

HCI   Human Computer Interaction

HSE   Health and Safety Executive

iCBT   internet-based Cognitive Behavioural Therapy

ICT   Information and Communication Technology

IMI   Internet and Mobile Interventions

MARS   Mobile App Rating Scale

MAT   Multi-Academy Trust

METUX   Motivation, Engagement, Thriving in the User Experience

NICE   National Institute for Health and Care Excellence

NHS   National Health Service

PI   Personal Informatics

PST   Problem Solving Therapy

RCT   Randomised Controlled Trial

SDT   Self-Determination Theory

TAM   Technology Acceptance Model

UTAUT   Unified Theory of Acceptance and Use of Technology

UX   User Experience

Chapter 1 Introduction

Stress - the adverse reaction people have to excessive pressures or other types of demand placed on them' (NICE, 2022)

This thesis explores the influence of contexts on the use of consumer digital technologies used by teachers to self-manage their stress and reflects on this insight for future digital health design and deployment. As such, it adds to our understanding of real-world digital health practice, building on the acknowledgements of facilitating conditions and contexts as actual determinants of technology use (Venkatesh et al., 2003) and of the design process continuing with implementation (Norman & Stappers, 2015). It adds value through Human-computer interaction (HCI) analysis of the more intermediate and distal effects in the technology value chain (Blandford, 2019; W. Smith et al., 2014). By analysing consumer technology use, the findings contribute knowledge that can inform at scale both design iteration and users' strategic choice and expectations of some digital solutions for stress self-management.

1.1 Chapter Overview

This chapter presents an overview of stress and teachers' stress management and digital technology potential for workplace stress support. It draws on literature in digital health and HCI self-care, psychology and education and describes how little we know about digital support for stress self-management in the specific context of schools. It then explains the multi-disciplinary approach to this thesis and the research questions. Finally, it acknowledges that the COVID-19 pandemic began part-way through this research, adding another layer of context and sets out the thesis structure.

1.2 Stress, teachers and digitally supported stress management

Pioneering endocrinologist Hans Selye was first to conceptualise stress in the medical lexicon, highlighting different responses of the body to demand. His work has influenced diverse research communities across medicine and psychology, and importantly distinguished between negative 'distress' of unwanted, unmanageable and possibly damaging stress, and positive 'eustress', a motivator for growth, development and change (Selye, 1976).

Whilst there are varying definitions of stress in use today, this thesis is concerned with distress, hereafter simply termed stress, and uses the UK National Institute for Health and Care Excellence's (NICE) definition of stress, viz 'the adverse reaction people have to excessive pressures or other types of demand placed on them' (NICE, 2022). This definition alludes to both psychological feelings and perception, as well as the physiological response of the body. The seriousness of stress has been acknowledged, described in research as a 'silent killer', with strong evidence for causal links with the top causes of death globally such as cardio-vascular disease, HIV and clinical depression (S. Cohen et al., 2007).

The World Health Organisation positions stress as a determinant of Mental Health, defining the latter as 'a state of mental well-being that enables people to cope with the stresses of life, to realize their abilities, to learn well and work well, and to contribute to their communities' (WHO, 2022). When the 'stresses of life' become excessive, common adverse psychological reactions can include anxiety and depression disorders. Thus, stress is part of the mental health continuum, a reaction as well as sometimes a symptom or precursor of mental health conditions (HSE, n.d.), and frequently explored together with affective conditions (Bennion et al., 2017; Buckley, 2018; Proudfoot et al., 2013; Simmonds-Buckley et al., 2020). Some clinical measures used in studies on stress also combine the three conditions e.g. Depression, Anxiety, Stress Scale (DASS) (Antony et al., 1998; Heber et al., 2017) although there are also stress-specific measures (Fimian, 1984; Fimian & Fastenau, 1990; Maslach et

al., 1997). Notably, NICE keeps stress and wellbeing standards and guidelines (NICE, 2017, 2022) separate from mental health problems (NICE, 2011) but encourages consideration of both in their Workplace Health guidelines (NICE, 2016). It is also important to note that stress is different from post-traumatic stress disorder (PTSD). PTSD is a condition related to previous trauma with a range of symptoms associated with functional impairment (NICE, 2018) and not the subject of this thesis.

The burden of stress is seen not just in the body but in the socioeconomic consequences in the workplace. A reduction in the ability to cope at work due to excessive stress can contribute to absenteeism, staff turnover, lost productivity, loss of income and human suffering. According to the Health and Safety Executive (HSE), 17.9 million working days were lost to stress, anxiety or depression out of a total of 26.8 million days lost in 2019/20 (HSE, 2020).

Persistent psychosocial stress is endemic amongst secondary school teachers in England. The 2019–20 HSE report (pre-pandemic) states that workers in education have one of the highest prevalence rates for work-related stress of any industry, with an average of 2,170 cases per 100,000 workers (HSE, 2020). There is recognition that school workplace stress threatens school performance and children's achievement (Briner & Dewberry, 2007), although not all schools explicitly acknowledge the corresponding need to support teacher wellbeing (Sisask et al., 2014). Concerns over employee wellbeing prompted the UK government to commission the 2017 Farmer-Stevenson "Thriving at Work" report. Recommendations in the report included public sector employers to "Ensure provision of tailored in-house mental health support and signposting to clinical help" (Farmer & Stevenson, 2017, p. 6). The COVID-19 pandemic and indications it further increased stress makes this need even more salient (A. Johnson et al., 2020).

Stress support potentially benefits teachers' wellbeing as well as students' achievement and behaviour (Jennings & Greenberg, 2009; Mclean & Connor, 2015; Roffey, 2012). Interventions can be at the organisational (system) or individual level, or a combination of these (Greenberg et al., 2016). For individual teachers, interventions can be categorised according to the stress management strategy they

support (Lundberg & Cooper, 2011). There is evidence for efficacy of teacher stress reduction strategies based on education (C. F. Mansfield et al., 2016; Unterbrink et al., 2012), exercise (Austin et al., 2005), situational change (including withdrawal to staff room or leaving a school) (Camacho et al., 2018; Sharplin et al., 2011; Skaalvik & Skaalvik, 2015), psychological (Frank et al., 2015; Jennings et al., 2013; Klap, 2020; Reiser et al., 2016; Roeser et al., 2013) and social support (Aulén et al., 2021; Day & Gu, 2014; Gu, 2014). Importantly, individual strategies respect teachers' autonomy, also a key component of the wider school psychosocial culture set by the school leadership (Newman & Beehr, 1979). Autonomy, the freedom to be self-directing, and one of the three components of motivation as described in self-determination theory (R. M. Ryan & Deci, 2000) is a concept that has been harnessed by consumer digital products as technology platforms have become ubiquitous. In technology design, Calvo et al have described autonomy as the 'sense of agency required for enjoyable gameplay and to the self-regulation we often seek to support through behavior change, healthcare and learning technologies' (Calvo et al., 2014). As there are differences in scholarly perspectives on the concept of agency, the term autonomy is used throughout the thesis when exploring user's choice and sense of volition when using technology. As such, autonomy can be both satisfied and frustrated by technology (Burnell et al., 2023).

Health and wellbeing apps, wearables and websites have proliferated over the past decade and now afford huge potential to facilitate self-care. Digital health interventions (DHIs) have built on the concepts of autonomous self-management of health and 'expert patients', where increasing patients' knowledge, self-efficacy and ability to self-manage are improved (Barlow et al., 2002). Variously referred to as 'e-health' (technology-supported healthcare provision, such as via computers and smartphones) or 'mHealth' (the use of smart, portable or other wireless mobile devices), studies have shown these technologies offer a medium for digitally-enabled stress relief (Ang et al., 2022; Coulon et al., 2016; Hickey et al., 2021; Lau et al., 2020).

Individual studies have shown DHIs to have beneficial effects for workplace stress, including psychosocial interventions such as forms of Cognitive Behavioural Therapy (CBT) via the web and apps (Heber et al., 2016; H. Hwang et al., 2022; Ly et al., 2014).

Reviews and meta-analysis of workplace digital (e-health) stress interventions have, similarly to non-digital, often looked at a mix of studies in the mental health domain as defined by the WHO, including terms such as wellbeing, mental health and workplace stress. The reviews note a small positive effect for improvement in workers' 'wellbeing' (Carolan, Harris, & Cavanagh, 2017), a reduction in stress symptoms (Stratton et al., 2017), a moderate effect on stress and burnout (Phillips et al., 2019) and low to moderate quality evidence of effectiveness for web-based stress reduction (C. Ryan et al., 2017). A recent umbrella review of meta-analyses found no other workplace e-health reviews and noted only e-health interventions (as opposed to non-digital) had a high certainty of a small effect on work effectiveness (Miguel et al., 2023).

Important to both designers and potential users are insights into people's lived experiences of using stress management interventions in the workplace. Human-computer interaction (HCI) health studies have provided insight both with novel designs (MacLean et al., 2013; Sanches et al., 2010; Sano et al., 2017; Stepanovic et al., 2019; Xue et al., 2019) and consumer devices (Ding et al., 2021; Gjoreski et al., 2017; Pakhomov et al., 2020; Sano & Picard, 2013). An understanding of contextual influences on design and experiences would further inform evaluation and iteration. Whilst there are some frameworks for defining which contexts are in play (Jumisko-Pyykkö & Vainio, 2010; Lallemand & Koenig, 2020) real-world studies of which features or contexts facilitate or impede use are few, especially outside office environments.

Just three studies in the DHI workplace stress reviews above had focused exclusively on teachers, showing a form of online Cognitive Behavioural Therapy (CBT)) had a small to medium effect on stress (Ebert et al., 2014), a large, sustained reduction in stress as a component of insomnia with both guided and automated CBT (Ebert et al., 2015; Thiart et al., 2015) and a positive response to social support through an online forum (S. S. K. Leung, Chiang, Chui, Lee, et al., 2011). Yet to deliver the vision of digital health enabling self-care (Kelsey, 2014) including stress self-management at scale (Bennion et al., 2017), that is convenient and personalised (Sano et al., 2017), accessible (Carolan & De Visser, 2018) and anonymous (Mak et al., 2015) requires

widely available technologies. Two other individual stress studies with teachers which utilised commercial wearables, the Philips' Discrete Tension Indicator (Kocielnik & Sidorova, 2015) and Fitbit (Runge et al., 2020) reportedly gave them insight into their stressors. Wearables offer the chance to detect stress manually through ecological momentary assessment (L. Chan et al., 2018), automatically through different sensors (Can et al., 2019; Sano & Picard, 2013) and to harness tracking and support prevention (Blankenhagel et al., 2019). Consumer technologies can now detect stress on a par with clinical grade sensors (V. Mishra et al., 2020).

Rather than creating something new, my methodology adds to other work that has sought to understand how people can use existing consumer technologies in real life scenarios to encourage or guide future design and implementation (Epstein et al., 2020; Gjoreski et al., 2017; Hao et al., 2017; Kocielnik & Sidorova, 2015; Puussaar et al., 2017; Runge et al., 2020; Sano et al., 2015; Schueller et al., 2021). As Epstein states, study of commercial tools can generate design insights, although there is a lack of translation back into new tracking tools or techniques. This research seeks to generate understanding for the specific cohort of secondary school Heads of Year and the condition of stress. In doing so it seeks to respect some, albeit limited, autonomy as few studies have offered any choice over stress-management strategy or technology concept or combined this with workplace use. One recent exception with office workers offered a choice based on effort, timing and medium (video, text prompt or chatbot) (Howe et al., 2022). Overall, my research seeks to contribute knowledge that can inform at scale both design iteration and contextual facilitation of some digital solutions that could contribute to teachers' stress self-management.

1.3 Approaches, research questions and contributions

Human-computer interaction (HCI) studies bring together many disciplines including computer science, software engineering, psychology and the social sciences (Rogers et al., 2019). Studying HCI in a real-world setting, sometimes termed 'in the wild', such as in healthcare or education adds another layer of complexity (Rogers, 2012). This intersection comprises scientific research, but research that carries the not

insignificant challenge of satisfying scientists who critique studies from very different perspectives – not least those of values, assumptions, terminology, methodology and culture (Blandford et al., 2018). Health research methodology reflects the dominance of pharmacological research and works well for questions focused on *effectiveness* of similar approaches where systematic review of curated resources within medical databases can be undertaken. HCI questions focus on *insight*, recognise the researcher does not know all variables in advance, values iteration and discovery and is focused on *understanding* (Blandford, 2019; Blandford et al., 2018). Given the multidisciplinary nature of my HCI research, incorporating complexity from a breadth of sources that fell outside health-oriented literature, e.g. Computer Science and education, systematic reviews were not appropriate. For each background chapter, literature reviews combine critical and scoping reviews with a narrative synthesis (Grant & Booth, 2009), using keywords to generate a tentative starting set of papers, snowballing forwards and backwards to identify potential candidate articles (Wohlin, 2014). Pursuing references of references as well as sources highlighted by colleagues and through personal knowledge aided the comprehensive knowledge base (Greenhalgh & Peacock, 2005). Evaluation was according to contribution with no assessment of quality of studies as literature was analytically and conceptually reinterpreted, as described in previous health and digital engagement reviews (Debono et al., 2013; Grant & Booth, 2009; Short et al., 2018). In both Chapters 2 and 4 it was also appropriate to apply a 'PICO' approach when reviewing educator and workplace stress interventions: Patient (person) and Problem (i.e. teacher or workplace and stress), Intervention (e.g. information, tracking, exercise or mindfulness and digital, internet, mhealth), Comparison (often none), Outcome (e.g. identifying, support, management, reduction). Academic databases searched included the ACM Digital Library, IEEE Xplore Digital Library, PsycINFO, Google Scholar, Cochrane and PubMed. As noted in Section 1.2, many papers combine exploration of stress with depression and anxiety, and I positioned stress in the continuum of mental health and wellbeing as there is not a uniform approach to the use of the term 'mental health'. Every effort was made to ensure that papers cited were focused on stress, but where mental health conditions were considered together and the paper is referenced, this is noted.

Given the literature outlined briefly above, which will be discussed in more detail in Chapters 2 to 4, and the gap in the literature on the opportunity teachers' situated use of technologies to self-manage their stress, this thesis aims to answer the following research question:

RQ: How do context and design factors influence the use of consumer technologies for self-management of stress by teachers?

The question was originally conceived to investigate 'workplace' stress. The COVID-19 pandemic and resulting disruption to the notion of 'workplace' (becoming at home as well as in school) and delivery of mainly online teaching during the summer of 2020 prompted a reframing of the question. It also meant that I extended the intended longitudinal study from the summer term, when most teachers were working from home, into the autumn term, when all teachers were back in school, albeit with many COVID-19 hygiene adaptations. I also learned from my first study that technologies used to support stress-management were not necessarily designed for health so the question was adapted from asking about 'consumer health technologies' to 'consumer technologies' retrospectively. With the teachers, consumer technologies were either referred to collectively as technologies or digital companions, or individually by their name.

To answer this main research question required asking several component questions and sub-questions to understand existing strategies and constraints, and to facilitate choice and capture situated experiences and potential design considerations. These are presented here along with the associated contribution.

RQ 1 What is influencing teachers' current stress management?

With sub-questions:

RQ 1a How do secondary school middle-leaders manage their stress?

RQ 1b What are the contextual influences on their management?

RQ 1c How and why do they use digital health tools?

Through a set of semi-structured qualitative, face-to-face interviews in Study One, the concept of self-management of stress in the macro-context of education was explored. Fourteen mid-career secondary school teachers' experiences were thematically analysed.

The first contribution of this research is a contemporary understanding of teachers' behaviours. Important cultural and physical contextual constraints for secondary school middle leaders' ability to manage workplace stress were revealed. These included both perceptions of their own wellbeing as second place to that of students, and an enduring stigma of admitting to stress. With little access to smartphones during the working day, apps were found to be less appropriate for in-the-moment stress support.

Physiological and cognitive strategies were the most utilised for stress management. Correlates of stress such as isolation and dehydration were identified. Original insight was gained into how digital interventions were being used to help with stress management, both within secondary schools and when teachers were off the premises.

These findings demonstrated a plurality of strategies adopted by teachers and prompted my thinking that a choice of technologies should be facilitated for them so that they could choose a technology that aligned with one of their current stress-management approaches. Therefore, the next research sub-question was designed to support teachers to make the choice of technology for the subsequent longitudinal study.

RQ 2 *How can teachers make an informed and supported choice of digital companion technologies to support their self-management of stress?*

Study Two comprised a 4-step study design to create and populate a taxonomy for systematic stress-management technology choice. In step 1, the dimensions of stress self-management and strategic classifications were identified. In step 2, the dimension of digital techniques and conceptual descriptions were determined. In step 3, six criteria for inclusion of technologies were created. In step 4, the taxonomy

framework created by steps 1 and 2 was populated with technologies for stress self-management, as identified in step 3.

An innovation from this research is the creation of this specific taxonomy tailored to teachers and their known stress-management strategies and the actions the technology can support. Additionally, as a new methodology, elements of this approach should generalise as principles for the creation of taxonomies for other occupations or conditions. Taxonomies such as this could be a valuable resource for individuals understanding what technology would be most appropriate in their personal context.

This populated taxonomy was presented to teachers in a series of online didactic workshops, sharing the rationale and content of the populated taxonomy with them. From this, each teacher made an informed choice of technology for the longitudinal study, Study Three. This study was designed to answer the third and fourth research questions:

RQ 3 What were the teachers' experiences with their consumer technologies?

With sub-questions:

RQ 3a In the context of their work, how do secondary school Heads of Year experience their chosen technology for stress self-management?
RQ 3b Does digitally supported stress self-management change from when working from home to working back in school?

and

RQ 4 How can consumer technologies facilitate stress management in the school environment?

With sub-questions:

RQ 4a What were the facilitators and barriers to teachers engaging with their technology?

RQ4b How could the school support use of consumer technology for stress-self-management?

Study Three was the longitudinal investigation of eight teachers' use of their chosen technology(s) during the summer term of 2020 and, for six of them, through the summer holidays and into the autumn term of the same calendar year. Qualitative interviews, firstly at around summer half term and secondly at the end of the summer term (both according to the original planned study), then thirdly around the autumn half term (extended study), were undertaken, along with online surveys half-way through the summer term. Feedback forms from the workshop and other communications also contributed data for thematic analysis.

The second contribution of this research is the insight from teachers' experiences of using of their technologies over time, which can inform both users and designers. Technology interaction generated intrinsic permission to care for themselves and colleagues, motivating ongoing self-compassion and engagement. All teachers valued the explanatory power of contextually mediated data and that technologies were personalisable, and some appreciated the social connectivity afforded and capture of achievement data.

The third contribution of this research is the insight for schools and designers into facilitators and barriers to teachers using the technologies. Easy and discreet interaction, prompts, affirmation and relevance of data were all facilitators, and the ability to edit data could be helpful too. Inadequate feature instructions and connectivity were barriers. Schools could facilitate use where a culture of self-care and acknowledgement of stress is normative. Suggestions included encouraging technology supported stress management from the start of teachers' careers and protected, private spaces for teachers to de-stress in school.

1.5 Coronavirus considerations

On March 20th 2020, the UK Prime Minister announced the closure of all schools across the UK due to the risk of contagion from COVID-19. This was two weeks before

the first scheduled workshop of Study Three, which was due to take place on school premises with five Heads of Year in one of the three participating schools. The immediate consequence was manageable; the workshop delivery was adapted for online. However, there were many other factors to consider as a result, including:

1. teachers having overnight to switch to online tuition from home (and navigate the changing educational technology as schools rushed to enable the transformation, often iterating over time), with added caring responsibilities (for children at home or elderly parents) or 'home-schooling' their own children. This resulted in half of the participants either not responding to or actively withdrawing from the workshop invitation;

2. changes to coordination with potential teacher participants, from being school facilitated via admin and leadership management to being managed directly between the researcher and individual staff, which was much more time consuming;

3. workshops being held over a longer period, from April 3rd to May 12th, with participants required to arrange their own attendance against a backdrop of uncertain timetabling and short notice changes to rostering;

4. a more staggered commencement of the study, due to technologies being supplied remotely and interviews arranged on an individual rather than a school basis;

5. added and changed sources of stress due to the COVID-19 threat, including catching the disease, children dropping out of online lessons and being uncontactable, sudden lesson and rota changes, and planning to be back in school with all the associated challenges (e.g., physical distancing and hygiene);

6. a fundamental change to the physical context in which Heads of Year now found themselves in the summer, working from home instead of on the school premises;

7. extending the intended longitudinal study and planning further interviews in the autumn term. My original study had been planned to be with teachers during the course of a standard six-week half of term in school. As participant numbers halved, and most teachers were not in school during the intended study period, I asked the participants if they would consider continuing their involvement into the autumn term. They all agreed, although when the time came for interviews, only six out of the eight responded.

8. further extraordinary changes to the physical context when teachers returned to school in the autumn, working in segregated 'bubbles', with staggered timetabling and longer days, isolation from colleagues and dealing with children often traumatised by their experiences of the pandemic. Teachers are known to experience 'secondary trauma' due to the psychological burden of supporting others during times of crisis (Lawson et al., 2019) and COVID-19 could well compound teachers' experiences of stress (A. Johnson et al., 2020). Secondary traumatic stress was an existential risk for all teachers in the autumn term.

Whilst technology could enable the planned methods to still be applied, it was clear that the uncertainty would mean a greater requirement for flexibility, a variation in settings for the longitudinal study and more demanding circumstances to be navigated. As this thesis is not concerned with the source of stressors, continuing the studies in such an uncertain climate was considered valuable to capture findings that arguably could provide more robust insight into the use and value of technologies for educators.

1.6 Structure of thesis

This thesis is structured in three parts:

Part One – Related work and background to the thesis

Chapters 2 to 4 provide the related work for the cross-disciplinary components and evidence base for this research. Chapter 2 gives an overview of stress in the workplace, focusing on teachers' experiences of stress and approaches to their stress management. Chapter 3 presents the contribution of HCI to self-care technologies, how design features can be used to support employees' stress management and how interventions can be categorised, described and contextualised. Chapter 4 synthesises knowledge and insight from digitally supported stress-management and digital health interventions in the workplace and for teachers.

Part Two – Studies and Analysis

In Chapter 5, the research paradigm and rationale for my methodology is presented, along with the core study methods, study details and methodological integrity and validity.

Chapters 6 to 9 cover the studies undertaken. Chapter 6 presents findings from my first qualitative study, the initial exploration through interviews with secondary school senior teachers on how they self-manage their stress in the educational environment and their familiarity with and use of digital health tools.

Chapter 7 details the four-step process for creating and populating a taxonomy which enabled presentation of rigorously selected technologies to teachers in workshops ahead of their use in Study Three.

Chapters 8 and 9 present the findings from my qualitative longitudinal study with eight teachers. The intended study was in the summer term, June/July, 2020 and six of the same eight teachers took part in the extended study in the autumn term when

they were all back in school. Interviews, surveys, workshop and correspondence data were analysed thematically, firstly by cross-case analysis of narrative case studies to generate insight into the teachers' experiences and how meaning was derived from the technologies. Secondly through generating themes from the original whole data set on facilitators and barriers to technology use, from both individual and organisational perspectives.

Part Three – Discussion and Conclusion

In Chapter 10 a summary of the studies is presented with contributions to knowledge and clear sets of recommendations on teachers' digitally supported stress management for users, designers and schools based on the findings. Further reflections on the approached taken are shared followed by more personal reflexivity, strengths and limitations are considered along with implications for policy and practice.

This chapter has presented a brief overview of the background, motivation, aim and conceptual framework and acknowledged that the COVID-19 pandemic began part-way through this research, adding another layer of context. Part One now describes the concepts, beliefs, theories and key factors that support and inform the research.

Part One, Related Work – Background to the Thesis

Chapter 2 Stress and Teacher Stress Management

"Creating schools as organizations which care for teachers as well as pupils is no longer an option, but a necessity in the contemporary contexts of teaching." (Day & Gu, 2009).

Parts of this chapter have been published in JMIR Mental Health & JMIR Formative Research (Manning et al., 2020, 2022)

2.1 Chapter overview

Research on stress is found in a variety of domains including psychology, neurobiology, medicine and human-computer interaction. In addition, stress is a significant topic of interest in occupational research, including in education. The focus of this chapter is briefly on literature from the domain of psychology and then more extensively synthesises the evidence base on school workplace stress and how interventions have sought to overcome stress experienced by teachers.

The potential for digitally supported health interventions and literature specifically on workplace stress interventions is reviewed in the following two chapters.

This chapter also presents a rationale for categorisation of strategies for the self-management of stress. It sets the scene for the motivation of this thesis and the foundation for human-computer interaction to contribute to the domain of digital health in the workplace.

2.2 Stress

Pioneering work by Selye conceptualised stress in relation to health, highlighting different responses to pressure. He differentiated between negative 'distress', unwanted, unmanageable and possibly damaging stress, and positive 'eustress', a motivator for growth, development and change (Selye, 1976). This thesis is

concerned with distress, hereafter simply termed stress. This persistent, excessive stress is a risk factor for illness, including affective disorders such as anxiety and depression (McEwen & Akil, 2020) and for cardiovascular disease (Steptoe & Kivimäki, 2012).

It was important to position stress as normal (not a disease) and experienced by most teachers, to avoid as far as possible any sense of fault or stigma, given research shows this is still an issue (Education Support Partnership, 2022; Evans et al., 2022). The UK National Institute for Health and Care Excellence's (NICE) definition of stress can be adapted to an educator focused description, viz 'the adverse reaction teachers (people) have to excessive pressures or other types of demand placed on them' (NICE, 2022). This alludes to both psychological feelings and perception, as well as the physiological response of the body. Whilst stress itself is not an illness, ongoing stress can prevent the body's return to homeostasis (a stable internal environment), generating an allostatic load (wear and tear) which can then trigger disease process (McEwen & Akil, 2020). Stress is thus related to both mental health and physical wellbeing. The World Health Organisation (WHO) positions stress as a determinant of Mental Health, which it defines as 'a state of mental well-being that enables people to cope with the stresses of life, to realize their abilities, to learn well and work well, and to contribute to their communities' (WHO, 2022).

2.3 Workplace stress

Studies of workplace stress have been uniting around the fear of "psychological pressures generated by the unfettered growth of industrial and technological capitalism" since at least the mid-19th century (Jackson, 2014, p. 301). In the 1990s, The Whitehall II was a seminal longitudinal cohort study that showed that persistent psychosocial stress was endemic in the modern workplace and that the psychosocial work environment predicted the rate of sickness absence (North et al., 1996). Yet a quarter of a century later the problem remains. A reduced ability to cope at work due to excessive stress can contribute to absenteeism, staff turnover, lost productivity, disability, loss of income and human suffering (HSE, n.d.). In 2017/18, 57 per cent of

all workdays lost were due to stress, anxiety or depression, thus more than for any other reason (Buckley, 2018). Whilst recognising that occupational stress can be considered a subset of all the stress experienced by an individual, and it can be difficult to disentangle stress factors that solely emanate from the workplace and those outside, the fact remains that the socioeconomic implications of stress for employment and employers are significant.

When exposure to occupational stress is persistent and negative, gradually over time symptoms of 'burnout' can present. Burnout is a prolonged response to chronic emotional and interpersonal stressors on the job (Maslach & Leiter, 2016), characterised by emotional exhaustion (feeling depleted, overextended, fatigued), cynicism or depersonalisation (negative or excessively detached response to the job), and professional inefficacy or accomplishment (decline in feeling of competence or productivity at work) (Maslach & Goldberg, 1998; Morse & Salyers, 2012). In line with organisational psychologist Sir Cary Cooper's view that occupational stress and burnout should not be treated as separate (Cooper, 1995), literature on both phenomena informed this review. Unlike stress, burnout is only viewed as an occupational aberration. The WHO's International Classification of Diseases (ICD) states, "Burn-out refers specifically to phenomena in the occupational context and should not be applied to describe experiences in other areas of life." (WHO, 2019).

2.4 School workplace stress

Occupational 'Teacher stress' was first specifically described as "a response syndrome of negative effects (such as anger or depression) resulting from the teacher's job" (Kyriacou & Sutcliffe, 1978). Teachers' experiences, sources and symptoms of stress at work have received extensive coverage in the literature (Cooper, 1995; Cooper & Kelly, 1993; Cooper & Travers, 1996; McCarthy, 2009; Reiser et al., 2016) and stress is cited as a key factor in studies on teacher attrition (Kyriacou, 2001). There appear to be fewer studies that solely focus on stress reduction interventions in secondary schools (compared to primary), or how senior or mid-career teachers can be supported. This could also be due to an alternative focus for

stress, that of resilience, a perspective advocated for its positive emphasis on sustaining motivation and commitment (Gu & Day, 2007). While an exploration of whether stress is the antithesis of resilience is beyond the scope of this thesis, it is interesting to note that the outcomes of being resilient – wellbeing, commitment, job satisfaction, agency, enthusiasm, sense of belonging, responsibility, passion, enjoyment and engagement (C. F. Mansfield et al., 2016) – could be mapped as goals for amelioration of the sources of stress, noted in 2.4.3 below. Also, Mansfield's observation that healthcare professionals "can't be resilient in isolation" is equally true for educators and a reminder that responsibility for stress management goes beyond the individual.

For the purposes of this thesis, definitions of resilience and burnout were derived from the health, psychology and education literature. They were terms that often occurred in this literature although only occasionally in computer science stress research, e.g. K. Lee et al (2020). Although there is little discussion of resilience or burnout in this thesis, they are ubiquitous terms in the teacher stress literature (with resilience sometimes interchangeable with workplace 'buoyancy' (C. F. Mansfield et al., 2016; Martin & Marsh, 2008)) and thus included for context. The following definitions are salient for this research.

1. Resilience – "the personal capacity to harness personal and contextual resources to navigate challenges…a process whereby teachers interact with their context over time…and the outcome of professional growth, satisfaction, and wellbeing" (C. F. Mansfield et al., 2016, p. 80). In short, positive adaptation by teachers despite adversity.

2. Burnout – "a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed" (WHO, 2019, QD85) It consists of three dimensions: emotional exhaustion, depersonalisation or mental distance from one's job, or feelings of cynicism, and reduced accomplishment in response to stressors in the teachers' job (Maslach & Goldberg, 1998; Maslach & Leiter, 2016). In short, a prolonged adverse response to chronic emotional and interpersonal stressors on the job.

Having described these terms, the prevalence, measurement and sources of stress among teachers are now briefly considered.

2.4.1 Prevalence and susceptibility

Despite the Farmer-Stevenson recommendation, and a subsequent proposal for a teachers' wellbeing charter (Gibb, 2020), stress remains an existential reality for too many. Teachers are in an occupation that experiences some of the highest prevalence of stress. The 2020 HSE report states there was an average of 2,170 cases per 100,000 educators, using data from the measure of working days lost and The Health and Occupation Research network for general practitioners (THOR-GP) (HSE, 2020). This equates to roughly double the average rates of stress, depression and anxiety in the general population. This proportional difference is informative. The UK's national charity for teacher wellbeing, the Education Support Partnership (ESP) surveys staff annually. In their (pre-covid) 2019 survey of 'senior leaders' in teaching, 84 per cent reported work-related stress, with 60 per cent of those who reported work-related stress saying they would not disclose stress or mental health problems to their employer (Education Support Partnership, 2019). Thirty-one per cent of leaders cited stigma as a reason for not talking about mental health. (Subsequent surveys from 2020-2022 have cited similar findings but have the extra variable of the pandemic to consider). These self-reports are not unique to the Western world. For example, a review of 116 studies of Chinese teachers between 1998 and 2013 found a gradual increase in psychological problems that were now reported by up to 50 per cent (R. Yang et al., 2019).

One of the reasons admitting stress to colleagues or friends remains taboo (Ferguson et al., 2017) is due to teachers fearing being perceived to be of 'inferior ability' if they ask for help (Butler, 2007). This highlights a culture where experiencing difficulty is seen as having its origin in the individual rather than in the system. These peer concerns mirror the reports of healthcare professionals (Montgomery, 2014; Spiers et al., 2017). Policy emphasis has often been on schools meeting the psychological needs of pupils, with hardly any recognition of the corresponding needs of staff

(Kidger, Brockman, et al., 2016; Kidger et al., 2009), despite the known heightened risk of burnout for professionals involved in meeting mental health needs (Clough et al., 2020). A teacher wellbeing charter, published by the Department for Education in 2021, seeks to address this issue for teachers https://www.gov.uk/guidance/education-staff-wellbeing-charter.

It has been demonstrated that self-compassion can be generated through stress interventions, including for school principals (Klap, 2020; Roeser et al., 2013; Taylor et al., 2016). Studies have noted teachers' comments that using a stress management strategy increased their awareness of the need for self-care and the importance of acknowledging emotions in a culture perceived not to encourage emotional expression (Schussler et al., 2016). Creating a caring culture starts with the school principal and enabling teachers' job fulfilment reduces some of the stress experienced (Day & Gu, 2014). They gain confidence and a sense of capability where principals are actively engaged in instructional leadership (Bellibas & Liu, 2017), reflecting principals' own opinions on what has helped them to reduce stress (Graf, 2018).

However, the lack of training for teachers in techniques to manage stress has been noted (Frank et al., 2015), despite broad understanding that exposure to chronic stressors and unsuccessful coping impacts the wellbeing of employees (Hakanen et al., 2006; Roffey, 2012; Spilt et al., 2011). There is robust evidence too that students' academic achievement, social-emotional development, and behavioural outcomes are influenced by teacher wellbeing (Briner & Dewberry, 2007; Collie et al., 2012; Hamre & Pianta, 2001; Jennings & Greenberg, 2009; Mclean & Connor, 2015).

Teachers in middle leadership positions are described variously as survivors, experienced or veterans and are thought to experience the most stress among those in the education workforce (Day & Gu, 2009; Huberman, 1989; Klassen & Chiu, 2011) – although the sources of stress appear to be constant for all ages and at all stages of teaching (Skaalvik & Skaalvik, 2015). Mid-career secondary school teachers are often in positions of leadership, such as Head of Year, Head of Department, Assistant or Deputy Principal. In addition to career stage factors, high stress is also associated with

city schools in areas of deprivation, where students are more likely to be affected by financial instability, community violence or food insecurity (Abel & Sewell, 1999; Camacho & Parham, 2019; Shernoff et al., 2011). It is also known that demand for city secondary school places is increasing (Claymore, 2018), which strengthens the case for knowing how to help reduce teacher stress in city schools.

2.4.2 Measurement

Studies have established and evaluated both subjective and objective measures of stress. Clinical studies have shown measurable changes to vital signs and biological pathways due to stress (Arza et al., 2019; Bellingrath et al., 2009). This gives us evidence of the physiological impact of stress on the body, although there does not appear to be one standard physiological measure for stress.

Subjective measures include the Teachers Stress Inventory (TSI), a widely used questionnaire developed by Fimian in 1984, who subsequently demonstrated adequate reliability and construct validity (Fimian, 1984, 1986, 1987). The TSI has since been translated into multiple languages and applied worldwide (Kourmousi et al., 2015). Another widely-used subjective measure is the Classroom Appraisal of Resources and Demands (CARD), created to quantitatively assess teachers' vulnerability to stress (Lambert et al., 2009) based on the transactional theory of stress developed by Lazarus and Folkman (Lazarus & Folkman, 1984). A meta-analysis of 18 studies using the CARD, undertaken in 2015, suggested that individual teachers' perceptions about demands and resources can be measured reliably and are meaningfully associated with indicators of vocational concern (McCarthy et al., 2016). Burnout is so widespread that an 'educators survey' adaption of the Maslach Burnout Inventory (MBI-ES) has been used to identify teachers at risk of excessive stress (Richards et al., 2018; Rosensteel, 2020). These measures tend to focus on the individual and organisational interface and provide insight into the intervention or the outcome. Another significant body of research has focused on the sources of stress.

2.4.3 Sources of stress

Teaching as a profession is known to have unique stressors. Some sources reflect contextual factors that are intrinsic to the job and shape the method of teaching (e.g. temporal constraints of classroom interactions and timetabling). These factors have also been referred to as relating to the 'school climate' (Anderson & Olsen, 2006; Loukas, 2007; Thapa et al., 2013). Sources of stress for teachers can be summarised as (a) teaching unmotivated students; (b) maintaining classroom discipline; (c) time pressures and school workload; (d) being evaluated by others and teaching to the test; (e) dealings with colleagues; (f) low self-esteem and status; (g) (poor) administration and management; (h) role conflict and ambiguity; and (i) poor working conditions (Camacho et al., 2018; Kokkinos, 2007; Kyriacou, 2001; Roeser et al., 2013; Shernoff et al., 2011; Tripken, 2011; von der Embse et al., 2016). Additional detail of stressors includes large class sizes (Cooper & Travers, 1996), challenging student demands and low performing schools (McCarthy et al., 2016; Skaalvik & Skaalvik, 2018), and continuous policy changes (Geving, 2007; Kaufhold et al., 2006; Kyriacou, 2001). Dealing with sources of stress is a key approach to mitigating stress but given there will always be stressors in the job, enabling teachers to deal with the experience of stress should be a high priority for the education sector. How stress management has been approached in the literature is described next.

2.5 School workplace stress interventions

Interventions to reduce stress in the context of the school workplace have been categorised in different ways, including in terms of teacher behaviours, e.g. direct-action, palliative and avoidance behaviours (Sharplin et al., 2011), or on the basis of information and psychology (von der Embse et al., 2019). Theoretical models have also been tested, e.g. Conservation of resources (COR) theory (Burgess et al., 2019), Selection, optimisation, and compensation (SOC) theory (Philipp & Kunter, 2013) and the Theory of preventative stress management (TPSM) (Kaspereen, 2012).

In order to answer this thesis' research question, a categorisation was required that could inform a stress intervention framework. There were three potential approaches to this. Firstly, the level at which the reduction of stress is made, for instance at the organisational (system) or individual level, or a combination of these, described by Greenberg et al (2016). A second approach is to structure the targets of stress interventions, for instance by considering the stressors themselves (such as workload) or to reduce stress symptoms, as illustrated by Bhui et al (2012). The third approach is to categorise stress management by strategy, such as a physiological or psychological tactic for rapid response or building resilience to stress, as proposed by Lundberg and Cooper in their review of occupational stress (2010). Each of these categorisations is considered in more depth to assess their suitability and potential to inform the design of the studies.

2.5.1 The Level of mediation/intervention

The level of a stress reduction intervention has been described as organisational, individual-organisational or individual (Brunton et al., 2016; DeFrank & Cooper, 1987; Greenberg et al., 2016; Montano et al., 2014; Naghieh et al., 2015), or a classroom-focused approach (Ouellette et al., 2017). Organisational interventions tend to be focused on the organisation's culture, essentially the psychosocial environment, which is set by the school leadership and includes (i) organisational conditions such as culture and governance, (ii) role conditions such as teachers' autonomy, and (iii) task conditions such as workload (Newman & Beehr, 1979). The organisation-individual level includes workplace relations, administrative and social and work-life balance initiatives. Individual level interventions include guided (taught and or supported) and unguided practices for managing stress (Greenberg et al., 2016). It is recognised that teachers' perception of their environment is critical to experiences of stress (Richards et al., 2018).

In a synthesis of reviews on managing stress at work (all occupations), the scarcity of organisational interventions and their outcomes was noted (Bhui et al., 2012). The greatest effects were seen in cognitive-behavioural programmes at the individual

level. A Cochrane review of organisational approaches to reducing work-related stress in schools found only four studies, all in primary schools, comparing controlled before and after organisational-level interventions. The evidence for improvement was judged to be of low quality (Naghieh et al., 2015). A more recent US-based review of 27 studies on organisational interventions in schools teaching pupils from 5 to 18 years between 1990 and 2015 found limited evidence linking the interventions (such as mentoring, peer-assistance-review, induction) to a reduction in teacher stress or improvements in teacher health (Landsbergis et al., 2017). An alternative angle to reducing stress has been to 'build resilience'. Yet resilience in teachers needs to be nurtured by the school environment just as much as being a personal attribute (Day & Gu, 2014). Whilst there is positive support for organisational-level resilience approaches in schools (Kangas-Dick & O'Shaughnessy, 2020; Kraft et al., 2016; C. F. Mansfield, 2020), evidence for which interventions are efficacious for improving contextual influences on stress is scarce (Kangas-Dick & O'Shaughnessy, 2020). Also, some reviews omit comment on the levels at which a stress intervention has been delivered (von der Embse et al., 2019). More details on individual-level interventions are described below, in section 2.5.3, but for the purposes of my research question, the lack of research at the different intervention levels (and this thesis' focus on individual self-management) determined that this approach to categorisation as a framework would be insufficient.

2.5.2 The Target of intervention

Stress intervention targets can be described as primary factors, i.e. stressors themselves; secondary factors, i.e. individual factors; or tertiary factors, i.e. stress symptoms (Bergerman et al., 2009; Kuster et al., 2017). Primary targets of interventions could be aspects of the work environment, such as the sources previously summarised in section 2.4.3. Arguably primary prevention for individuals should be the priority and normative for school management, as has long been argued in the healthcare sector (Bergerman et al., 2009; Firth-Cozens, 2003).

Secondary targets for prevention are the individual's perceptions of or responses to the stressor itself. By targeting the way someone manages or copes with stress, the aim is to modify in a positive way the individual's response rather than remove the stressor itself. This has been much of the emphasis in resilience research (C. F. Mansfield et al., 2016). Tertiary targets of intervention are the stress symptoms. The aim is to manage or treat the emotional, cognitive, behavioural or psychological manifestation of stress.

The secondary and tertiary targets are regarded as 'stress management', and while both can be facilitated at the organisational level (through training or treatment), they can also be tackled at the individual level. The latter has the advantage of respecting autonomy. This target categorisation is useful for evaluating interventions, but in isolation does not indicate potential self-management strategies or describe targets which are potentially within the individual's control. Bhui et al (2012) referenced the level and target categorisations, illustrating them with intervention strategies that aligned with the level and target of intervention (Table 2.1). Classifying the exemplar strategies with which Bhui's model is populated forms the third approach to categorising stress interventions.

Level	Primary prevention	Secondary prevention	Tertiary Prevention	Outcome measures
Organisational	Improving work content, fitness programmes, and career development	Improving and communication and decision making and conflict management	Vocational Rehabilitation and outplacement	Productivity, turn-over, absenteeism, and financial claims
Individual and Organisational interface	Time management, improving interpersonal skills, and work/home balance	Peer support groups, coaching, career planning	Posttraumatic stress assistance programmes and group psychotherapy	Job stressors such as demands, control, support, role ambiguity, relationships, change with burnout
Individual	Pre-employment medical examination and didactic stress management	Cognitive behavioural techniques and relaxation	Rehabilitation after sick leave, disability management, case management, and individual psychotherapy	Mood states, psychosomatic complaints, subjective experienced stress, physiological parameters, sleep disturbances, and health behaviours

TABLE 2.1 BHUI'S MODEL OF CATEGORISING STRESS INTERVENTIONS (2012) ADAPTED FROM DE JONGE AND DOLLARD

2.5.3 The Intervention Strategies

The literature on individual stress management strategies or actions that can be taken to mitigate stress for teachers is vast. Eight types of intervention that could be taught in an occupational training programme have been summarised by Cartwright and Whatmore as follows:

a) stress awareness and education;

b) relaxation techniques;

c) cognitive coping strategies;

d) biofeedback;

e) meditation;

f) exercise;

g) lifestyle advice;

h) interpersonal skills training (Cartwright & Whatmore, 2005).

The authors included the caveat that often insufficient attention was paid to individual differences and existing stress levels where interventions were delivered as programmes. Most of these strategies had been previously grouped more succinctly under four umbrella headings in a study on caring professions (teachers, psychologists and health professionals): 1. Educational 2. Physiological 3. Situational (environmental adjustment) 4. Cognitive (Brown & Uehara, 1999). One meta-review of interventions aimed at reducing teacher burnout also included a fifth category of social support and social-emotional skills (Iancu et al., 2018). Social support is particularly important as it relates to the school culture and relationships, which are integral to teachers' well-being (Gu, 2014).

The categorisation of strategic approaches has several advantages. Firstly, the strategies have strong explanatory power and are accessible to the layperson.

Secondly, the meaning of each term is universal to an interdisciplinary audience; and thirdly, it provides a conceptual framework that facilitates individual autonomy.

A potential limitation of categorising interventions in this way is that such stratification could discourage a holistic approach to stress management, and this mirrors the risk that a focus on self-management absolves the organisation of its responsibility. It is therefore important to communicate that a suite of interventions at both the individual and organisational level are necessary. This has often not been the case. Whole-school approaches to stress-management have frequently focused on the students and ignored workforce needs (G. Patton et al., 2003; Willis et al., 2019; Wyn et al., 2000), although there are exceptions (Evans et al., 2022; Garland et al., 2018; Sisask et al., 2014). Another potential limitation could be the assumption that management strategies are the same for everyone, therefore not taking into account individual differences. However, as the strategies are broad categories, this should allow for both autonomy and personalisation. Indeed, used as a framework for reviewing the literature on teachers' stress management, this approach shows the variation possible within each category as in reality, few interventions are purely one dimensional. The literature is now reviewed within each of these strategic categories.

2.6 Evidence for teachers' stress management strategies

2.6.1 Educational interventions

Education on stress aims to improve information on, and understanding and awareness of, stress and accompanying symptoms and mitigating options. Qualitative studies have detailed teachers' learning strategies as help-seeking from colleagues, trialling their advice and researching solutions in high-need areas (Castro et al., 2010); also for new teachers, accessing professional development, help-seeking and sourcing information (Sharplin et al., 2011). As positive adaptions to stressors, professional learning opportunities and problem-solving are two of the most cited educational approaches in the literature on teacher resilience (C. F. Mansfield et al.,

2016). A 10-week taught educational course with secondary school teachers covering stress physiology, mental attitudes, pupil management, parent/carer management and collegial social support found positive effects on those who participated in at least half of the programme, but there was no follow-up (Unterbrink et al., 2012). A more recent online stress intervention study with both primary and secondary staff included training in guided psychological techniques in its 30-minute educational modules and had a high retention rate of 92 per cent. Post-intervention, there were significant reductions in two of three of the burnout measures, emotional exhaustion and depersonalisation as determined by the MBI-ES (mentioned in section 2.4.2), but only six out of 26 teachers had taught for more than six years (few would have been in management) and there was no follow-up (Ansley et al., 2021). Being such a small sample of teachers, this study would be worth repeating with a much larger cohort as it appears to have been well received. Therefore, there is some evidence of reduction of stress and burnout after some education interventions, but not for how long or whether duration in teaching, seniority or school level are significant variables.

2.6.2 Physiological interventions

Physiological interventions are those which can reduce stress symptoms or build resilience to experiences of stress through exercise or relaxation, including meditation. They have also been referred to in the teaching literature as palliative techniques (Howard & Johnson, 2004; Kyriacou, 2001; Sharplin et al., 2011). A brief review of the literature indicates that the line between body and mind relaxation, meditation and cognitive techniques is opaque, making it harder to determine whether the exercise or cognitive components of an intervention are of significance. Such studies are often termed mindfulness, but only a careful reading of the intervention, if the detail is described, can help discern whether it is predominantly one of body relaxation or more psychosocial.

There is modest evidence for 'exercise as medicine' having a positive effect on stress symptoms (Pedersen & Saltin, 2015) although. A growing body of evidence has

indicated the mental health benefits of exercise, although more recent work has suggested that an understanding of neuroplasticity and behavioural mechanisms is required to help frame and target more personalised treatments to improve outcomes (P. J. Smith & Merwin, 2021).

One study exploring existing coping strategies amongst secondary school teachers found that participants reporting low levels of stress used exercise as the main activity to gain relief, and this was the only positive strategy they utilised (Austin et al., 2005). In another study, although not focused on secondary schools, middle-aged and older teachers cited relaxation and exercise to reduce stress (Skaalvik & Skaalvik, 2015). Relaxation alone was shown to reduce perceptions of stress in one small study of secondary school teachers (Kaspereen, 2012), but overall there seem to be few intervention studies to reduce stress with exercise or relaxation.

Of relevance to this research is a workplace study with nurses, who have similar temporal constraints to educators, which failed in its aim to increase their physical activity: the results showed they were already highly active in their jobs (Tucker et al., 2011). However, the nurses reported that the intervention was a stress reliever, preferring the components of Nintendo Wii, taking the stairs and using 3-minute energy-burst DVDs over frisbee, relaxation aids and written advice. Additionally, they reported requiring adequate privacy for activities and that managerial support was important for success. This study is salient in that it highlights that interventions can require contextual facilitation (relevant to the next section on situation); it also indicates that having time out and fun was the benefit and that unintended outcomes can generate insight.

2.6.3 Situational

A widely researched situational strategy is physically moving away from the stressor, either in the moment or to recover in the short or long term. This withdrawal requires autonomy and opportunity and is not always practical or facilitated due to the temporal and spatial constraints inherent in teaching. However, it is a strategy referenced in the teaching literature (Camacho et al., 2018; Sharplin et al., 2011;

Skaalvik & Skaalvik, 2015) that aligns with recognition of a physical dimension to stress (Hargrove et al., 2011). In the short term, withdrawing could be accommodated by 'local privacy' (i.e. staff rooms) for public-facing professionals (Palm, 2009). In the longer term, taking sick leave has been recognised in the Teachers' Stress Inventory (Fimian & Fastenau, 1990) and one that is reported by middle-aged and older teachers (Skaalvik & Skaalvik, 2015). The alleviation of stress was a key reason given for providing what has also been termed in the literature as a 'backstage' area, such as staff rooms, along with enabling social support and some autonomy, given the polychronically crammed nature of their work (Hargreaves, 1990).

There are few studies examining the ability to take a break, the provision of a staff room or environmental changes for teachers. Situational change is hinted at in a large study of combined interventions amongst Chinese teachers, which referenced establishing flexible work schedules and redesigning the work environment, but without accompanying detail of what that entailed (Wu et al., 2006). School workplace conditions are sometimes described as the school climate or culture, ethos or atmosphere. The multidimensionality of the school climate is most comprehensively constructed from academic, community, safety, and institutional environment aspects (M. Wang & Degol, 2016). School culture has also been framed as the psychosocial environment (Newman & Beehr, 1979) and as multi-contextual (Ainsworth & Oldfield, 2019), but details on how stress and the teachers' physical situation or environment are related are sparse in the literature. As an individual strategy, situational change usually requires facilitation at the organisational level. There is an understanding of its importance in schools (Hakanen et al., 2006) and extensive research has been undertaken among office workers (Magzamen et al., 2017). Even where a healthy work environment for staff is referenced as part of the culture, specifics on what that entails or provisions made to reduce stress are often absent (Ouellette et al., 2017; Pelsma et al., 1987).

2.6.4 Psychological

The literature on psychologically based or psychosocial interventions is more extensive. Several systematic reviews have looked at psychological interventions for teacher stress or burnout. Psychological interventions include cognitive techniques such as cognitive behavioural therapy (CBT), Problem Solving Therapy (PST) and Acceptance and Commitment Therapy (ACT). CBT is a talking therapy, designed to 'modify the individual's idiosyncratic, maladaptive ideation', a psychotherapy that helps people learn to think and react in more helpful ways in everyday situations (Beck, 1970; Blenkiron, 2022). Psychological interventions have also been termed as mindfulness, which comprises multi-dimensional interventions, extending beyond relaxation and meditation to include psychological and sometimes social and educational components (Bertoch et al., 1989; Frank et al., 2015; Jennings et al., 2013; Klap, 2020; Reiser et al., 2016; Roeser et al., 2013). There are many similarities between some CBT and mindfulness approaches and the differences can be unclear, as noted in a systematic review of mindfulness interventions with teachers (Y.-S. Hwang et al., 2017). Other studies describe the multi-dimensional approach as Stress Management Training (Siu et al., 2014) or Stress Inoculation Training (Shimazu et al., 2003), or simply use the catch-all terminology of 'third-wave' CBT (Hayes, 2004).

Looking at the intervention process can help determine whether it is predominantly psychological. One pilot study tailored 'yoga and mindfulness' to stressors common to educators in a city school were emphasised, with chair-based yoga poses taught in six short sessions over three weeks. Yet the process was strongly psychological with reframing of thinking in most sessions. For primary and middle school teachers, there was a medium effect size in pre-post stress and emotional exhaustion reductions. They were positive about the intervention but cited temporal constraints for both session attendance and practice at home (Ancona & Mendelson, 2014).

Another mindfulness study had the notable combined strengths of being targeted at stress reduction, adapted for teachers, and with use of both objective and subjective measures. They averaged over 12 years in the job and they were all from primary schools. After eight weeks of training and at one-month follow up, both subjective

and objective data (including morning saliva cortisol measures) showed reductions in stress. A key limitation not discussed was the time demand – the weekly meetings took 2.5 hours, plus a 7-hour full day session and home practice (Flook et al., 2013).

Iancu et al's systematic review of taught interventions aimed at reducing teacher burnout found eleven RCTs including secondary school level educators and showed CBT to have an overall small effect. Despite the common focus on burnout, limitations included many studies not measuring each of the standard burnout categories (emotional exhaustion, personal accomplishment, depersonalisation/cynicism) and not all teachers recorded being burnt out before receiving an intervention (Iancu et al., 2018). In contrast, Jeffcoat & Hayes' study showed that an effective intervention could be self-taught. An ACT bibliotherapy course with primary and secondary teachers had a completion rate of 79 per cent and the improvement in psychological health post-test was significant and at ten weeks even better, but this seems to have been measured in the school holidays. The seniority of participants was not noted, and 90 per cent of the sample were female (Jeffcoat & Hayes, 2012). Denuwara's more recent meta-analysis of individual level stress-reduction interventions found a substantial effect in high-quality CBT studies with teachers across primary and secondary schools and in special schools, although CBT interventions were more effective still if combined with relaxation techniques (Denuwara et al., 2021).

Few studies or reviews look at duration of effect through follow-up measures. Exceptions include a review of stress reduction interventions with healthcare workers where CBT with or without relaxation was still effective after six months (Ruotsalainen et al., 2015). In two studies with a mix of primary and secondary level teachers, internet-based problem-solving training effects were still significant for reductions in emotional exhaustion and depersonalisation after six months (Ebert et al., 2014) although not with personal accomplishment. Likewise, stress reduction reports remained after a three-month third-wave CBT intervention, which included focus on meditation, yoga, skills and education (Roeser et al., 2013). These are interesting results, as burnout intervention studies with just primary school teachers have reported almost null results (Iancu et al., 2018).

Altogether there is some evidence of reduction of stress and burnout after psychological interventions, but there is little detail on benefit for more senior teachers, on self-guided interventions and on facilitating the implementation of time-consuming interventions.

2.6.5 Social

Social support through friends, family and work colleagues has been credited as an important resource to cope with stress (Maslach, 2001). It has been shown to aid teachers' resilience (Howard & Johnson, 2004) and be important for occupational wellbeing (Michie & Williams, 2003), and is described as both a direct action and palliative coping strategy amongst new recruits (Sharplin et al., 2011). Relationships are a crucial component of resilience (Day & Gu, 2014; Gu, 2014; Gu & Day, 2007). Conversely, lack of social support has been associated with stress (Kyriacou, 2001; Ouellette et al., 2017; Roeser et al., 2013), with a suggestion that decreased self-efficacy is correlated with reduced experience of social support (Muenchhausen et al., 2021). Cutrona and Suhr distinguish between five different types of social support, namely informational, tangible, emotional, appraisal and companionship, the last three of these having a particular emphasis on caring and relationship (Cutrona & Suhr, 1992).

Social-emotional skill development is often grouped with social support, underlining the ability to handle and benefit from peer relationships. Social support is frequently referenced as important in qualitative studies (Gu, 2014). In one recent study of 107 Finnish teachers of under 11s on coping with stress, nearly a quarter mentioned peer professional support, over a third social support from family and friends, and nearly 70 per cent cited the importance of social relationships in and out of school (Aulén et al., 2021). Another short study provided 75 secondary school teachers with moderated, online forums for anonymous communications over the course of a week (S. S. K. Leung, Chiang, Chui, Mak, et al., 2011). Of these, 63 activated their accounts and 56 took part in the intervention; nearly half considered it socially supportive and 62 per cent reported that it was effective in managing stress, although only 26 of the

participants took part in the evaluation. This is one of the few studies where the majority of participants were male (63 per cent), and they reported easily being able to incorporate use of the forum into their busy work schedule.

An intervention study with German secondary school teachers focused on improving management of work relationships with monthly sessions spread over ten months, allowing time to apply learning (Unterbrink et al., 2012). Significant effects were maintained at one month follow-up but there was a high rate of attrition, with just 92 out of 171 completing more than half of the ten intervention modules. No mention was made of whether the study took part in protected school time or after school, which could have been a significant factor. Temporal constraints were cited as the main reason for attrition, and the depersonalisation component of burnout was unaffected, unlike with Ebert et al's (2014) CBT-based intervention mentioned above. No details of their time in teaching or seniority were included. Kidger et al's mixed methods study trained nominated colleagues in peer-support using the Mental Health First Aid training programme. After a year, 6.3 per cent of staff in the intervention schools had used the service, all reporting it as helpful, and 17.4 per cent of staff said they would use the service if they needed to (Kidger, Stone, et al., 2016).

Unterbrink, Kidger and Leung's studies all focused on social support between teachers, which has been correlated with a sense of belonging or connectedness to the school (Day & Gu, 2014; Skaalvik & Skaalvik, 2015). This connectedness or strong organisational identification has been shown at the primary school level to mediate the likelihood of seeking social support (Avanzi et al., 2018). This indicates the overriding influence of the school culture. Connectedness or relatedness is one of the innate psychological needs affirmed by self-determination theory (SDT), and the relevance of SDT to teachers' workplace experiences has been established (Collie et al., 2016). Gender differences in the effectiveness of teacher stress interventions seem to be under-explored (Collie, Bostwick, et al., 2020; Martin & Marsh, 2008). This is possibly because male teachers are under-represented in many studies (Pau et al., 2022), and they are less likely to talk to their social supports about stress (Ferguson et al., 2017). However, when men do take part, they report more psychological issues than women (Avanzi et al., 2018; Pau et al., 2022).

Conversely, professional isolation is a known risk factor for stress (Dussault et al., 1999), although one recent study of Irish teachers highlighted the more complex intersection of isolation, individualism and competitiveness (C. Murray, 2020). This also raises questions about social networks and improving teacher quality (Baker-Doyle, 2015), and links back to the school culture mentioned above in 2.6.3, much of which is beyond the individual teacher's control.

2.7 Gaps in knowledge

Whilst there is evidence of the effects of some individual approaches to stress management, few conclusions can be drawn due to study heterogeneity and missing data, and broader questions remain on teachers' experiences and the influence of educational contexts on permitting, facilitating or hindering stress relief strategies.

Some studies have reported self-awareness and stress management generating compassion and permission to self-care (Schussler et al., 2016; Taylor et al., 2016), but many studies report losing participants due to temporal constraints, with taught interventions too difficult to fit in or too burdensome on top of the day job. Indeed, authors of a recent review of psychological interventions, having found the greatest effect on alleviating stress (more than burnout, depression and anxiety), then expressed the view that few interventions would translate well into real-world contexts where teachers are time-poor (Beames et al., 2021).

The qualitative literature indicates that teachers have a wide range of personal stress management strategies (Castro et al., 2010; Kiltz et al., 2020; Richards et al., 2018; Sharplin et al., 2011; Skaalvik & Skaalvik, 2015). They are highly aware of stressors and the need for stress alleviation, but there seems to be a lack of investigation into this for teachers who have taken on management or pastoral responsibilities. There is some research on what school principals have reported as helping their stress (Graf, 2018), and more recently it has been suggested that asynchronous programmes have a part to play in teachers' stress management as they offer necessary flexibility of access (Beames et al., 2023).

Insights into the effects of interventions focused on secondary school teachers appear less frequently than at the primary or elementary level. Additionally, quantitative research is not set up to yield insight into why an intervention was or was not helpful, which are the crucial details required for improving design or facilitating use.

2.8 Summary

The aim of this second chapter has been to provide an overview of stress and to briefly synthesise the literature on school workplace stress. It explores how stress management interventions can be categorised and that there is some evidence for individual teachers' self-management of stress.

Whilst the concept of teacher stress has been recognised for many decades, the rates of professional stress remain high amongst educators. The literature indicates a knowledge of sources and stressors but understanding the efficacy or experiences of individual self-management of stress is more fragmented.

Teachers in the secondary sector, particularly in city schools and those who have pastoral or managerial responsibilities, report greater levels of pressure, but temporal constraints on teachers have led researchers to doubt whether many stress management interventions would translate at all outside of research studies.

There was no obvious framework or theory to replicate from this literature in my studies but synthesising the evidence for individual stress-management strategies provided a useful explanatory categorisation. The concept of autonomy emerges as important to teachers, and this influenced the decision to enable some choice for teachers in the longitudinal study.

Clearly significant needs remain, and this raises the question of whether digital tools can help teachers better manage their stress given the polychronic nature of their roles that demands their concentration on several tasks at once. The evolution of

digitally supported stress self-care could provide an answer and this subject is explored in the next chapter.

Chapter 3 Digitally enabled stress self-management: HCI, Consumer Choice and Contexts

"Maybe you are getting a little stressed out, and a little walk would be quite welcome at that point. But it's all work that's in progress…we'll see how much users will be welcoming such software, and we'll design it until they do welcome it. We'll iterate it and do it better." Dr Mary Czerwinski, 2018, MS research Podcast

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Parts of this chapter have been published in JMIR Mental Health & Formative Research (Manning et al., 2020, 2022) and submitted as a further paper now under peer review.

3.1 Chapter Overview

The previous chapter synthesised the literature on teachers' stress management as the first concept. Teachers' reports of stress remain one of the highest of all professions and this chapter introduces Human Computer Interaction (HCI) as a multidimensional discipline that allows examination of a potential solution to this problem. HCI complements digital health literature on workplace stress, providing a way to examine how technology can best serve the needs of the user, often through exploration of user experience (UX) and influences of human factors. HCI and its application to digital self-care and how interventions can be categorised are described, followed by a review of some of the mechanisms or techniques used. The rationale, categorisation and descriptions of technologies and contexts are then explained.

3.2 HCI and self-care

Human Computer Interaction has become the umbrella term for interdisciplinary, overlapping fields of computing, social sciences, engineering and design. A definition

is difficult to pin down as the field continues to expand; the general term 'interaction design', defined as 'designing interactive products to support the way people communicate and interact in their everyday and working lives', has tried to capture more of the complexity (Rogers, 2012). HCI designers have long been encouraged to collaborate with users (Cresswell et al., 2017; Suchman, 2007) and understand real-world situations (Blandford, 2013; Rogers et al., 2019). Therefore, not only is HCI itself interdisciplinary but it becomes a lens through which other disciplines and their problems are explored. This can pose challenges relating to definitions, terminology, values and assumptions (Blandford et al., 2018), which will be borne in mind throughout this research. However, HCI offers an opportunity to explore questions and solutions along the whole value chain of influences and effects (W. Smith et al., 2014), and is well-placed to evaluate technology to support self-care.

3.2.1 Technologies for self-care

HCI has contributed to understanding the use of technology in health for self-care (Nunes, 2019; Nunes et al., 2015), although Nunes et al note that reviews of this in HCI are not common. Digital health interventions build on the concept of the self-management of health, explored at a policy level in the UK by the government-initiated Expert Patients Task Force in the 1990s, which drew on international expertise (Barlow et al., 2002). There seems to be no agreed conceptual distinctions between self-care and self-management in the health technology literature (Peeters et al., 2013). However, Barlow et al use a definition of self-management that emphasises the personal outcome of adequate psychosocial functioning as follows:

> *Self-management refers to the individual's ability to manage the symptoms, treatment, physical and psychosocial consequences and lifestyle changes inherent in living with a chronic condition.* (Barlow et al., 2002, p. 178)

This definition has found salience in the health technology literature (Derboven et al., 2018; Tadas & Coyle, 2020) and is the definition that adequately encompasses teachers' stress self-management strategies described in section 2.6.

Consumer health and wellbeing apps, wearables and websites and more recently chatbots now afford huge potential to facilitate self-management. HCI in health can be seen as a subset of the vast 'eHealth' and 'mHealth' literature, contributing key insight into issues of safety, usability and utility (Blandford, 2019). Apps have proliferated, with over 300,000 available on app stores (Neary & Schueller, 2018) and over 1,000 for stress alone (Lau et al., 2020).

Studies have shown the potential of digital health stress interventions accessible via web and computer-based programmes (Heber et al., 2017), apps (H. Hwang et al., 2022; Ly et al., 2014) and wearables (E. N. Smith et al., 2020) and how tracking can be harnessed to mitigate stress (Kim et al., 2022; K. Lee et al., 2020). Additionally, popular websites have been repurposed to provide stress management interventions (Paredes et al., 2014). Each of these platforms and tools instantiate components to deliver the intervention (Mohr et al., 2014), and describing some of these components is one way of explaining how they are experienced or what action they support. Categorising DHIs can help users choose consumer technology and different classification approaches have sought to enable informed user choice.

3.2.2 Categorising digital interventions

There are some public facing evaluation frameworks and most seem to have categorised interventions according to condition, outcome (such as gratitude), app or website name, sometimes the treatment approach such as CBT or medium such as a chatbot (ORCHA, 2020; Psyberguide, 2020). However, another approach is to categorise intervention strategies. This gives a practical, descriptive model for explaining what the digital technology seeks to enable, and the literature this is based on is now described briefly because it is detailed in more depth in Chapter 7 where a taxonomy was created to offer participants choice of digital technology.

An early smartphone taxonomy (Klasnja & Pratt, 2012) provided a framework for explaining how mobile phone features afforded five intervention strategies. These were (1) tracking health information, (2) involving the healthcare team, (3) leveraging social influence, (4) increasing the accessibility of health information, and (5) utilizing

entertainment. These strategies were later applied to other mobile technologies, e.g. wearables (Klasnja & Pratt, 2014). Five similar strategies were also described in an analysis of digital self-care opportunities for long-term conditions that took a user and carer perspective, rather than a designer or clinician basis (Nunes et al., 2015). These strategies, also termed active ingredients or mechanisms of action (E. Murray, 2012)) have been explored in more detail and depicted as 17 'motivational' strategies identified through an empirical review of 85 papers on persuasive technology for health and wellness (Orji & Moffatt, 2018). Both Nunes and Orji emphasised they were identifying 'trends' in design, and along with Klasnja created a short-list of candidate intervention strategies with explanatory power for the lay person. The five strategies arrived at, also conceptualised as 'action-enabled design features' were summarised as 1) Fostering reflection, 2) Suggesting treatment or guided self-management, 3) Peer to peer social support and 4) Utlising entertainment. Involving the Healthcare Team (5) was dropped as it was not an individual strategy.

There is some specific research on how such features have been deployed to help with stress management of employees, and the following sections give an overview of some literature on how this has been achieved.

3.3 Mechanisms and features that can support employee stress management.

3.2.1 Reflection

Reflection on information, data or context can be enabled by provision of relevant educational content or data capture by the technology. Where data is collected, reflection can occur during data collection (Choe et al., 2014), also termed reflection-in-action, or after the event, reflection-on-action (Ploderer et al., 2014; Schön, 1983). Apps and wearables have facilitated the collection, tracking and use of personally relevant data either through self-report or automatic sensors through the working day. This facility has stimulated a new subfield within HCI of personal Informatics (PI) (I. Li et al., 2010) which is now described.

3.2.1.1 Personal informatics

Li described five stages of PI - preparation, collection, integration, reflection and action tracking – and the PI concept has been extended to 'lived informatics' to further communicate the multiple ways and role of context in which personal data are used and reflected upon (Epstein et al., 2015; Rooksby et al., 2014). Importantly for both, reflection precedes action. Epstein notes that PI can now draw on patient-generated health data and patient reported outcome measures (PROMS) (Epstein et al., 2020) which can give valuable insight for tailored self-management, prevention, and social support (Dimaguila et al., 2019). Three streams of research in PI have been identified as psychological, phenomenological, and humanistic (Ayobi et al., 2016). The phenomenological stream of research in PI seeks to understand the user's experience in their real-world, complex contexts and can generate insight into contextually relevant features and concepts. This stream is where investigating the deployment of consumer digital health interventions for a specific condition and occupation naturally fits.

In the PI and digital health literature, self-report of stress has been demonstrated with students through ecological momentary assessment (EMA) (L. Chan et al., 2018) but they cautioned that the micro-interaction nature of EMA might not be compatible with the time taken to sense one's emotional state. Popular consumer apps such as Daylio have sought to manage this by providing emoticon options that can be quickly tapped and then allow reflection on collated data of feelings or symptoms associated with stress and wellbeing at the user's volition (Potapov et al., 2021; Schueller et al., 2021).

Automatic detection of stress can be achieved through wearable sensors utilising galvanic skin response (GSR), also known as electrodermal activity (EDA) (Sano & Picard, 2013), through photoplethysmography (PPG) to detect heart rate variation (HRV) (Hao et al., 2017; Pinheiro et al., 2016) and from smartphone text language (Byrne et al., 2021). Equivalence of stress detection in the real-world has been demonstrated between manual self-reports and both automated GSR or voice-based analysis (P. Adams et al., 2014). Heart rate and HRV using PPG are a burgeoning area

of research (B. W. Nelson et al., 2020; van Dijk et al., 2015) due to the continuous, unobtrusive, scalable and ecologically valid data collection of cardiac activity afforded by consumer wearables. Nelson et al note however that metadata standards are required to ensure reporting accuracy and enable valid comparisons.

Collected sensor data is turned into a visualisation for the consumer which supports reflection, but this is not without its challenges. Visualisations of information have been shown to generate powerful affective ties between people and their data (Kocielnik & Sidorova, 2015; Ruckenstein, 2014), but some visualisations do not allow differentiation between causes of stress, such as physical exertion as opposed to emotional pressures, or don't align with subjective experiences (Stepanovic et al., 2019; Xue et al., 2019). This has been demonstrated both in terms of severity of stress (Sillevis Smitt et al., 2022) but also lack of differentiation between distress and eustress (McEwen & Akil, 2020).

When monitoring stress with the Empatica wrist-worn device in real life conditions, contextual information was critical to being able to distinguish between psychological stress and the varying situations that caused a similar arousal of heart-rate, such as exercising and hot weather (Gjoreski et al., 2017). The social context of data has also been shown to enable people know their 'baseline' for normative comparison of health, and to support collaborative exploration of the meaning of data, which could inform an individual's mental model of the relationship between the physiological indicators and contextual factors (Puussaar et al., 2017).

Others have reported people appreciating awareness of their stress, but then not knowing what to do having seen the data (Ding et al., 2021; Kersten-van Dijk et al., 2017; van Dijk et al., 2015). This has previously been noted in a study on people using a Fitbit to track their sleep, where they lacked an understanding of what constituted normal sleep, why they lacked sleep and what to do about it (Liang & Ploderer, 2016).

Mixed feelings were expressed in the study by Liang on awareness of stress at the personal, micro-level, aligning with previous work highlighting the risk that

perception of stress can, for some, lead to increased stress (Kersten-van Dijk et al., 2017; MacLean et al., 2013; Sanches et al., 2010; Yassaee & Mettler, 2019).

A significant advantage of PI is that a small-scale qualitative evaluation of digital tracking technology can generate significant insights into how, when and why users engage or not with the technology, and their experiences of use (Kersten-van Dijk et al., 2017). PI is not the only route to reflection; reflection can also be facilitated through apps supporting emotional self-awareness (Litvin et al., 2020; Morris et al., 2010), chatbots offering guided therapy (Howe et al., 2022; Inkster et al., 2018) or timely reminders (Howe et al., 2022; Morrison et al., 2017; Sano et al., 2017).

3.2.2 Suggesting treatment or guided self-management

In addition to reflection, digital tools can be a platform for practical support and therapy. Treatment and self-management for stress can include iCBT, third wave iCBT, mindfulness, online forums, psychoeducation, exercise and internet stress management interventions which can include any of the aforementioned. Exploring employees' experiences from interaction with such treatments is limited but has included determinants of adherence. Employees were more likely to stick with a tailored stress intervention when given either content or adherence focused guidance and support (Zarski et al., 2016), and digital health reviews tend to agree that employees prefer and do better when given practical support (Phillips et al., 2019; Renfrew, Morton, Morton, et al., 2021; Stratton et al., 2017). For a non-clinical adult population, humour, relevance, encouraging content and flexibility were meaningful to sustained use of a positive psychology audio-visual programme via an app or website (Renfrew, Morton, Northcote, et al., 2021). Amongst the general population, exercise guidance was effective in reducing stress, but whether this was facilitated by the adaptivity of the web-based design or convenience of activity location (gym or non-gym) couldn't be determined (Konrad et al., 2015). Reflection and treatment can be brought together, as demonstrated when machine learning was applied to tracking data, leading to suggested interventions for stress-mitigating planning and action by office workers (K. Lee et al., 2020).

3.2.3 Peer to peer social support

Another way of supporting stress management is through peer and social support. This is powerful because mutual understanding creates solidarity and empathy, and communities that have shared experiences support individual meaning making (Ruthven, 2019). Teachers described this from using an online forum in Hong Kong (S. S. K. Leung, Chiang, Chui, Lee, et al., 2011), and sharing ideas for stress management was valued by students (K. Lee & Hong, 2018). Also, IT workers found social networks leveraged humour and intimacy that could reduce individual perceived stress levels (Paredes & Chan, 2011). Recreating a sense of empathy or compassion with artificial agents (chatbots) with professionals or students to support stress management has been challenging (Park et al., 2019; Yorita et al., 2020) and researchers in the broader mental health space have emphasised the need for context-sensitive design (Damij & Bhattacharya, 2022). Yet empathy has been demonstrated in a public cohort reporting depression (Inkster et al., 2018) and ChatGTP responses to various patient questions were perceived by health professionals as more empathetic than physician responses (although not clinically validated) (Ayers et al., 2023). Automated social support in the workplace for stress does not appear to have been explored much with educators, although chatbots have been used as teaching assistants (Hamam, 2021).

3.2.4 Utilising entertainment

Gamification and entertainment are mechanisms that could help with stress based on evidence from positive psychology, relaxation, improved self-perception or psychoeducation, (Fleming et al., 2017; Kato, 2010) but there seems little study of such in the workplace (M. Li et al., 2021; Paredes & Chan, 2011). Signposting through contextually informed machine learning to popular web apps that support therapeutic strategies including fun and games has demonstrated increased self-awareness of stress and new ways to deal with it (Paredes et al., 2014). However, app designers do not yet seem to be exploiting the potential of gamification techniques (Cheng et al., 2019; Hoffmann et al., 2017, 2019; M. Li et al., 2021). A

population specific stress intervention role-playing game (RPG) showed design could be relatable to a specific culture (M. D. Lee et al., 2014) but again RPGs for stress management appear generally to be untested (Arenas et al., 2022). Studies have also shown stress reduction is possible indirectly from digital technology use, as in IT employees using gamification to build resilience (Litvin et al., 2020), and nurses using an exercise video and Nintendo Wii intended to increase their activity levels (Tucker et al., 2011).

3.4 Rationale and categorisation for digital stress support

The interest shown by industry, researchers, innovators and policy makers in digital interventions to support psychological health and wellbeing health has been multi-factorial. A key driver has been hypothesised reductions in disparities and health inequalities, with the rationale for this including some of the following:

- scaling of treatment access – Stress has a high teaching population prevalence (Education Support Partnership, 2018, 2019, 2021, 2022) and digital tools are a potential way of increasing the availability of interventions for unmet workplace stress needs (Heber et al., 2016; Howe et al., 2022) although acceptability to different demographics is largely unknown (Goodday & Friend, 2019);

- reduction in treatment costs – potential cost reductions to the patient and health provider has stimulated interest in e-therapies (Bennion et al., 2017) but it is unclear whether this applies to stress, particularly as for online interventions, guided support is more effective (Heber et al., 2017) and we know therapist guidance is still required for cost-effectiveness of digital interventions for other conditions such as depression (Paganini et al., 2018);

- timeliness and duration of interventions – Long NHS waiting times have been a consequence of high demand and insufficient staffing, therefore technology-mediated interventions are a potential way to offer support more quickly (NHS Digital, 2014). Digital stress support can offer pre-scheduled or just-in-time solutions (Sano et al., 2017) as well as flexibility over time and

place of access (Carolan & De Visser, 2018) and shorter intervention duration (Mak et al., 2015) which could be of appeal in the time-pressured education sector;

- circumventing stigma – The continuing stigma and fear associated with teachers' help-seeking on stress (Butler, 2007; Education Support Partnership, 2018, 2019, 2021, 2022) can be circumvented through digital tools enabling anonymous access to mental or emotional health support. Anonymity was shown to be appreciated by university staff and students in an online mindfulness-based study for mental wellbeing (Mak et al., 2015), and in qualitative feedback on a web-based CBT based stress management intervention from charity, university and telecoms employees (Carolan & De Visser, 2018). Avoiding stigma was mentioned as a consideration in the design of a smartphone-based stress reduction study amongst mostly female employees in Korea (H. Hwang et al., 2022);

- consumer availability – Technology platforms including smartphones, wearables, apps and websites, have made digital access to stress management interventions available without the need for clinical prescription. The challenge remains however for public awareness and assurance of the evidence base for the interventions (Ding et al., 2021; Lau et al., 2020; NICE, 2021; E. N. Smith et al., 2020);

- smartphone availability – Initial concerns about health care delivery costs being transferred to the participant via mobile and connectivity charges have been shown to not be detrimental to digital trials recruitment (Whitehead & Seaton, 2016).

Counter to this rationale is the argument that the health and wellbeing app sector has grown exponentially not from individual demands or noble ends but as a commercial expedient from industry, aided by successive neo-liberal governments (Catlaw & Sandberg, 2018; Petrakaki et al., 2018). In digital health (as opposed to medical therapeutics) there have been no regulatory compliance requirements, and commercial models of digital health tools provide data for marketing and capitalist exploitation (Zuboff, 2019). Whilst this landscape has facilitated innovation, it has

also raised issues in the broader mental health domain beyond commercial ethics of assurance for both professionals and the public around concepts of safety, privacy, efficacy and validity, and hence trust (Torous et al., 2014, 2018). The research community has exposed and recognised these issues, highlighting privacy risks (Huckvale et al., 2015), the need for evidence-based wellbeing apps (Carlo et al., 2019) and creating evaluation frameworks to give users more information on health technology privacy, experience and clinical evidence (Leigh et al., 2017; Neary & Schueller, 2018; Stoyanov et al., 2016).

3.5 Public choice of digital health Interventions and trust

User recommendation on app stores is a common route for choice but it has many limitations. Availability of mental health apps is hampered by high turnover: 50 per cent of search results change within 4 months and an app is removed every 2.9 days from online platforms (Larsen et al., 2016). Also, the sources of the reviews are unknown. More detail on public sentiment via user recommendations of mental health apps has been achieved by machine learning analysis, revealing the top positive and negative themes for user satisfaction (Oyebode et al., 2020). High cost, app instability, low quality content and privacy/security concerns were the most common dissatisfaction themes. Tracking, outcome visualisation and analytics, and content quality and variety were the most common satisfaction themes. Some apps use scientific language in their descriptions to verify their clinical validity. Yet one study of 73 popular mental and emotional health apps found that although 44 per cent used such language, only two apps actually provided direct scientific evidence associated with app use (Larsen et al., 2019).

The wearable medical device market continues to grow, with 60 per cent growth predicted between 2019 and 2024 to $27bn (Bloomberg, 2020). Early evidence shows wearables can accurately capture exposure to psychosocial stress in everyday life (Pakhomov et al., 2020). Currently, wearable choice seems to be guided by perceived value, design and brand (H. Yang et al., 2016) over and above condition management, and due to their large-scale deployability, wearables are of increasing interest to

public health researchers (Huhn et al., 2022). Although derived from a broad mapping of personal informatics literature, Epstein et al note that so far, few solutions to promote privacy and trust with self-tracking are proposed in the literature, but there should be critical engagement between companies and policy makers on how tracking data is used (Epstein et al., 2020).

Drawing on data and conversations with the Education Support partnership whose annual surveys informed this research (Education Support Partnership, 2018, 2019, 2021, 2022), concerns on privacy described in Chapter 4, Section 4.3.1, and health professional's concerns on DHI reassurance (O'Connor et al., 2016) retaining teachers' trust was paramount. I therefore chose to describe the digital interventions to teachers with care. The rationale for therefore choosing to describe them as Digital Companions is described next.

3.6 Deriving the term Digital Companion

A variety of terms have been used to describe digitised mental health support, reflecting the cross-disciplinary environment. Terms including Digital Health Interventions (DHIs) and ehealth or mhealth are frequently used in healthcare (Blandford et al., 2018; Finucane et al., 2021; Stratton et al., 2021). Also self-quantification (Choe et al., 2014; Lupton, 2016a; Sharon, 2017) and 'personal informatics', for those that help people collect and reflect on personal information (Epstein et al., 2020; I. Li et al., 2010). Much psychological and social science literature emphasises the behaviour change component in Digital Behaviour Change Interventions (DCBIs) (Perski et al., 2017; West & Michie, 2016). The latter approach has been challenged in public health research as undermining autonomy, with the behaviour being potentially changed through coercion and manipulation, not just information and persuasion (Tengland, 2012). Tengland proposed that to describe an intervention as 'empowerment' would be preferable, but this too has been challenged on the basis that it is paternalistic and ignores the social, economic and contextual constraints on how digital tools are used (Floridi, 2016; Morley & Floridi, 2019).

The term 'companion' has been used in different ways in HCI and associated research (Jingar & Lindgren, 2019; Morley & Floridi, 2019; Niess & Wozniak, 2020; Turkle, 2011), but it retains the meaning of an accompaniment, not a replacement, used in various contexts. The conceptual framing is important to communicate both that the digital health ecosystem is not a techno-utopia and that individual autonomy is being respected. Therefore, the term 'digital companion' was adopted when describing to teachers potential apps, websites or wearables that could be used to manage stress.

Also requiring definition for the purposes of this research was 'context' as. the multi-disciplinary literature demonstrated a need for clarity/

3.7 Context explored

There is a complex interplay of contexts in any given situation, but some disentangling is required for sense-making. In parallel with the assertion that 'usability' is a construct that needs to be unbundled (Tractinsky, 2018), HCI health research would benefit from clearer definitions of context for evaluation or critique of design to be meaningful.

Understanding contexts has inspired subjective enquiry, including ethnomethodology in the late 1960s (Garfinkel, 1967) and longitudinal studies in healthcare in the 1980s (Pettigrew, 1990). Pettigrew defined two sorts of context: the 'outer' context, which refers to the economic, social, sectoral and political environment in which an organisation is established, and the 'inner' context, which includes the structural, cultural and political environment as the setting for developing and delivering ideas. In HCI, contextual influences are largely focused on the inner context and behaviours described as 'situated action', acknowledging that behaviour is constructed and reconstructed dynamically in response to the specific circumstances, context or relations in which it takes place (Suchman, 2007). These relational situations were further elucidated as organisational, geographical, cultural and temporal boundaries (Carayon, 2006), reflecting that dynamic interactions are taking place between people and technology in complex, multi-layered systems. In a later literature review to frame the contexts of technology use for HCI, five

components were identified: physical, temporal, task, social, and technical and informational, with related subcomponents (Jumisko-Pyykkö & Vainio, 2010). Their model is depicted in Figure 3.1 to illustrate the assignment of their subcomponents.

The advancement of ubiquitous computing and application of intelligent software adds a deeper dimension and definition to context, particularly physical and informational. Context awareness has been defined as "any information that can be used to characterize the situation of a person, place or object deemed relevant to the interaction between a user and an application, where the relevance depends on the user's task" (Gubert et al., 2020, p. 246). Whilst studies on context awareness are evolving, the personal emphasis touches on the individual attributes recognised as contextual variables influencing the Technology Acceptance Model (TAM) (Davis, 1989; Holden & Karsh, 2010; Paganin & Simbula, 2021). This individual level adds another layer of context that requires consideration.
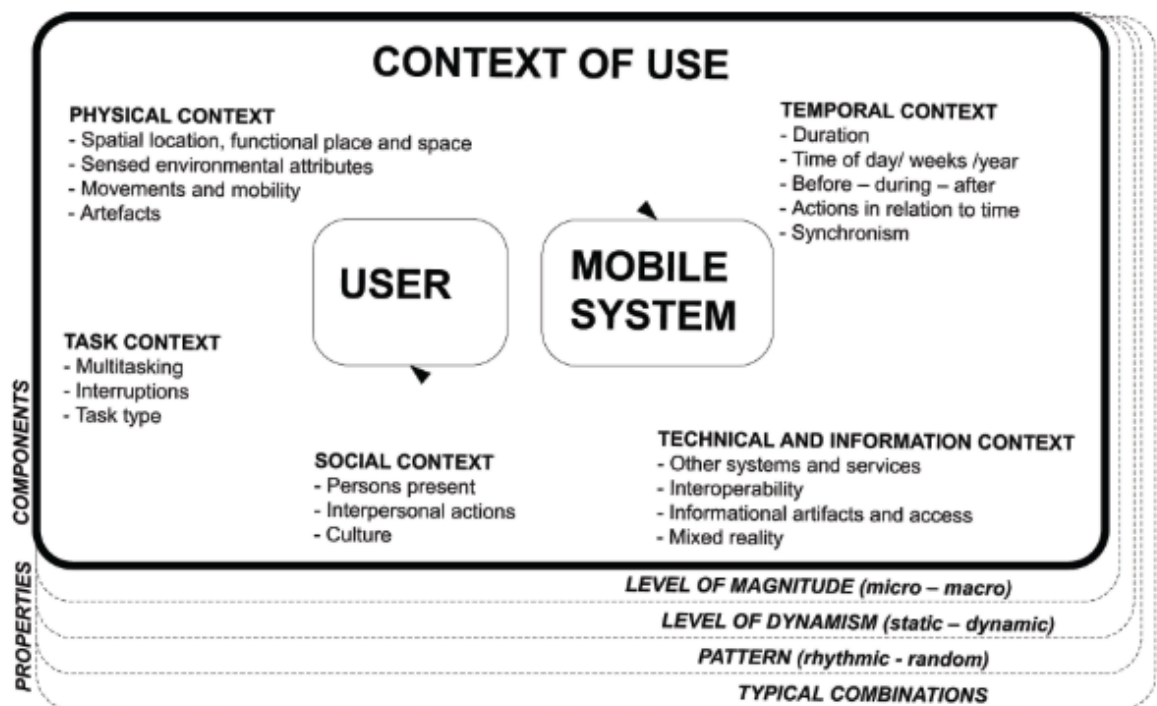
FIGURE 3.1. IMAGE OF JUMISKO-PYYKKO & VAINO'S MODEL OF CONTEXT OF USE IN HUMAN-MOBILE COMPUTER INTERACTION (2010) – REPRODUCED WITH PERMISSION

The wider educational context for this thesis has previously been stratified into component contextual concepts. These conceptual dimensions have been described

as overlapping and inter-connected. In the education literature examining policy ramifications, to understand nuanced relevance, contexts have been described by Ball et al (2012) as:

1.   situated contexts (such as school history, intakes and settings);

2.   professional contexts (such as values, teacher experiences and policy management);

3.   material contexts (such as staffing, budget, technology and infrastructure);

4.   external contexts (such as degree and quality of local authority support, pressures and expectations from the broader policy context, legal requirements and responsibilities) (Ball et al., 2011).

Elsewhere, educational contexts have been framed as cultural when describing the professional and psychosocial contextual variables (Ainsworth & Oldfield, 2019), or as ethnic geography (S. S. K. Leung, Chiang, Chui, Lee, et al., 2011) or as school climate when describing the situated, professional and external contexts (Thapa et al., 2013). Often contextual factors are simply described and not categorised (Kokkinos, 2007; Skaalvik & Skaalvik, 2015) leaving the reader to infer context category, such as situated, external or personal.

This brief overview shows there is variation in framing and definitions, and a definitive mapping and critique of health, HCI and educational contexts is beyond the scope of this thesis. But to enable clarity of contextual descriptions, the literature mentioned above has been drawn upon to suggest a simplified working framework, as depicted in Figure 3.2.

Macro-Context: Education

Meso-Contexts: Temporal, physical, social, cultural, informational

Micro-contexts: Individual e.g. perception, behaviour, personality, traits, characteristics (such as age, sex), spatial, stress symptoms, strategies
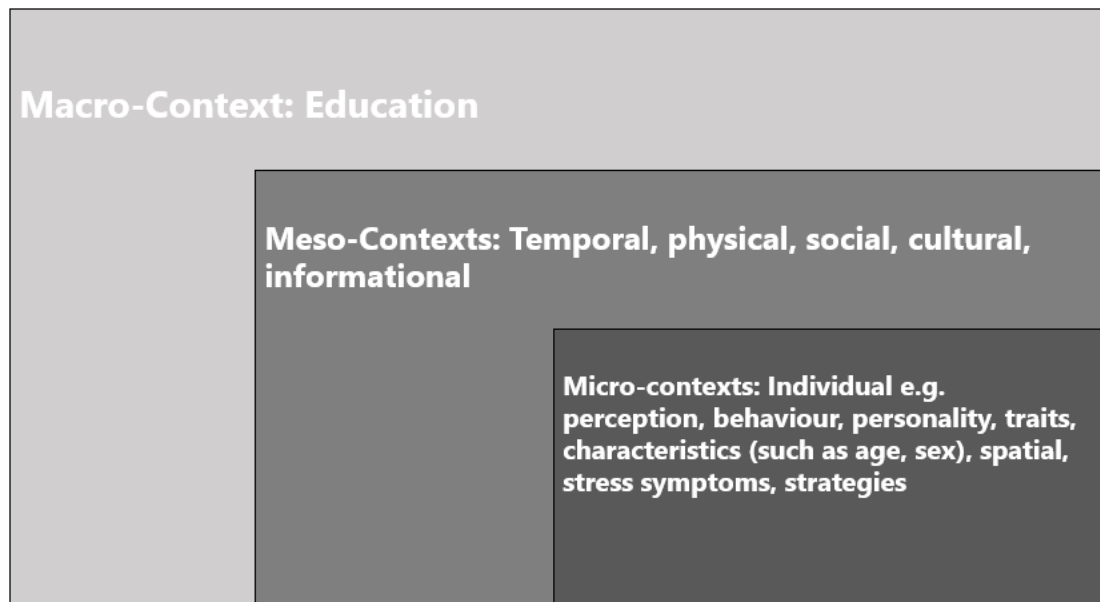
FIGURE 3.2 FRAMING OF CONTEXTS RELEVANT TO THE RESEARCH QUESTION

The outer or situated context of education is framed as the macro-context. The inner contexts include the components that are experienced within education and are termed the meso-contexts. Micro-contexts are those pertaining to the individual, including their character, stress symptoms and stress management strategies.

3.8 Summary

This chapter has introduced HCI as a lens through which digitally supported stress management for teachers can be explored. DHI mechanisms and features that can support employees' stress management were drawn from the health informatics literature. The rationale for digitally enabled stress relief is compelling in terms of the potential, with flexibility, availability, scale and privacy of particular interest for the teaching profession.

Trust, autonomy and expectation management influenced the umbrella term 'digital companions' to describe the different technology mediums for teachers. Finally, this chapter considered the framing of contexts in the literature and set out a simple framework for positioning them as macro, meso or micro-contexts ahead of the exploration of their influence on digitally supported stress management.

The next chapter builds on Chapters 2 and 3 and reviews the literature on digitally supported stress management in the workplace and for teachers.

Chapter 4 Digitally-Supported Stress Self-Management in the workplace

"Without being effective in the actual setting of interest, a health technology health product is not a solution." Prof John Torous, Assistant Professor Psychiatry, Harvard Medical School 2018

Parts of this chapter have been published in JMIR Mental Health & Formative Research (Manning et al., 2020, 2022) and submitted as a further paper now under peer review.

In the previous two chapters, teachers' approaches to stress management were discussed from the education and psychology literature, then the literature from the HCI and digital health community was reviewed for its contribution on digital designs that could support stress management in the workplace.

4.1 Chapter Overview

In this chapter, I present a brief reflection on stress in the mental health continuum in the HCI health literature, and insight from employees on barriers and facilitators and experiences of use of technologies for stress management. I then present a synthesis of the digital health and HCI literature on digitally supported stress interventions in the workplace and in schools.

4.2 Stress in the mental health continuum

In Chapter One it was noted that stress is part of the mental health continuum and often explored in research alongside common psychological conditions such as anxiety and depression. This is also true within the ehealth, DHI and HCI literature, and partly due to interventions being designed for symptoms common to both stress and psychological disorders (Bennion et al., 2017, 2019; Marciniak et al., 2020;

Proudfoot et al., 2013; Whitton et al., 2015). Stress is also sometimes explored within the concept of 'mood' (MacLean et al., 2013; Rivera-Pelayo & Fessl, 2017; Zenonos et al., 2016). Also, clinical measures used in stress studies or interventions sometimes use scales for depression or anxiety (H. Hwang et al., 2022) or can combine the three together e.g. Depression, Anxiety, Stress Scale (DASS) (Antony et al., 1998; Heber et al., 2017; Konrad et al., 2015; Mak et al., 2015). It is worth noting that this combination can make extrapolation of insight on stress alone more challenging.

Also of note is that interventions for stress have been described helping to influence someone's affective state or included in work on affective health in the computing literature (MacLean et al., 2013; Sanches et al., 2019) which can be a little confusing as it is not an affective disorder (Affective Disorders: Mood disorders, n.d.). 'Affective computing' research, i.e. into systems and devices that can recognise, interpret, process and stimulate human feelings and emotions (affects), can be applied to stress management systems (Xue et al., 2019) as well as mental illness (E. Smith et al., 2021). This demonstrates the point made by Blandford that there are subtle differences in culture and language between the HCI and digital health domains which need to be recognised to facilitate the quality and utility of research on digitally supported healthcare (Blandford et al., 2018).

Few studies have examined digitally supported stress management reduction amongst teachers, but there is some insight in the HCI and informatics health literature on the wider workforce. Firstly, insight into facilitating designs and use of technologies is discussed, then reviews of workplace stress interventions are described, and finally research into teachers' experiences is considered.

4.3 Insights into digital stress-reduction interventions at work

4.3.1 Facilitating features and design

As described in Chapter 3, Personal Informatics (PI) has facilitated correlations between stress and real-world stressors through enabling reflection on personal data. Reports of real-world experiences of consumer technologies to track workplace

stress are few. One study on a university campus who already used mood tracking app reported that the visualisation of emotion and moods facilitated an understanding of the impact of stress on their mood (Schueller et al., 2021). Visualisations of information from wearables have been shown to be powerful for both teachers and the general working-age population, with different preferences stated on presentation and differences reported on ability to take consequential actions (Kocielnik & Sidorova, 2015; Ruckenstein, 2014). Reducing stress in the educational context with wearables has motivated research with consumer wearables (de Arriba-Pérez et al., 2019). Associations between data and stressors were reported by another group of teachers using Fitbits who all reported self-care as a stress coping mechanism (Runge et al., 2020). Also, principles of PI were applied to enable anticipation of stress for mitigation planning with the MindForcaster stress assessment, intervention, and calendar app amongst students (K. Lee et al., 2020).

Timing and choice of stress intervention or prompts (Just-in-time (JIT)) have given indications of user receptivity. Desk-based workers preferred prompts at the start of a task or day, at lunch breaks or during the post-lunch circadian rhythm dip of 2-3pm (Sano et al., 2017). Choice over manual and automated personalisation of both relevant content and delivery schedule were valued by desk workers (Howe et al., 2022). Stress reduction was equivalent between those who received automated JIT interventions as opposed to interventions pre-scheduled by the employee, and importantly user preferences for timing and content varied both between people and within individuals over time.

A mixture of providers and users who had more than two years' experience of digital technologies for stress support were interviewed in one study. Findings included short, calming and decelerating interventions should be the priority, accessible from mobile and offline, and with system feedback on efficacy of chosen interventions or on causal links (Blankenhagel et al., 2019). They also emphasised data protection, which creates a challenge for efficacy. Where CBT, mindfulness and tailored stress-management therapies have been delivered digitally to employees from a variety of occupations, they have fared better in the workplace when supported or guided than

not (Renfrew, Morton, Morton, et al., 2021; Stratton et al., 2017; Zarski et al., 2016). Inevitably for such guidance, data has to be shared, raising issues of trust and privacy.

Even in mere fitness tracking devices, negative perceptions of privacy reduce use, including in employees (Esmonde, 2021; Mishra et al., 2021). Although adequate privacy and security in health apps generally are seen as highly important by patients, clinicians and engineers (Llorens-Vernet & Miró, 2020), they are not always assessed (Stoyanov et al., 2015). However, the complexity of consenting to data processing (Kurtz et al., 2020) and the gatekeeper role of platform providers (Kurtz et al., 2022) mean that assessing security and having privacy assurance is not straightforward. Studies with wearables have described the paradox between employees valuing the potential support for workplace wellbeing and the threat of invasion of privacy and surveillance concerns (Ajunwa et al., 2017; Schall et al., 2018). Some employers have tried cross-company wearable interventions, collating aggregated data to retain privacy, but have found ascertaining benefits from doing so complicated and forgone further data collection (Esmonde, 2021). However, having the discussion with employees about privacy and data use is strongly recommended as opinions differ (E. M. de Korte et al., 2018).

In education, despite some extensive trials with teachers (Ansley et al., 2021; Ebert et al., 2014; Kocielnik & Sidorova, 2015; S. S. Leung et al., 2009; Persson Asplund et al., 2018; Runge et al., 2020; Thiart et al., 2013, 2015) qualitative insights on facilitating features of digital stress interventions are few. Temporal flexibility of intervention (Ansley et al., 2021; S. S. K. Leung, Chiang, Chui, Lee, et al., 2011); informational support (Klap, 2020); and anonymity and peer social support (S. S. K. Leung, Chiang, Chui, Lee, et al., 2011) have all been credited as facilitating engagement. In other workplaces, interesting content and interactivity, short completion time, and progress tracking for reflection and reminders (Carolan & De Visser, 2018) and personalisation in apps were appreciated (Alhasani et al., 2022; Howe et al., 2022) and flexibility, goals and calming strategies desired (Blankenhagel et al., 2019).

In summary, personal choices over timing and components, supported reflection and relevance of data to individual contexts appear to facilitate stress management.

4.3.2 Barriers to use and interaction

Barriers to digital stress interventions from heterogenous sources have included lack of information, i.e. the need for 'communities of practice' (Lave & Wenger, 1991) and not understanding how to respond to data or lack of instructions (Ding et al., 2021; Kocielnik & Sidorova, 2015; Tucker et al., 2011). Although not a workplace study, Ding's research highlighted that many working age adults already using consumer wearables did not realise they had features to track and illustrate stress.

Meso-contextual barriers have included temporal themes of time pressure (Blankenhagel et al., 2019; Counson et al., 2021; Sanatkar et al., 2022), physical themes such as lack of privacy (Tucker et al., 2011) and cultural stigma from having to admit a need or the intervention being for 'mental health', or practical deficits such as lack of active management support for intervention deployment (Carolan & De Visser, 2018; Havermans et al., 2018; Peters, Deady, et al., 2018). Carolan also found that anonymity of interventions was less achievable for employees in open-plan workplace, and personal barriers include being unmotivated (Carolan & De Visser, 2018) or lacking choice over design intervention (Havermans et al., 2018; Stratton et al., 2020).

In summary, a lack of signposting from or contextualising of the data, deficits of time, space and support, and absence of cultural acceptability appear to block the potential of digital workplace stress support.

A sense of autonomy, partially bestowed by choice of intervention, links to the meaning that employees have derived from using digital interventions. Although there seems to be little in the literature that describes what using interventions have meant to employees, there are a few insights which are now described.

4.3.2 How employees have experienced and derived meaning from digital stress interventions.

Just a few studies have given insight into teachers' experiences with technology supported stress reduction. One iCBT and two wearables study reported that they enabled personal insight into their triggers for, responses to or management of stress (Ansley et al., 2021; Kocielnik & Sidorova, 2015; Runge et al., 2020). Together with another study, awareness of stress was described as gained from personal data, psychoeducation or colleagues' experiences, and that autonomy in strategy choice or re-evaluating how they used their time was valuable (Ansley et al., 2021; Kocielnik & Sidorova, 2015; S. S. K. Leung, Chiang, Chui, Lee, et al., 2011). Although reported from the wider population, autonomy to make choices within an intervention has been linked to enhanced motivation and adherence to mental health interventions (Renfrew, Morton, Morton, et al., 2021). Studies have also reported teachers appreciating mutual social support or the sense of connectedness with others online (S. S. K. Leung, Chiang, Chui, Lee, et al., 2011) and headteachers (Principals) that an app had utility in supporting their ten-minute daily mindfulness meditation (Klap, 2020). Wearable data was shown to motivate more physical activity (unrelated to stress) (Ertzberger & Martin, 2016) and an understanding of both in and out of work stressors was generated through a teacher-tailored online programme (Ebert et al., 2014).

On the negative side, not knowing how to act on knowledge of stress from collated wearable data was reported by some teachers (Kocielnik & Sidorova, 2015). Ding et al reported that even when a selection of working age adults was aware of stress tracking afforded by their wearables, a lack of real-time measures or alerts resulted in reduced engagement (Ding et al., 2021). Counter to this, the smartphone sensing app designed to generate awareness of stress via a smartwatch with computer-based university employees found real-time alerts were not straightforward. There was less receptivity to alerts if the employee was experiencing negative emotional valence; work goals overrode managing emotions in the moment; and personalisation was preferred in deciding when to act upon an alert (Lentferink et al., 2018, 2022).

In summary, digital tools can generate personal insight on stress and stressors, and motivation for use is linked to having some autonomy over component choices. Connecting with peer experiences is valued but automated prompts to self-care are not always appropriate or effective.

There have been some reviews of DHIs in the workplace and these are now critiqued for their relevance to the education setting.

4.4 Learning from DHI's for stress in the workplace

Some systematic views with slightly different emphases have looked at the impact, effectiveness or active ingredients of interventions for the wellbeing, stress and or mental health of employees. A meta-analysis of 21 Randomised Controlled Trials (RCTs) of web-based psychological interventions for workers 'wellbeing' showed an overall small positive effect for improvement (Carolan, Harris, & Cavanagh, 2017). Greater engagement was associated with shorter time frames (6–7 weeks), use of persuasive designs and use of secondary mediums such as email and text to support the intervention. In ten of the 21 studies, stress was the primary condition targeted; just one study involving teachers, and this had stress reduction as a secondary measure (Ebert et al., 2014). Two studies used smartphone apps to deliver the intervention but no data on whether mobiles were accessed at work was recorded. The authors noted the marked heterogeneity and that wellbeing is more than an absence of stress. Most interventions were delivered online (which would raise accessibility issues for teachers) and the nature of the review meant that other non-psychological interventions or the potential of tracking were not assessed.

Another review concluded that approval from employers can result in health benefits. Of 22 workplace digital health-related interventions, ten of which targeted, measured or evaluated the effect on stress including three in healthcare settings but none in schools (Howarth et al., 2018). The authors found that interventions were most favourable when embedded into the workplace, with the intervention software installed on a work computer (just one study had utilised a smartphone) and restricted to targeting specific health behaviours conducted at work, such as physical

activity. Whilst employer approval is a useful insight, teachers are not routinely working at computers rendering online interventions potentially less feasible.

A similar meta-analysis looking at eHealth RCTs of interventions for 'reducing mental health conditions' had ten studies on stress that overlapped with Carolan's review but eight other studies on stress were unique (Stratton et al., 2017). One of these unique studies utilised a smartphone app supplied on a dedicated phone to deliver a third-wave CBT stress management intervention. Most (university staff) participants used the app at home and just over a quarter at work, with the requirement for concentration one key reason given for preferring home access; but not having the app on their personal phone was also a deterrent (Ahtinen et al., 2013). Stratton's meta-analysis also found a small overall reduction in stress but makes the interesting observation that CBT appeared less effective in working populations compared to universal and clinical populations, and therefore the workplace setting might not be the right therapeutic milieu. However, only two of the nine CBT interventions utilised a smartphone and only one primarily targeted stress (Ly et al., 2014), thus giving little insight into the potential for mobile interventions for teachers. One more recent study has shown smartphone-based CBT to be effective on reducing stress amongst a mixed group of employees, but there was no data on when or where the intervention was accessed (H. Hwang et al., 2022). Location of access to the intervention was also missing in a smartphone CBT study with nurses despite deployment in a supportive work environment (Imamura et al., 2021). Neither Carolan nor Stratton's reviews commented on burnout even though it was part of the systematic search.

A scoping review of 48 web-based interventions focusing on stress in the workplace included email interventions, websites and two further mobile based studies (C. Ryan et al., 2017). Both these mobile based studies utilised videos, one improving relaxation for commuters (at a time when mobile videos were novel) (Riva et al., 2006) and the other tailoring stress management training for oncology nurses, who reported a decrease of stress and increase in coping skills (Villani et al., 2013). Overall, Ryan's analysis found that only 13 studies reached moderate methodological quality, and the participant attrition, poor adherence, and lack of both blinding and follow up

meant there was only low to moderate quality of evidence for efficacy in stress management. The three studies that looked at burnout found no benefit from the intervention, which could indicate that intervening on stress before it escalates is required for digital efficacy.

Burnout as well as stress was considered in one further meta-analysis of occupational 'e-mental health' interventions, as were other symptoms of stress such as insomnia and alcohol intake (Phillips et al., 2019). This analysis found better, moderate evidence for reduction of stress, burnout and insomnia than other mental health conditions such as depression, anxiety and alcoholism which the authors speculated could be due to greater stigma with the latter. They also noted that due to the heterogeneity of the studies, they could not assess the actual amount of treatment required and duration for effectiveness as it was not consistently reported.

More recently, a review of digital CBT-based interventions, tailored to the individual employee purely through an automated analysis of employee input, found reduction in stress scores in the three (out of four) studies reporting on general work stress reduction (Moe-Byrne et al., 2022). Just one of these three seems to have utilised an app but the authors reported moderate to high non-adherence and that more diverse components could have helped (Weber et al., 2019).

Reviews including wearables or stand-alone apps for stress management are sparse. In the healthcare literature, one recent review focused on healthcare workers mentioned only two delivered by smartphone (Shiri et al., 2023) and another on reducing stress amongst teachers did not mention either (Agyapong et al., 2023). Agyapong et al noted six out of the 40 studies included online delivery, just two were online only (Ansley et al., 2021; Oliveira et al., 2022) and both achieved reductions in symptoms of stress or burnout. Little is stated in the reviews above on workplace outcomes, beyond self-reported symptoms and measures. This latter gap was addressed in a further review of 28 previously analysed studies to investigate workplace engagement, productivity, absenteeism and presenteeism (Stratton et al., 2021). A small, potentially sustained (up to medium term) positive effect was found

on employee engagement and productivity, but not for other potential stress correlates, such as absenteeism or presenteeism.

Only one study in all these reviews clearly targeted middle-managers. Corporate managers used a specially built smartphone app to access third-wave CBT (or more precisely, Acceptance and Commitment Therapy) for six weeks in short (up to six minutes) weekly audio and text form. Forty-four per cent completed all six weeks of the intervention. Perceived stress was reduced with a small to moderate effect size (Cohen's d=0.41–0.50; noted as "d" hereafter, where small effect is d=0.2; medium effect is d=0.5 and large effect is d=0.8 (J. Cohen, 1988, p. 25)). Of note is the brevity of the intervention, but there was no information published on when or where the intervention was accessed and no follow-up evaluation (Ly et al., 2014).

In summary, there is evidence for stress reduction with digital interventions, and with CBT in particular; that employer support is significant, and smartphones can offer flexible access to interventions, but they are understudied. Wearable research was not included in any of the reviews. However there have been at least two stress-management studies with teachers using wearables and they are now summarised with other digital intervention findings.

4.5 Digital stress support amongst teachers

Despite being a profession recognised for high levels of stress, teachers have not been the subject of many digital intervention studies. One early exception is Ebert et al's study with 150 German teachers (in-work teachers of all levels) who were randomised to undertake internet-based problem-solving therapy (iPST), a form of CBT specifically tailored to teachers (Ebert et al., 2014). Averaging 19 years of teaching experience (making involvement of teachers in management roles more likely) and 83 per cent female, the teachers had access to one training session a week for five weeks and received feedback after each completion (simply aimed at improving adherence to the web-based intervention, not additional therapy). It was not stated whether the online modules were accessed at work or at home. Depressive symptoms were the main objective, but perceived stress was a secondary

outcome of interest in this study. The study found a small to medium effect size (d=0.36) compared with waitlist controls; the improvement was still present after six months, with over 80 per cent providing data at follow-up. There were also positive effects on the emotional exhaustion and depersonalisation (cynicism) components of burnout, but not on the third component (personal accomplishment) or absenteeism. Qualitative analysis indicated that the intervention assisted with both work and non-work problems that had contributed to the participants' symptoms. The authors noted that individual differences in work situation or risk factors were not explored, but the potential limitation of educational level demographic does not apply when considering relevance within the highly educated teaching profession.

Another German study with 128 teachers looked at stress as a contributor to insomnia. All six weekly online modules of CBT with psychoeducation, total duration three hours, were accessed by 95 per cent of the intervention group. As with the study above, weekly feedback to support adherence was given. Sleep was significantly improved (d=1.37) compared with waitlist controls, with the effects sustained after six months (Thiart et al., 2015). High adherence could be attributed to user satisfaction rates (90 per cent would recommend the training to a friend), and possibly the training guidance and personal contact in the diagnostic interviews before the intervention began.

Two more recent studies have offered online stress interventions. One was to American teachers, most with less than five years' experience (77 per cent). The tailored programme of eight 30-minute modules included mindfulness, relaxation and cognitive restructuring strategies, and referenced, but did not promote or enable, social support and physical exercise (Ansley et al., 2021). The high retention rate of the intervention group (93 per cent) over four weeks and small to medium effects, along with 89 per cent saying they would recommend the interventions, are very positive. Only the strategies directly promoted in the programme increased in utilisation, but participants commented on their improved ability to communicate feelings and appreciation based on the asynchronicity of the programme, allowing temporal flexibility. The second study was with mostly female (96 per cent) primary school teachers, and although a digitally delivered half-group, half-individual

intervention (via zoom and moodle), the A+ intervention is of note both because it was developed to encompass SDT principles and because of the findings on school contexts. Where there was a supportive/democratic school leadership and strong social relationships between colleagues, the intervention was more efficacious (Oliveira et al., 2022). The authors conclude that teachers' wellbeing is impacted on multi-dimensions (i.e. by multiple different contexts) and that given the systemic influence, teachers cannot be solely held accountable for their wellbeing.

Another study included educators amongst other professionals (health and IT) and is a rare example of a workplace study focused on first-line or middle managers. A self-administered course of eight weekly modules was accessible online, using both CBT and third-wave CBT, with participants also receiving weekly personalised feedback on the modules (Persson Asplund et al., 2018). One significant difference with previous studies is that each module took up to three hours to complete; given this, the mere 21 per cent attrition indicates strong engagement. The effect on reduction in symptoms of perceived stress across all sectors was large (d=0.74) versus waitlist controls, with a medium effect still present after six months (d=0.59); however, work-related job-satisfaction outcomes were not sustained. The authors noted that data from subordinates on their perceptions of their managers' stress could have been useful.

Digital stress-management interventions amongst school leadership are sparse. A study amongst Australian principals (headteachers) introduced third-wave mindfulness as professional learning, with a smartphone app to support 10-minute daily practice (Klap, 2020). Some participants mentioned that the app served as a reminder to focus on themselves and be quiet.

Some wearable studies have been conducted amongst teachers. One combined a Philips' Discrete Tension Indicator wristband that uses skin conductance to estimate sympathetic nervous system arousal with online visualisation software of collated data by time and day (Kocielnik & Sidorova, 2015). The 21 vocational teachers were between 23 and 56 years old and of the 15 who provided feedback, 12 found the insight into which activities are stressful as useful and sometimes surprising.

However, only five indicated that they felt they could change anything on the basis of what they had learned and the reasons were not given. Another longitudinal, 12-week mixed-methods study tracked four teachers using a Fitbit to see if higher heart rate, low sleep and high step data could be correlated with more workplace stress (Runge et al., 2020). The aim was to see if Fitbits could help the teachers pinpoint stressful occurrences in their daily work, and over time they became aware of their stressors without having to check their Fitbit data first. It was not clear whether their coping strategies were implemented more because of seeing the data or whether they would have had them in place anyway.

Finally, an earlier study amongst secondary school teachers in Hong Kong utilised online stress management forums where teachers could post anonymous messages about their work-related stress and coping strategies (S. S. K. Leung, Chiang, Chui, Mak, et al., 2011). The forums were moderated for guidance and safety. Sixty three of the 75 participants reported enjoying the support and encouragement, the anonymity and flexibility (no time constraints), and half or more said it stimulated new ideas for and confidence in managing work-related stress.

In summary, digital stress-management interventions with teachers based on CBT have shown efficacy, and social support as well as wearable data generated insight into stressors. Not all teachers know what action to take to manage their stress, but for some the insight instilled confidence and prompts to self-care.

4.6 Summary

This chapter explored digitally supported stress management in the workplace. Studies show that personal choices over timing and components, supported reflection and relevance of data to individual contexts are important, but a lack of signposting from or contextualising of the stress data, deficits of time, space and support, and absence of cultural acceptability are barriers.

Employees have gained personal insight on stress and stressors and been motivated to use digital tools through having some autonomy over component choices.

Connecting with peer experiences is valued but preferences for automated prompts to self-care vary between employees and within individual circumstances. Yet there is a paucity of qualitative insight from smartphones and wearables, self-selected interventions or data-enabled self-management that could inform design or improve effectiveness.

We know little as to how teachers could use PIs or DHIs or other technologies to self-manage their stress, despite the abundance of consumer technologies, and whether their experiences of digital support would be of value. Nor do we know what contexts or design features would help or hinder use of digital tools, particularly for those with pastoral management responsibilities adding to the demands of their polychronic role.

Yet the evidence so far on stress reduction with digital interventions encourages further exploration. The education literature indicates an urgent need yet plausible strategies for enabling stress-self-management. The digital health and HCI health and PI literature demonstrate the potential for supporting these strategies, through technology capturing data and delivering insight on stress. These along with the psychology literature have also revealed the opportunity and potential flexibility of workplace stress interventions. The empirical studies undertaken and recorded in the forthcoming chapters built on this multidisciplinary foundation.

This chapter concludes Part One, Related Work, of this thesis, and is followed by Part Two, Studies and Analysis, comprising five chapters on the methodology and studies undertaken. The next chapter will present the main research question, the sub questions that motivated each study and philosophical underpinning of my approach.

Part Two – Studies and Analysis

Chapter 5 Methodology & Thesis Approach

"The purpose of computing is insight, not numbers" Richard W. Hamming, 1915–1998

5.1 Introduction and Chapter Overview

Part One set out the conceptual framework for this thesis.

Part Two of this thesis begins with Chapter 5, which presents the reasoning for the research paradigm and chosen methodology, and then reiterates the chief research question and the sequence of research questions and associated studies. This is followed by descriptions of the core study methods, ethical considerations and recruitment of participants. The three study designs and aims are then described in detail, followed by an account of my approach to methodological integrity and validity. Similar methods were applied for both the first and third study and are described in this chapter to avoid repetition. A summary of the Research Questions and studies is shown in Table 5.1.

RQ: How do context and design factors influence the use of consumer technologies for self-management of stress by teachers?			
Study	Main Question	Methods	Outcomes
One	**RQ 1 What is influencing teachers' current stress management?**	Semi-structured qualitative interviews Closed questions (stress symptoms)	**Understanding** Teachers' current experiences of stress management and use of digital health technologies
Two	**RQ 2 How can teachers make an informed and supported choice of digital companion technologies to support their self-management of stress?**	Analytical study informed by Study One and relevant literature Workshops	**Choosing** A taxonomy of stress management strategies and Digital Companion concepts/techniques, populated with candidates Presentation to enable teachers' informed choice ahead of Study Three – demographic and DC choice data
Three	**RQ 3 What were the teachers' experiences with their consumer technologies?**	Semi-structured qualitative interviews at Summer half-term, end of term and Autumn half term Closed questions (stress symptoms) Open questions (Patterns of use, perceptions of stress, meso-contexts and school culture)	**Experiencing** Detail on how teachers' derived insight, meaning, permission and connection from using personally chosen technologies Validation of stress and opportunity to for technology to demonstrate values
	RQ 4 How can consumer technologies facilitate stress management in the school environment?	As above	**Facilitators and Barriers** Interaction enablers and blockers, from technology design, instruction and contextual perspectives

TABLE 5.1 SUMMARY OF RQS AND STUDIES

5.2 Research paradigm and chosen methodology

Human-computer interaction (HCI) is a multi-disciplinary science. Much of the scientist's perspective derives from the methodological approach taken, generally categorised into quantitative or qualitative methodology. Quantitative methodologies characteristically relate to the scientific or positivist paradigm where an objective epistemology is applied to obtain meaning. Evidence is sought by directly testing hypotheses of cause and effect, often involving empirical testing, random samples and controlling variables. Qualitative methodologies characteristically relate to interpretivist, constructivist or critical paradigms where a more subjective epistemology is applied to obtain meaning. Evidence is sought through understanding phenomena from an individual's perspective: their beliefs, actions, understanding and reasoning.

Both categories have their strengths and weaknesses. Quantitative methodologies tend to provide precise data that can be statistically analysed and more readily generalised. They are useful for answering questions of who, what and when. However, in general they are inadequate for answering questions of how and why, or why not, which require an understanding of contextual variables. This is the strength of qualitative methodologies, which provide more detailed information to explain complexity or sensitive issues, as well as multiple methods for collecting data that can reveal nuance. However, they do not answer binary questions of effect. The decision when choosing a methodology is about which approach is the appropriate approach to answer the research question.

My interest in exploring subjectivity did not necessarily exclude quantitative approaches, but quantitative methods, seeking to decrease variables and produce binary evaluations of efficacy, would inevitably try to reduce confounders such as context, the understanding of which is central to my enquiry. Additionally, although there are many established and validated surveys of workplace and teachers' stress developed (Maslach, 2001; McCarthy et al., 2016; Pelsma et al., 1987), they would not have given me the opportunity to explore issues and probe answers. There are

conflicting opinions on whether selecting a research paradigm ahead of conducting studies is essential (Mertens, 2008; Scotland, 2012) or unnecessary (Mertens, 2019; M. Q. Patton, 2002). However, to fulfil my aims I clearly required a paradigm that incorporates subjectivity in the interpretation of data to reveal how meaning has been constructed in a specific real-world context. Constructivism embraces this and given this HCI research is situated within education where social and cognitive constructivism are leading paradigms for teaching and learning, established by Vygotsky and Piaget (Eun, 2008; Halpenny & Pettersen, 2013), choosing such a philosophical positioning gives epistemic consistency.

The philosophical constructivist paradigm posits an ontology and epistemology of gaining knowledge of reality through the medium of our minds and bodies. Our humanity and our activities shape our experience of reality and constructivist research aims to understand how people make sense and meaning of the world given their contexts, lives and social interactions. The latter is important because meaning is not constructed privately, but in and though social communication and process, using language and within culture. Data can be "collected in the natural language of participants and encourages reflection on the social and subjective processes" that have influenced the constructed interpretations (Marks & Yardley, 2004, p. 4). Additionally, a person-centred approach of enquiry that appreciates the psychosocial factors and perspectives of the user complements the person-based approach to design (Yardley et al., 2015). The HCI approaches can elicit rich information into how and why, or why not, a DC worked as intended when the user is understood (Klasnja & Pratt, 2014), recognising that varied contexts and settings of use influence actual use (Cresswell et al., 2017).

Constructivism is not the only valid way of understanding the world, nor does it exclude differences in perceptions and interpretations of 'reality' as it recognises the complexity and variety of human experiences and activities (Lincoln & Guba, 1985; Marks & Yardley, 2004; M. Q. Patton, 2015). Also, human interpretations are not seen as biased by subjectivity but valuable because of subjectivity. No view is ever without bias, and this paradigm embraces subjectivity to collect data that reveals how meaning has been constructed in a specific real-world context.

Some quantitative data was also collected through short open and closed-question surveys (as described in 5.4.5 below) and related to the qualitative data. I intentionally combined these approaches to give a richer contextual understanding of participants' situations and to give them the opportunity to reflect on their progress or experiences.

5.3 Research Questions

This thesis took a real-world approach to investigating the main research question:

RQ: How do context and design influence the use of digital companions for self-management of work stress by secondary school Heads of Year?

To answer this question, I planned a series of studies, based on findings from the literature. Building sequentially to enable the progressive compilation of knowledge, the studies were designed to answer the main questions summarised in table 5.1 following the flow depicted in Figure 5.1
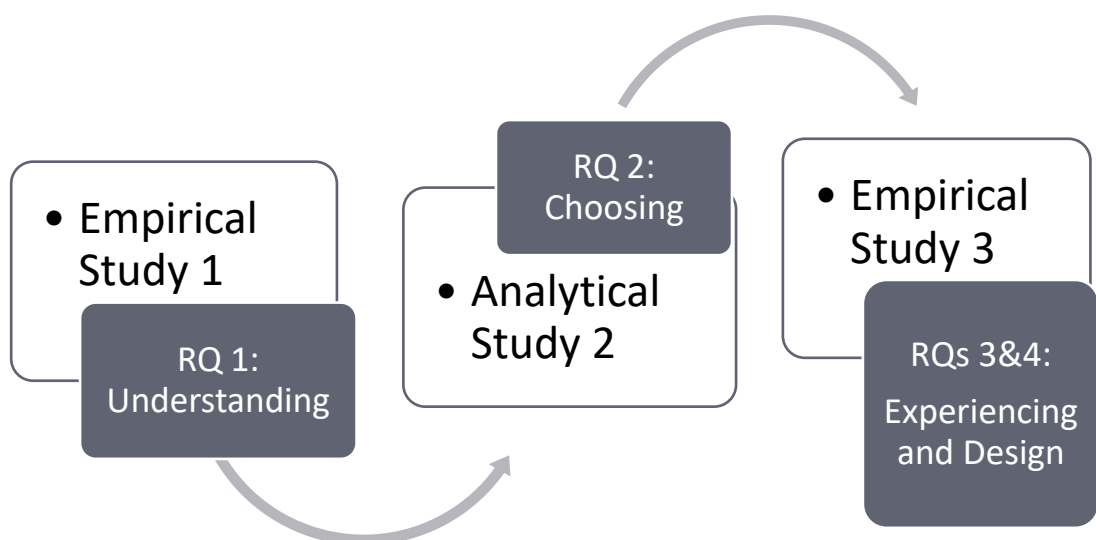
FIGURE 5.1 FLOW AND PURPOSE OF THE STUDIES UNDERTAKEN

5.4 Core Study Methods

In choosing the methods for the studies, it was important to align them with the epistemological constructivist paradigm that allows participants to tell stories of their experiences and reality. This paradigm is appropriate as it allows for the exploration of plurality in experience. This is crucial to this contextual HCI study of teachers' use of technology to support workplace stress. It recognises the reality of variation in practice and that context influences the situations in which people exist. My aim was to acquire "an understanding of the situations in which technology is used and might be used and in evaluating how technologies are used in practice" (Blandford et al., 2016). The methods for this research were chosen so that users, their behaviour with and reaction to technology could be explored (Rogers et al., 2019) in the real-world situation of their workplace. Core to each study were ethical considerations, the recruitment of participants and semi-structured qualitative interviews. The details of these are now described.

5.4.1 Ethical considerations

The Studies I conducted had ethical approval from the University College London (UCL) Research Ethics Committee (Approval ID numbers: UCLIC/1718/013/Staff_Marshall/Manning; UCLIC_1920_004_Staff_BlandfordManning).

An amendment was made to the latter ethics approval after the emergence of the COVID-19 pandemic and the need to deliver studies online and not in person. Teachers gave informed consent ahead of joining in any of the studies (the two information sheets and consent forms can be found in Appendix A and B). All signed forms were kept in a locked drawer or encrypted in an electronic folder protected by password. After schools had been closed due to COVID-19 (March 20th 2020), some teachers emailed to explain they could no longer take part in the studies. Each teacher was written to and asked if the reason for their non-participation could be

recorded and referenced in this research and where permission was given this was collated into a separate document and stored along with the consent forms.

5.4.2 Recruitment of participants

One of the gaps in the literature was the lack of information about stress management by more senior schoolteachers, particularly those in middle-management who had taken on pastoral or wellbeing roles. This motivated the approach to sampling which is discussed next.

Purposive sampling

It has been argued that purposive sampling is not only a distinguishing element of qualitative research, but that it is the entirely logical approach (M. Q. Patton, 2002). My questions could only be answered by deliberately selecting participants who could provide the abundant information to generate understanding about the issues of central importance to this inquiry. Therefore, I chose to recruit from amongst secondary school leaders who had responsibility for wellbeing or pastoral care and are amongst the mid-career teachers who report the most stress in the education sector (Day & Gu, 2009; Klassen & Chiu, 2011). Obtaining consent (as described above) also included informing them that there were to be questions about stress and digital health technologies, such as apps and wearables. All schools that engaged with this research were state funded and either a comprehensive or part of a Multi-Academy Trust.

Convenience sampling

There was also an element of convenience sampling to my method, as teachers were selected according to their availability. Whilst this approach can typically mean a sample is not representative, as the study purpose had already determined the group of teachers from which I was sampling, there remained an element of representation. Teachers did of course have to volunteer to take part and study findings are considered in the light of this self-selection.

5.4.3 Workshops

Workshops were conducted as the final stage of Study Two before data gathering in Study Three, and their primary purpose was to enable teachers to make an informed choice of DC based on their personal stress-management strategy and preferences. Workshops enable the dissemination and consideration of new knowledge by a group of people who can then use this information to think or problem solve in relation to the issue being presented. The workshops also meant that the teachers had 'met' the researcher online before their semi-structured interviews. Due to the pandemic, attendance was virtual and based on individual availability, not school location, so the teachers did not necessarily know which of their colleagues was taking part. The workshops are described in Study Two, Method Detail, in section 5.6.2.

5.4.4 Semi-structured interviews

Interviews have been described by many as 'conversations with a purpose'. The aim of my interviews was to hear about teachers' experiences, and the semi-structured interview approach offered both a framework for topics to be covered with all participants, as well as the freedom to pursue or probe some answers with spontaneous follow-up questions, where interesting and relevant (Rogers et al., 2019). Additionally, it was clear from the literature on stress amongst teachers and from informal conversations that stress was still a sensitive topic. Semi-structured interviews allowed me the time to set participants at their ease, reassuring them of the value and confidentiality of my study. The settings for interviews were planned carefully, to ensure privacy and knowing that the more natural the setting for the respondents, the more likely they would be to give naturalistic responses (A. Adams & Cox, 2011).

5.4.4.1 Process

For each set of interviews I planned the interview scripts on the five-phased structure outlined by Blandford et al. (Blandford et al., 2016). Interviews were used in both empirical studies. For Study One when on school premises a meeting room was used

where the interview could be conducted undisturbed. For Study Three, pandemic circumstances meant that all interviews were undertaken on zoom and ultimately only two teachers were on school premises when they took place due to the impact of COVID-19. The process for each interview was as follows.

Opening the conversation:

In Study One, the interview was the first occasion that the researcher and teacher had met. Pilot interviews had been undertaken in two individuals' homes; study participants were interviewed on the school premises during school hours with leadership's permission. The teacher was thanked for making the time to participate, their experience was referenced as being of value to the study and the author introduced herself and briefly explained how this research had come about. In Study Three, the author had already 'virtually met' the participants, so some familiarity had been established.

Introducing the research:

In all interviews, the aims of the study were revisited with the teacher and with reference to the Consent Form and the Information Sheet. Importantly, the opportunity to receive assistance from the Education Support Partnership should they want it and the right to withdraw were emphasised. Notes were taken throughout, but the purpose of recording the interview was clarified along with assurances of how confidentiality would be achieved – through ensuring anonymity of the recording, transcribing, analysis and the writing process. It was also stated that there were no right or wrong answers to questions as the purpose of the study was to capture subjective experience, not to test any knowledge, current understanding or what 'should' be.

Beginning the interview:

In Study One, the first part of the interview was used to gather background information on the teacher's motivation for teaching and their experiences of workplace stress and explore some of the symptoms of stress. This was important for

contextualising the research, highlighting that it was not simply about stress per se, but stress related to the workplace and to their personal experiences. There was also a component to this of validating and normalising the experience of stress. In Study Three, this contextualisation was simply recapped as it had been shared during teachers' participation in workshops, and the initial questions were shaped by the responses the teachers had given in the workshop feedback form (Appendix C).

During the interview:

The body of the interviews then focused on the major themes of interest for the research, or that stage of the research. Examples are shown in Figures 5.2, 5.3, 5.4 and 5.5. Knowing that I would be broaching details of technology use not normally considered in depth in everyday life, the interview scripts contained a variety of prompts to probe use, usefulness and usability. For Study One I explored further the theme of stress in the school setting, the teacher's familiarity with digital tools for health and wellbeing, and whether any tools were deliberately used to support stress management or other wellbeing strategies. In Study Three, I used interviews at each stage of the longitudinal in-the-wild research. Each teacher had chosen a digital companion technology for the longitudinal study which was obtained by the participant after the workshop. In all but one case the participant had begun to use their technology by the time of the first interview. The interviews also covered contextual factors, with broad themes being: First Interview (early summer) – Expectations; Second Interview (end summer) – Adoption and experiences; Third Interview (autumn) – Evolution of use on school premises. Full interview scripts can be found in Appendices E, F and G.

Closing the interview:

Teachers were asked in Study One before the interview ended whether there was anything else they wanted to say about the topics covered, or whether they had any questions. Having broached such an emotional topic, I also deliberately asked a final question about the participant's most recent experience of elation in teaching, so their final thoughts were about the rewards of teaching, rather than the stresses. In

Study Three, teachers were simply asked at the end of the first interview if they had any further questions, at the end of the second how teachers could be encouraged to try digital stress support solutions and whether they would take part in a third, extra interview in the autumn. For the six teachers who took part in the autumn, the interviews ended with closed questions on overall impressions of DC use, usability and usefulness.

During each stage of research, some teachers continued to talk after the interview had been formally ended. On occasions where something pertinent was said, these comments were noted manually. All interviews were ended with thanks for participants' time and contributions, and then briefed on what would happen next with the research.

5.4.5 Open and closed-question surveys

Short surveys were incorporated into both Study One and Study Three. They contained mostly closed questions that required a simple yes or no response. Closed questions allow an economical approach to data collection, which when the sample size is large enough can be used for quantitative analysis and which are also replicable, allowing for reliability checks. For Study One, I simply wanted to pose closed questions verbally to capture stress symptoms during the interview; these are listed in the interview guide in Appendix D. In Study Three, closed questions were asked in online surveys using Microsoft Forms to provide more data for triangulation and to give information on how participants were progressing with their technology. Open questions were also asked to allow for more reflection on the teachers' experiences as the study progressed. The questions and responses are shown in Appendix H. All responses informed the end of summer (intended study) interview scripts. In the final interview undertaken in the extended study, closed questions were again asked to create a small survey of final thoughts on experiences; these are listed in the interview guide in Appendix G.

5.4.6 Thematic Analysis Approaches

Thematic analysis (TA) is a foundational method for qualitative analysis and a method compatible with constructivist paradigms for identifying, analysing and reporting patterns (themes) within data (Braun & Clarke, 2006). My analysis was not guided by an existing theory but combined inductive (bottom-up from the data), cognitive and social constructivist (the participants' experiences and learning through interaction with others) thematic analysis. I used a reflexive approach to TA as well as creating case studies for cross-case analysis. Both analyses were informed by Interpretive Phenomenological Analysis (IPA). In the case study analysis for Study Three, I particularly wanted to capture ideographically and inductively "The participant trying to make sense of their personal and social world; the researcher trying to make sense of the participant trying to make sense of their personal and social world" (J. A. Smith, 2004, p. 40). This approach enabled my analysis to embrace subjectivity, more deeply understanding specific cases within a particular context and creating narratives that act as a patchwork of information from which similarities and differences could be identified. (M. Q. Patton, 2002, 2015). Details on the approach to cross-case analysis are described in section 5.7.3 and summarised in Chapter 8, Table 8.4.

Whilst Braun and Clarke's analytical "steps" for TA have been widely quoted, they themselves have acknowledged there is no linear approach and that analysis is an "adventure, not a recipe" (Braun & Clarke, 2019). Flexibility, reflexivity and clarity are all essential, as is a deliberate and explicit approach. Their original steps were used as a prompt rather than a checklist for my analytical approach. Details of the analysis are described in section 5.5.3.

All interviews were transcribed verbatim. Transcripts were not returned to participants, as (i) the researcher did not want to add a time burden to the teachers taking part, (ii) the evidence suggests that doing so adds little to the accuracy of the transcript (Baker & Edwards, 2012), and (iii) this retains the responses precisely as they had been given at the time of the interview, when the teacher had the time and space to respond naturally. Personal names or identifying remarks or subjects

mentioned in the audio were excluded from the transcripts. Transcribed interviews were checked against the audio recordings for accuracy.

NVivo (version 12) software was used for the organisation and development of codes and categories and SimpleMind (versions 1.22 and 1.31) were used for the mapping of relationships and themes. NVivo also allowed for the creation of relationships and grouping of themes, interrogation of frequency of words and phrases allowing both manifest (story or descriptive meaning of the data) and latent (conceptual and intentional meaning) analysis. Examples of coding and mind-maps are presented in Appendices I and J.
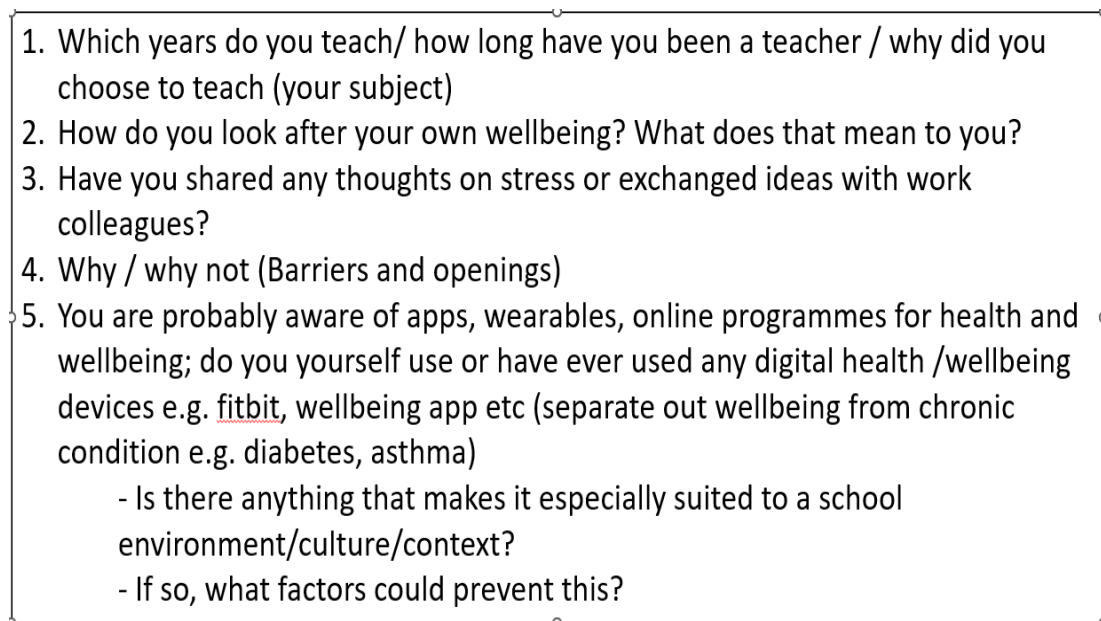
5.5 Study One Method Detail

5.5.1 Recruitment detail

The inclusion criteria for Study One stipulated being a secondary school teacher in a position of management, such as in the senior leadership team, head of department or Head of House, or a teacher who had previously held a management role. The information sheet specified a willingness to talk about stress and digital health technology. No prior individual training in stress management was specified, but participants' schools were required to demonstrate an awareness of the importance of wellbeing, such as having a Head of Wellbeing. My interest was that in such schools there would be some organisational recognition of stress. Staff from five different schools in London, southern England and the Midlands who met the inclusion criteria were recruited using the researcher's networks (with head teachers' permission sought for the two on-site sets of interviews). The researcher had not previously met the participants and they were all sent a comprehensive information sheet and consent form to read after their expression of interest and given a paper copy on the day. This is contained in Appendix A. The consent and information forms specified the purpose of the interview, the interviewer's department and university and that the interviews would contribute to a study being undertaken as part of a PhD.

5.5.2 Semi-Structured Interviews Detail

I chose semi-structured interviews for an initial exploration of teachers' experiences of and approaches to stress management, to enquire into their use of apps, online and wearables and how their use was influenced by their work context. The interview schedule had been piloted with two teachers separately to test timings, flow and sense-making of the questions. One of these teachers was my husband, at that point an assistant headteacher, and the other a neighbour who was a head of department, both in city comprehensive schools. These interviews were not part of data collection and therefore not used for analysis. An example extract of the interview guide is shown in Figure 5.2; the complete interview guide can be found in Appendix D.

1. Which years do you teach/ how long have you been a teacher / why did you choose to teach (your subject)
2. How do you look after your own wellbeing? What does that mean to you?
3. Have you shared any thoughts on stress or exchanged ideas with work colleagues?
4. Why / why not (Barriers and openings)
5. You are probably aware of apps, wearables, online programmes for health and wellbeing; do you yourself use or have ever used any digital health /wellbeing devices e.g. fitbit, wellbeing app etc (separate out wellbeing from chronic condition e.g. diabetes, asthma)
      - Is there anything that makes it especially suited to a school environment/culture/context?
      - If so, what factors could prevent this?

FIGURE 5.2 EXAMPLE QUESTIONS FROM STUDY ONE INTERVIEW GUIDE

During the interview, four sets of closed questions were asked of the participants as both a way of illustrating stress symptoms and to give a snapshot of these teachers' experiences of stress. The questions required a simple yes or no response, although some teachers offered further information, such as a description of a behaviour. The symptoms were derived from the stress literature and were grouped under the headings of emotional, cognitive, behavioural and physical. A table of participants and their self-management activities are included in Chapter 6 Table 6.1.

5.5.3 Reflexive Thematic Analysis Detail

Interview transcripts were checked against the audio recordings, and notes taken during and after the interviews formed part of the data set imported to NVivo version 12. Reflexive thematic analysis acknowledges the centrality of the researcher's subjectivity and considers it a resource (Braun & Clarke, 2019). It allows themes to be conceptualised as patterns of shared meanings, not superficially identified as mere topics or content.

Whilst Braun and Clarke's six-step approach to TA (Braun & Clarke, 2006) needs to be seen as a framework, not a ladder, it provided a structure for analysis that was applied to the whole data set:

1.   Familiarisation with the data

2.   Generating initial codes

3.   Searching for themes

4.   Reviewing themes and producing a thematic map

5.   Defining and naming themes

6.   Producing the analytical report

I began by immersing myself in the data, listening to the recordings and reading the transcripts and notes, recording my thinking and impressions in memos. Memos were kept throughout the analytical process. The aim was to understand deeply what the teachers were meaning and how they were making sense of their experiences beyond the obvious semantics. I tried both to put myself in their position to think about the statements and assumptions they made, as well as think about any assumptions in my questioning and how my experiences were influencing interpretation. Codes were initially based on participants' answers and interesting features and observations in the data, and then increasingly based on latent meaning. When the whole data set had been coded, I checked back through the data with the codebook I had generated

to review and refine my interpretation. I also looked for similarities and duplications to refine the codes. I created thematic mind maps from the codes, (an example can be found in Appendix J), refining and reflecting on the overall story that the analysis was telling. In producing the findings, I searched for the most vivid and compelling extracts that related to the theme and research questions, ensuring that each teacher had their voice heard in the final report.

A self-reflexive approach was taken throughout the analysis, including creating a rolling diary of reflections from the time of the interviews until the end of the study. In this I made observations on relationships, created narratives of experiences (e.g. of stress management experiences), drafted possible themes and subthemes, and recorded thinking on the relative importance of the codes and themes I was generating from the data. An example of my code book can be found in Appendix I.

5.6 Study Two Method

Answering the second research question required three stages: the creation of a robust taxonomy; population of the taxonomy; and presentation of the taxonomy in a workshop. The first two stages comprised an analytical approach to constructing the taxonomy. Firstly, drawing on the strategies described in Study One and the HCI, education and health literature, dimensions and classifications were identified to create a unique framework of teachers' stress management and supporting digital companion concepts. Secondly, six criteria were created for the inclusion of digital companions in the taxonomy based on the same study and literature, and candidate DCs were chosen. These two stages are presented in detail in Chapter 7. Thirdly the taxonomy was presented in workshops to teachers to facilitate an informed choice of DC ready for Study Three. The process for this is described next.

5.6.1 Recruitment Detail

Recruitment for Studies Two and Three was undertaken with criteria similar to Study One, but I specified a *current* pastoral role with participant willingness to trial a DC to

support their stress management strategy with no ongoing related treatment. The latter was stipulated to avoid interference between this study and potential prescribed interventions. The criteria were described as:

i.   school teacher in a position of pastoral management such as Head of House, Head of Year or Assistant Principal. For this longitudinal study I required teachers who were currently in pastoral leadership to incorporate the additional caring component of their role;

ii. willingness to talk about stress;

iii. not currently receiving treatment for a clinical stress disorder such as PTSD or acute stress disorders.

No prior individual training in stress interventions was required.

Another difference with Study One was that recruitment was from schools in just one Multi-Academy Trust (MAT) based in South London. The Trust had been approached for several reasons. Firstly, as a MAT, it has its own governance and policies, providing some reduction of internal organisational variation. Secondly, the MAT had three secondary schools in the South London region, providing a geographical locus and urban context for the research. Whilst there are always some differences in the local housing and labour markets, the good transport links, a predominance of business and service sector jobs along with low unemployment gave some relevant cohesion to area characteristics (Thrupp & Lupton, 2006). That said, the schools served many students from socio-economically deprived backgrounds, and this limitation is reflected on in Chapter 10, section 10.4.1. Thirdly, the MAT had a track record of interest in staff wellbeing. When first approached in October 2019, it was in the process of appointing a new Director whose role would include the promotion of a wellbeing culture, building on the work of one of the MAT's trustees. Serendipitously, this Director's previous role had included being the lead for technology and innovation. By working in the same city with one MAT the aim was to ensure some contextual consistency. Through similarity of schools, location and roles of participants (i.e. teachers with pastoral management roles) the planned exploration

and comparison of teachers' experiences with technology through deep, rich, thick narratives and analysis should be more plausible (Thrupp & Lupton, 2006).

Of the 16 teachers who originally volunteered to take part before the pandemic (with permission from the MAT Directors and Principals), just eight teachers were still able to participate after lockdown, with participation now facilitated online. The abrupt changes brought about by university then school closures meant that the researcher (thesis author) firstly had to persuade each principal that the research could still go ahead, then take on all communication with the participants, instead of schools coordinating contact, workshops and appointments. This was facilitated by each school Principal sharing agreed participant contact details with the researcher. This also meant that although the Principal had sanctioned the research and shared Head of Year details, the dropout of eight teachers meant the Principal no longer knew which teachers were taking part in the study. Scheduling of interviews was attempted using an online scheduling tool (Doodle), but the lack of response meant that teachers were phoned to arrange times. Four of the 16 who dropped out gave reasons and consented to have them noted. These included extra childcare responsibilities, their partner working for the NHS and being overwhelmed, and increase in teaching load. The other four did not communicate their reasons.

Information and consent forms were sent electronically to teachers before the workshops, followed up with reminder emails if they had not been received by the day before the workshop. As with the first study, the consent and information forms specified the purpose of the workshop and subsequent interviews and survey should they choose to take part, also the interviewer's department and university, and that the data would contribute to a study being undertaken as part of a PhD. This is shown in Appendix B.

Due to the pandemic, only two participants spent more time in school than working from home during the summer leg of the study. Six of the eight teachers generously extended their involvement from the 'intended' study by six weeks into the autumn term, back in school. This is described as the 'extended' section of Study Three.

5.6.2 Workshops

The primary purpose of the workshops was didactic, with the outcome of enabling teachers to make an informed choice of DC based on their personal stress-management strategy and preferences.

Workshops were chosen to create a non-adversarial and safe space in which teachers could reflect, explore and interact around the sensitive topic of stress and on its alleviation with potential support tools. They were planned to be held at each participating school during the working day with permission from the school Principal. Two workshops were piloted in person, facilitated by the researcher. The first was run with several PhD student volunteers, including a part-time secondary school teacher. When feedback on the materials and presentation had been considered, a second pilot was held with three senior secondary school teachers from schools outside the MAT, one of whom had helped pilot the Study one interview scripts to test content and timings.

The workshops were designed to firstly introduce the study concept. Secondly, to allow teachers the time and information to understand the different ways in which they consciously or subconsciously seek to manage stress. This was intended to facilitate the identification of personal stress-management strategies. Thirdly, to introduce teachers to the different ways in which technology could potentially align with and support their stress management strategies. Finally, to describe each of the DC options open to them for the forthcoming study. Mentimeter, interactive presentation software, was adopted to enable anonymous crowdsourcing of ideas from teachers. The software aggregates responses to questions and displays them in real-time as a wordcloud.

Speculation on school closures was happening at the time of teachers being recruited, and before in-person workshops could be held, schools had closed to all but vulnerable and key workers' children. The study workshops were therefore adapted to be held virtually online by Zoom, with the main changes of removing time

for group discussion on issues of stress, rethinking how to enable interaction virtually and directions for the workshop assistant.

Two workshops were held at midday during school hours, and one at 3 pm; each lasted between 1.5 and 2 hours. Due to COVID-19 disruption, one was held before the Easter break and two afterwards in the first half of the summer term. As the teachers had chosen preferred workshop timing from a selection of dates, they were not necessarily participating with teachers that they knew. Three computer screens and one smartphone were used to deliver the workshop, giving the researcher continuous sight of a) the teachers, b) the interactive Mentimeter survey results, and c) the PowerPoint presentation.

At the start of the workshop, the moderator (thesis author), assistant (author's husband, a teacher) and participants introduced themselves. The moderator then explained the purpose and process of the workshop. Time was incorporated to enable participants to reflect on and discuss materials. A five-minute break was held at the halfway point. At the end of the workshop, participants were invited to make a choice of DC, should they take part in Study Three. They were instructed to only send back the Participant Form section if they wished to go ahead with the next half-term 'practical' study. No participants dropped out at this stage.

5.7 Study Three Method Detail

A longitudinal study was planned that used semi-structured interviews, as described in 5.4.4, as well as open and closed-question surveys to answer the third and fourth research questions. These data were supplemented with feedback questionnaires, memos and note taking and email responses (including from non-participants, with their permission). The detail, rationale and elements of these methods are now described.

5.7.1 Semi-Structured Interviews Detail

Eight teachers took part in two one-to-one interviews planned for the intended study; six teachers went on to participate in a further interview for the extended study in the autumn. For this study, given the immense disruption caused by the pandemic, the first interview guide was not piloted before being used. As the second and third interview guides built on the first interview and participant's responses, it would not have made sense to pilot them with another teacher.

Example extracts of the interview schedules from the first, second and third interviews are provided below in Figs 5.3, 5.4 and 5.5 and the full interview guides can be found in Appendices E, F and G. In each interview a screenshot of a matrix was shared to facilitate understanding of and thinking about contextual influences. A blank matrix, as depicted in Figure 5.6 (but without the prompts), was shared on screen to assist each participant to consider the use, usability and usefulness of their DC, and the influence of different contextual factors. The researcher used prepared notes to give examples, if needed, of factors that could be considered. An example of this is when the teacher was asked about their experience of usability in the social context of the school; this question was expanded by asking if there was anything in their workplace relationships that deterred or encouraged usefulness and how this could be addressed or enhanced.

1. Have you used any digital tools to support your stress management before now?
2. How do you think you will use the DCT?
3. What are your hopes or expectations from using it? Both in terms of benefits and drawbacks?
4. Where do you think you would use the DCT?
5. How do you think the type of school that you are in impacts the way that you experience stress?
6. Do you think your school colleagues will influence your use of the DCT?

FIGURE 5.3 EXAMPLE QUESTIONS FROM STUDY THREE FIRST INTERVIEW GUIDE

1. What do you think has been the impact of Covid19 on your experience of work stress?

2. Were there any issues with learning, functionality, amending or remembering how to use the watch?

3. The watch provided data on which to reflect – it also enabled meditation, social support, setting alerts and reminders. What did you find the most helpful to looking after yourself?

4. Did you think the watch was particularly useful to you as a teacher/ Head of Year in managing stress, and if so, why?

5. What encouraged you to use the watch (facilitators)

FIGURE 5.4 EXAMPLE QUESTIONS FROM STUDY THREE SECOND INTERVIEW GUIDE

1. You have just had the first full half-term with pupils back in school since the start of the pandemic – what have been the similarities and differences compared to pre-pandemic?

2. What have been your experiences of stress during this half term?

3. Now you are back in the school workplace, what has your experience been of using your watch/app to help with your stress management?

4. If we consider a stressful moment in school – whatever that happens to be – do you think the technology you chose helped you in the moment (at the time of the stressful incident)?

   a. If yes, what is it about the technology that helps?

   b. If no, what is it about the technology that doesn't help?

FIGURE 5.5. EXAMPLE QUESTIONS FROM STUDY THREE third INTERVIEW GUIDE

The matrix was populated during the interview whilst on the shared screen to enable the participant to see, and if necessary correct, what was written. After the interview, each participant's responses were copied into a file and added to the case study folder for that participant in NVivo (as described in 5.7.3).

	Facilitator / barrier contextual factors		
Influence on <u>Stress management with Tech</u>	Situated - Physical environment *Workspace, conditions, building layout e.g. isolated buildings, internal windows.*	Individual – Social culture *Inter-staff relationships - mutual trust/support/collaboration with colleagues; ok to raise issues.*	Organisational – Culture approach *Trust and value teachers/ Support PDP & Student behaviour/ prevent interruptions/ good comms and clear expectations / responsibilities*
1. Use – When, where, how, why; data-driven, intent, motivation	**Opportunity – what is needed?**	**Perception – better for being informed by data?**	**Legitimacy – Stigma?**
1. Usability – efficiency, ease, satisfaction, enjoyment, context	**Practicality – how easy?**	**Attitude – Trust?**	**Local Privacy - Ability to withdraw provided?**
1. Usefulness – helpfulness, demands, relevance, facets, self-management, perception, comparison	**Value in location – specifically helpful/unhelpful?**	**Value amongst colleagues?**	**Value by leadership?**

FIGURE 5.6 THE UNPOPULATED MATRIX SHARED WITH EACH OF THE PARTICIPANTS DURING THE INTERVIEW WITH PROMPTS FOR INTERVIEWER SHOWN

5.7.2 Open and closed survey questions

In the intended Study Three, spanning about six to seven weeks of the summer term, surveys were sent after the halfway mark. It had been intended to start them the week beginning June 22nd, teachers having been informed of the date at the end of their first interview and in the information sheet. The researcher had been exploring using an app for survey delivery, but on reflection, this would have required all teachers downloading this app to participate and necessitated in-school access which they might not have. The teachers were all emailed to advise them of the one-week postponement of the survey and were all called to advise them of the use of Microsoft Forms instead. The surveys were therefore set up using Microsoft Forms and each participant was sent a link by email. The questions were arranged around themes and sent in the week beginning June 29th 2020 at 3.30 pm on the Monday, Wednesday and Friday of that week. The questions included branching from responses to ensure subsequent questions were logical and related to their DC choice. Closed yes/no, MCQ, Likert scale and open responses were included. The full surveys and anonymised responses are shown in Appendix H.

The themes covered included:

i.   Monday: Emotional state, Tech Choice, Stress relief activity, Effect of data, frequency of use, stress symptoms during lockdown.

ii.   Wednesday: Previous use of tech for health and wellbeing, use of tech as a teacher and date for next interview.

iii.   Friday: Influence of contexts, how DC has helped or not, their work situation, individual and leadership contexts.

The response rate to the Monday survey was 100 per cent with a mean completion time of 8.02 minutes and n=7 responding within 2hrs and n=1 responding just before the second interview.

The response rate to the Wednesday survey was 75 per cent with a mean completion time of 5.01 minutes and n=5 responding within 6hrs and n=1 responding just before the second interview.

The response rate to the Friday survey was 100 per cent with a mean completion time of 4.27 minutes and n=5 responding within 2hrs, n=1 on the following day and n=2 responding just before the second interview.

One teacher answered the Monday and Friday surveys shortly before her end-of-term interview, citing busyness precluded her from doing so beforehand. They also with another teacher sent no response to the Wednesday survey. One further teacher had thought she had submitted the Friday survey responses but they had not been received so her answers were received on the day of the interview. In the extended section of Study Three, 14 closed questions were asked at the end of the interview as a way of capturing participant experiences of having the data from their DC. These were simple agree – disagree responses which both quantified experience and allowed for greater confidence in the analysis.

5.7.3 Analysis Detail

The approach to thematic analysis was twofold. Case studies and cross-case analysis were undertaken to answer RQ 3, and Reflexive Thematic Analysis was undertaken to answer RQ 4. These approaches are now described.

5.7.3.1 Case and Cross-Case Studies

Case studies are not unique to qualitative research but are an in-depth approach that reflect the researcher's intent to investigate and interpret real-life circumstances (Yin, 2009). In HCI research, "investigations of an individual, group or organization where data is typically collected from across a variety of sources over an extended period of time" are less common (Iacovides & Cox, 2015, p. 2). Yet the relevance to my research was the opportunity case studies offer to examine detailed phenomena in the relevant situation, with the intersection of technology and health providing a

plentiful source of case study material (Furniss et al., 2014). This aligns with Yin's rationale for case study design (as cited by Baxter 2008), which should be considered when:

(a) the focus of the study is to answer "how" and "why" questions; (b) you cannot manipulate the behaviour of those involved in the study; (c) you want to cover contextual conditions because you believe they are relevant to the phenomenon under study; or (d) the boundaries are not clear between the phenomenon and context. (Baxter & Jack, 2008, p. 545).

Exploring in-the-wild interventions through case studies also allows the generation of descriptions and illustrations that can lead to insight, explanations and understanding (Yin, 2009). This complexity would not be explained, described or explored through quantitative methods.

In education, the comparing of case studies across different sites (multi-site case studies) among those with the same job description has been employed to understand burnout and stress in a context-specific setting (Jeter, 2012; Merriam, 2015). Additionally, longitudinal, collective case study design has been used to examine teachers' perspectives on coping strategies (Sharplin et al., 2011). Of the different types of case study compiled by Baxter & Jack (2008), I chose descriptive and multiple case studies. Descriptive case studies are used to describe the real life context in which an intervention or phenomenon has taken place, and cross-case studies allow the exploration of differences within and between cases (Yin, 2009).

The case study method allowed me to use data from multiple sources – my interviews, facilitator-barrier matrices, workshops, memos and surveys – and triangulate them in analysis to give me deeper understanding and validity. Sources that contributed to the data set are shown in Figure 5.7. I was able to create a narrative of experiences and understanding of situated technology use and how this evolved over time. I do note however that I could not assume a complete 'warts and all' story, given that I was talking to employees who would not want to fall out of favour with their employer (Furniss, 2008).

• *For all eight participants in the summer*

1. Entry semi-structured Interview

2. Summer semi-structured Interview

3. User-context matrix responses on use, usability and usefulness through physical, social and cultural contextual lenses from the summer and autumn

4. Summer online survey results

5. Workshop feedback, memos, emails and a diary spreadsheet from one participant in the summer included with permission.

• *For six of these participants, additional data was included*

6. Autumn semi-structured interview with additional closed questions at the end.

(Each interview was about an hour long).

FIGURE 5.7 SUMMARY OF THE DATA SET

Eight case studies were created from the data collected in the summer term to analyse the teachers' individual experiences of adopting and using their chosen Digital Companion for stress self-management. Cross-case analysis was then undertaken to thematically analyse the similarities and differences in their experiences.

Six of these case studies were then extended to include data collected in the autumn term. Cross-case analysis examined how use of technologies had varied and evolved when the teachers were back on the school premises. This approach allowed me to answer the second part of my research question.

The steps for analysis were adapted from two main sources. Firstly, the creation of descriptive case studies as described by Yin (Yin, 2009). Secondly, a within-case and cross-case phenomenological approach illustrated by Kavanaugh from the three different approaches to such analysis described by Ayres, Kavanaugh, & Knafl (2003), enabled a systematic approach to the analysis. Creating case-studies allowed me to develop detailed profiles for each teacher from the data. This provided an understanding of subtle differences in their experiences and appreciate how these were shaped by context (Powell & Bodur, 2019). These within-case analyses enabled me to become immersed in the data from each teacher and gain a sense of their

experiences of adoption and use of their DC (Miles & Huberman, 1984). Examples of case studies are included in Chapter 8, section 8.3.3 and 8.3.9.

Steps to analysis consisted initially of immersion in the data from the summer, through listening to the audio recordings and reading transcripts of the interviews, and reviewing the feedback and survey responses, email correspondence and memos written during and after the interviews. NVivo (version 12) software was used for the organisation of data, creating case study folders for each participant, annotated by pseudonym, before the development and iteration of codes, analysis and categories.

The initial answer-to-the-questions narrative was heavily based on the data from the two interviews and began with listening to the audio recordings then creating a detailed participant summary. These findings were then checked against the workshop feedback, memos, emails and spreadsheet, reviewing all for corroboration or contradiction. The survey responses were then reviewed in the same way. The aim was to critique the weight of, and identify convergence in, the evidence for technology adoption and use, in terms of both process and influence.

This triangulation of sources was used to check whether there was consistency in responses for each participant (M. Q. Patton, 2015). After this, individual descriptive interpretations of teachers' experiences of using their chosen technology for stress self-management were created. Key quotes (self-reports) from the participants' case study files were used to illustrate the interpretation. In this way, eight separate case studies were created. The next step was comparing across the cases and interpretations of experience to identify the similarities and differences. I cross-checked with the original transcripts for fidelity with individual case contexts and to guard against bias as I developed themes. This was followed by critically reflecting on the themes and refining, before beginning to compile them into a narrative that answered the questions of teachers' experience of adoption of their chosen DC technologies in their workplace. The themes were illustrated with statements taken from the individual case studies. This whole process was then repeated for the six teachers who completed interviews in the autumn term, creating six extended case studies that spanned the entire duration of the study and then conducting cross-case

analysis. This second analysis focused on the evolution of use of the DCs when back on school premises.

5.7.3.2 Reflexive Thematic Analysis

Reflexive thematic analysis was undertaken of the whole dataset, using the same approach as described in section 5.5.3. In Study Three, the data set was larger than in Study One, with data sources summarised in Figure 5.7. The stages of analysis and reflexivity were applied to each research sub-question in turn, with themes generated in answer to both questions. In reporting the findings they have been combined to emphasise the interaction between the individual and their contexts.

5.8 Methodological integrity and validity

The integrity of the methodology can be judged on faithfulness to the subject under investigation and its usefulness in addressing the aims of the research" (Levitt et al., 2018). The choice of appropriate methods for this study was made to generate rich, detailed and contextualised data from participants in order to answer my research questions. Combining different data-collection strategies such as interviews, observations, communications and written reports enables triangulation, minimises bias (Strauss & Corbin, 1998) and enhances the reliability and validity of findings and "perception of credibility" (M. Q. Patton, 2015). As described by Levitt et al on qualitative reporting standards, there are four central conceptual questions to fidelity and utility that should be asked:

1. Is there 'data adequacy' – where procedures reveal variations in the phenomenon under study?

2. Is there 'perspective management in data collection' – where the researcher's perspective and influence on data collection are recognised?

3. Is there 'perspective management in data analysis' – where the researcher's approach to analysis is considered?

4. Is there 'groundedness' – are the findings rooted in the data?

Added to these, questions on the relevance of procedures to research aims should be covered:

5.   Is there 'contextualisation of data' – were the findings considered in terms of location and culture?

6.   Are there 'catalysts for insight' – does the data enable insightful analysis?

7.   Are there 'meaningful contributions' – is the analysis relevant to the research goals?

8.   Is there 'coherence amongst the findings' – are differences and similarities explained? (Levitt et al., 2018)

As well as asking these questions of my data and analysis, I used the following measures to further ensure validity and integrity.

5.8.1 Data triangulation

The term triangulation is taken from land surveying and the value of knowing about more than one single landmark. The logic of triangulation is based on the premise that more than one single method, data source, investigator or theory is required to reveal different aspects of empirical reality. This analysis deployed triangulation of qualitative sources, which tested the consistency of different data sources within broadly the same methods (M. Q. Patton, 2015). Whilst validation through true triangulation is hard to achieve, the plurality of approaches is good practice because it leads to insight (Rogers et al., 2019).

5.8.2 Transparent, comparative thinking

Confidence in data and findings can be enhanced by setting out clear process and steps of methods and analysis. In doing so, the reader can then clearly judge for themselves the aptness and accuracy of the information gathered and how it was examined. Importantly, transparency and trust are not the same thing. As discussed

in the 2002 Reith Lectures, "even the most impressive systems of accountability – though they can improve trustworthiness and offer helpful evidence for placing or refusing trust intelligently – cannot eliminate the need for trust" (Manson & O'Neill, 2007, p. 163). To engender trustworthiness, as a constructivist researcher, I reflected on the way the aims, context, process of research, my role and the participants' assumptions and viewpoints may have influenced the outcome. This approach was taken to demonstrate reflexivity and intellectual rigour (Lincoln & Guba, 1985) rather than simply using data to illustrate or make claims about concepts.

5.8.3 Repeated review of primary data

Referring back to collected data regularly and re-questioning my assumptions is a self-reflexive way of ensuring cogency. By revisiting transcripts or listening to recordings or re-reading notes and memos I was able to critique and confirm or sharpen my findings, as well as consider how the process of data collection may have influenced the findings.

5.8.4 Sense-checking with participants and low-inference descriptors

The longitudinal nature of Study Three meant that I had a series of conversations with the teachers which allowed me to re-check my interpretation and clarify and solidify my understanding of their experiences. Even before Study Three formally began, some participants were emailing comments back to me about changing circumstances and thoughts on stress management, largely prompted by adaptations they were having to make due to the pandemic and the evolution of teaching practice as the lockdown continued. As each theme was generated, low inference descriptors in the form of verbatim quotes were used from my interviews and surveys to evidence the analysis.

5.8.5 Personal reflexivity

Personal reflexivity in research is about acknowledging how I as a researcher have influenced the production of knowledge within research (Blandford, 2013; Braun & Clarke, 2019; O'Kane, 2016; M. Q. Patton, 2015). The Journal Article Reporting Standards for Qualitative Research (JARS-Qual) section on methodological integrity includes techniques such as memos, field notes, diaries, logbooks, journals etc. (Levitt et al., 2018). Throughout the process of the research, I kept memos, diaries and observations. I was aware from the start of my personal impact, both as the wife of a comprehensive school Assistant Headteacher and as a mature student who had worked for nineteen years with NHS patients. From my own experience, I knew that some of my credibility as a researcher amongst teachers would be derived from familiarity with my husband's job, which led to a more natural rapport with participants and a sense of being on their side. I was able to demonstrate an empathy borne out of an awareness of workplace issues, culture, terminology and values based on insider knowledge, not just academic insight, and drawing out fundamental concerns was a practice familiar to me given my years of working with patients.

This enabled me to reassure participants of prior expertise that conveyed empathy and knowledge of public sector employment and subjects relevant to both research and their roles. I was still initially surprised, given the sensitive topic, by teachers' willingness to open up and speak frankly about emotive experiences. It was not unusual for participants to be tearful during the semi-structured interviews in Study One, but in all studies teachers were positive about the immediate experience of taking part. This demonstration of emotion in Study One meant that I put extra emphasis on the provision and availability of emotional support by the Education Support Partnership at the start of the workshops in Study Two and at each interview stage in Study Three.

5.9 Chapter Summary

In this chapter I have presented my research paradigm and overall methodology for exploring my research questions. I described the data collection methods and acknowledged the impact that the worldwide coronavirus pandemic had on my research methods and recruitment. I also explained my approach to maximising methodological validity and integrity and how I analysed my research. I also noted my own impact as the researcher on the studies and ethical precautions that I have taken.

Chapter 6 Study One: Exploring stress self-management amongst schoolteachers

"I went down to my staff base. I moved myself away from the door so nobody could look in, went to one of the last compartments, and I cried and I cried and I cried." Teacher describing overwhelming stress, 2019

Parts of this chapter have been published in JMIR Mental Health 2020 (Manning et al., 2020)

6.1 Introduction

Part Two of this thesis began with Chapter 5, which explained the methodology and core study methods for this thesis. This chapter starts by recapping the gaps in knowledge demonstrated in Part One, and then details how the first research question was answered.

6.2 Motivation

Teachers who have survived the early years of teaching tend to have some direct stress management strategies in place (Bradley, 2007) which can also indirectly reduce the number of events that teachers experience as stressful (Betoret, 2006). Understanding what constrains stress management and how digital technologies could help is essential information for teachers and designers.

6.2.1 Knowing how teachers manage their stress

As described in Chapter 2, stress management studies have either examined how individual teachers manage demand (their direct-action, palliative coping or avoidance strategies) or reviewed the deployment or evaluated an intervention. Intervention studies are more numerous (Frank et al., 2015; Kidger, Brockman, et al.,

2016; C. F. Mansfield et al., 2016; R. Mansfield et al., 2021). Other studies have identified organisational and cultural stress sources, such as timetabling; professional, practical or relational support; ineffectual school leadership and workplace change (A. Carroll et al., 2020; Richards et al., 2018). Some studies have considered personal themes of well-being (A. Carroll et al., 2020; Kiltz et al., 2020), which can be the direct result of actions such as setting boundaries and allowing time for self-care (Sharplin et al., 2011; Skaalvik & Skaalvik, 2015). It has been shown that the contextual factors of time and culture (in the form of perceived autonomy support) influence teachers' personal resources (adaptability and buoyancy) and are related to being able to deal with stress (Collie, Guay, et al., 2020).

6.2.2 Teachers' use of digital support for stress management

There appears to be little detail in the literature on contextual influences on teachers' ability to self-manage their stress with technology, partly because there are few such studies in occupational contexts (Phillips et al., 2019). This is also because context is so often not clarified (Klap, 2020). Temporal constraints are most frequently cited as a meso-contextual barrier to engagement (Persson Asplund et al., 2018; Thiart et al., 2015). Conversely, an intervention accessible asynchronously or self-determined use facilitates engagement (Ansley et al., 2021). The potential for digital health technologies to increase awareness of the micro-context of the individual and their wellbeing or symptoms has been noted (Ertzberger & Martin, 2016; Klap, 2020), and interventions have been shown to have relevance and benefits for teachers beyond work contexts (Ebert et al., 2014). In the workplace, wearables have allowed more granular exploration of stress symptoms as well as meso-contextual associations through reflection (Runge et al., 2020), but this does not necessarily lead to stress self-management (Kocielnik & Sidorova, 2015). Investigation of the influence of context on digital companions' mechanisms of action, such as fostering reflection on data or suggesting treatment, has received little attention.

6.2.3 Summary

Although the public has access to over 1,000 stress apps, plus web, computer and wearable-based stress interventions (Borghouts et al., 2021; Lau et al., 2020; Neary & Schueller, 2018), we know very little about what teachers have adopted, why, how, when or why not. The literature indicates that teachers at the middle-management level will have adopted stress management strategies but gives no indication of whether these strategies are digitally supported. We have some knowledge of contextual influences, such as time or symptoms, on digital interventions, and the literature indicates that where trialled, some interventions have been efficacious, with high engagement and lasting effects. The little information on wearables at the time of this study suggests they could have a role in enabling teachers' reflection on data, but this might not trigger a stress management strategy. Therefore, in this chapter the first study is presented to answer the research question:

RQ 1 What is influencing teachers' current stress management?

Through the sub-questions:

RQ 1a How do secondary school middle-leaders manage their stress?

RQ 1b What are the contextual influences on their management?

RQ 1c How and why do they use digital health tools?

The investigation of existing stress-management by educators managing both teaching and pastoral duties was designed to generate thick descriptions to inform the creation of the longitudinal study. The subsequent study would then explore the educational context's influence on teachers using digital tools for stress self-management. The process, results and discussion of Study One now follow.

6.3 Method

Consistent with the overall epistemology of this thesis, I chose to explore participants' strategies in their everyday work context through semi-structured qualitative interviews, the methodology of which was described in Chapter 5, section 5.5. In the planning of teacher interviews, I also spoke to some headteachers to give me a richer understanding of the education environment, and notes taken from these discussions helped refine the study.

Fourteen teacher interviews to be undertaken during school hours were planned; however, several teachers volunteered to be interviewed on a Friday afternoon after classes had finished. A print-out of the information document was also given to participants at the start of the interview, which included information on where they could obtain free and confidential advice should they feel in need of support after the interview had finished. It also contained details of the Departmental Ethics Approval Project Number UCLIC/1718/013/Staff Marshall/Manning.

6.3.1 Interview Script Development

The interview guide was informed by the literature on stress in the school workplace (see Chapter 2), as well as previous Education Support Partnership stress questionnaires (Education Support Partnership, 2018) and Health and Safety Executive research (HSE, 2007; A. Smith et al., 2000).

The interview had been pilot-tested with two teachers independently: an assistant head and a head of department from two separate schools. The data from these interviews were only used to refine the interview schedule and not used in the thematic analysis. The whole interview schedule is contained in Appendix D. None of the interviews were terminated prematurely. They were timed to last for 30 minutes, with the shortest interview lasting 22 minutes and the longest 43 minutes.

6.3.2 Data Analysis

All interviews were transcribed verbatim and analysed using inductive thematic analysis, supported by NVivo (v12) and Simplemind (v1.22) software. My analytical approach is described in detail in Chapter 5, section 5.5.3. Participant quotations have been used to illustrate the themes, but in line with assurances of anonymity given to interviewees, no personal identifiers have been used.

6.3.3 Study Participants

The teachers who took part in this study were assigned a number to maintain anonymity and in the results are referred to by their participant number (P1, P2, etc.) and their years in teaching. Table 6.1 records their reports of stress self-management activities and technology used, though the technologies were not all designed for stress management or always used consciously.

Study One Participant Number	Years as TEACHER	STRESS SELF-MANAGEMENT ACTIVITIES	Technology used
P1	34	Reflecting on patterns of feelings & behaviour & managing time	My Wonderful Days - diary App
		Exercise	Strava App
		Friends and family network	
		Medication	
		No alcohol	
P2	17	Mindfulness	Headspace App
		Running	Steps to Wellbeing Online
		Collaboration with colleagues	
		Keeps a diary to 'process stress' and 'gain perspective'	
		(Online) iCBT	
P3	28	Guided Breathing	Fitbit Blaze Wearable
		Breathing App	Breathing App
		Sharing more with colleagues	
		Walking – 10k steps	
		Mindfulness & relaxation	
		Yoga	
P4	16	Mindfulness	Samsung Gear 2 Wearable
		Activity reminders – Samsung Gear 2	
		Medication	

		Yoga	
P5	21	Accepting 'good enough'	Fitbit Wearable
		Dropped Leadership Role	Now then free – diary App
		Yoga	
		Diary dates	
		Mindfulness	
		Exercise and movement – Fitbit	
		Reflecting on patterns of feelings & behaviour	
P6	20	Intentional self-management	Fit2teach Online (fb group)
		Professional updates	Teacher Tapp App
		Meditation	Headspace App
		Sharing workload via social media groups	Calm App
		Swimming and Exercise	FitBit Alta Wearable
		Used heart-rate data to drop some classes	
		Diary dates	
		Activity & Hobbies	
P7	16	Dog walking	iphone step tracking App
		Steps/Exercise	
		Buddhify	
		Audio books	
		Wearing headphones to disincentivise others' conversation	
		Holidays	
P8	28	Writes a diary	
		Pilates	
P9	9	Mindfulness	Mindshift App
		Intentional time-out and not using social media	
		Family network	
		Park run	
P10	22	Walking – work group	Fitbit Alta Wearable
		Guided meditation	Insight timer App
		Pilates	Breathe App
		Yoga	Calm App
		Talking to herself	
		Intentional slowing down	
P11	22	Yoga/exercise	Buddhify App
		Writes a diary	
		Friends network	
		Physically moves away from point of stress or puts 'it' away	
		Talking to herself	
		Mental shift in focus "strategic disengagement"	
P12	32	Meditation - iCBT	Pacifica App
		Activity tracking	Happy not Perfect App
		Mindfulness	
P13	11	Running	PolarM430 Wearable

		Monitoring heart rate	
		Monitoring sleep	
		Holidays	
		Meditation – focused unwinding	
		No alcohol	
P14	15	Talking to herself	Fitbit Blaze Wearable
		Deliberate time management - lists	Headspace App
		Hobbies	
		Slower pace	
		Activity tracking	
		Mindfulness	

TABLE 6.1 STUDY ONE PARTICIPANTS AND SELF-MANAGEMENT APPROACHES

6.4 Results

6.4.1 Overview of themes for RQ 1

Teachers were unanimous in both their recognition of workplace stress and their sincere commitment to teaching. Participants revealed the physical and cultural workplace context to be one of relentless, all directions exposure, multifaceted delivery objectives and fear of peer opinion, and one in which their wellbeing was less important to policy-makers and school heads than that of students. They described the constraining effects of the school context which significantly affected teachers' ability to look after their wellbeing. Stress-management strategies, except for mindfulness in one school, were self-taught and varied from immediate real-time, deferred and external to the workplace to cumulative learning approaches designed to build coping strategies. Many teachers experienced burnout before finding successful stress self-management strategies, which included moving school (a situational strategy that is reflected on in Chapter 7 and Chapter 9 and falls within the definition of self-management in Chapter 3). The pace of work meant real-time use of health apps by teachers was rare. Out of school, apps were used for symptom control (e.g. insomnia), sometimes automatically (embedded usage that had become second nature, such as diary app entries), and frequently for relaxation and the creation of sustainable habits (such as mindfulness). Wearables were accessed by some teachers in the workplace and often used for quantification, occasionally for

prompts (e.g. to move or to exercise) or rewards, but wearers' enthusiasm was rarely shared with colleagues.

There was evidence of a shifting organisational culture with the introduction of the concept of teachers' wellbeing, and most staff were both very positive about their school leadership and potentially open to leadership recommendations of supportive technology.

A total of 14 participants, 10 females and 4 males, with between 9 and 34 years of experience as a teacher, completed the interviews.

The findings reflect two overarching themes of understanding how the education workplace context constrains stress self-management and teachers' use of digital health technology. Other themes were identified but went beyond the research questions and scope of this thesis, so are not reported here. A summary of themes and sub-themes within each overarching theme is reported in Table 6.2.

Overarching theme	Theme	Sub-theme
Educational practice constrains teachers' wellbeing and self-management of stress	Contextual constraints on the use of technology for stress self-management	Relentless and often simultaneous demands dominate the day
		Social and physical exposure of the teacher's role
		Stigma of not coping deters help-seeking

	Organisational culture influences self-management of stress	Teachers' wellbeing secondary to students' wellbeing
	Feeling isolated in the school context but signs the culture is changing	Individual scenarios of isolation
		Tackling isolation within a local culture
		Raising the profile of teachers' wellbeing
Some digital stress technologies can be used and could be expanded	Stress reduction technologies are considered useful by teachers	Both the form of technology and physical workspace influences its use
		Teachers are open to schools promoting de-stressing technologies
	Sequelae of stress targeted by tech intervention informs potential choices	Monitoring behaviour or mood patterns to aid reflection
		Use of technology to directly self-manage stress sequelae

		Use of technology for more holistic self-care

TABLE 6.2 SUMMARY OF THEMES IN ANSWER TO RQ 1

The quotations used in the results are all self-reports. Some of these reports have the following notation: '…' signifies editing of a quote that allows for clarity without any change in meaning; '[ ]' indicates text added for comprehension purposes; and '[…]' signifies where text has been omitted to ensure anonymity. The participant code is included at the end of the quotation in the form of participant's (P) number and duration of teaching experience.

6.4.2 Educational practice constrains teachers' wellbeing and self-management of stress

This overarching theme captures the experiences of teachers as framed by system organisation and culture. Educational practice was described as all-consuming, non-stop and comprehensively demanding, with the admission of strain or need for respite stifled by fears of being perceived as inadequate. The lack of time and reluctance to articulate needs results in the neglect of stress management during the day. The three themes and their subthemes are described below.

6.4.2.1 Contextual constraints on the use of technology for stress self-management

Teachers described a work environment that comprised constant exposure on the frontline, with their activity temporally constrained through tight timetabling and unplanned interruptions. These temporal, physical, social or cultural constraints prevented opportunities for self-care in the workplace.

Relentless and often simultaneous demands dominate the day

The relentless nature of the teacher's role was illustrated by descriptions of not only delivering back-to-back lessons to class 'audiences' of up to 30 (or more) students, all

with differing needs and abilities, but also having to manage junior staff or act on their requests and respond to changing situations. Not having any time to themselves during the day was frequently mentioned, such as:

So as well as being a teacher I'm also Head of House. So I've got the additional responsibility of that… it's unpredictable [in] nature because you've got no idea what's going to happen, but then obviously the time constraints of when someone has an issue and you're teaching full day it's the time you then have to actually deal with that situation. P9, 9yrs

I don't think a lot of people who aren't in teaching totally get the fact. Oh, you get all these holidays and stuff. It's like, you try teaching. You try presenting to groups of kids for five hours a day. And then getting bombarded with things that you can't just not switch off from. P4, 16yrs

Social and physical exposure of the teacher's role

There was a tangible sense of the social and physical environment dominating teachers' sense of agency and dignity, with no opportunity for privacy, compromising their ability to self-manage the frequent stressors. The non-stop visibility of the job was an additional issue, with analogies made to acting and becoming 'talked out', having had to present and talk to people all day:

One of the most exhausting things about teaching is that you are performing a role, constantly…And even if you are incredibly stressed, you have to perform a role anyway. And the responsibility and accountability on your shoulders combined with the fact that you are acting most of the day is exhausting. P4, 16yrs

6.4.2.2 Organisational culture influences self-management of stress

Participants went on to describe organisational cultural reasons for the lack of opportunity to manage stress. The school social environment was described as one in which many teachers still feared admitting the need for help, and for some this had

been exacerbated by the perception that student welfare was promoted over workforce wellbeing due to government policy.

Stigma of not coping deters help-seeking

Numerous fears were expressed on how help-seeking would be perceived, with concerns including loss of job or demotion, negative peer opinion and sense of failure. This fear sometimes extended to staff not sharing helpful digital tools with peers despite occasionally recommending them to students.

> *No, [I haven't recommended Mindshift to colleagues]. I think we're quite secretive by nature. I think it's such a stigma. As teachers I think we've all got a character trait that we like to do well and I think if you admit you're stressed it's like admitting you're failing. P10, 22yrs*

> *I say it's for research purposes, but actually it's for me as well that I access these things. I use Pacifica. P12, 32yrs*

Many participants' concerns reflected a fear of peer perception that they might not be coping well, highlighting a culture where weaknesses were seen as having their origin in the individual rather than in the system.

Teachers' wellbeing secondary to student wellbeing

Added to this fear of an unsympathetic social culture was the inference, from recent national policy, that the focus was on prioritising student wellbeing, a growing emphasis in the education sector on teachers meeting the mental health needs of students, with little provision for their own.

> *You've really got to look after yourself because nobody else is going to look after you here. They're not because they can't…nobody's got time to look after their staff. P7, 16yrs*

> *So you've got stressed teachers trying to un-stress children which doesn't make much sense. P9, 9yrs*

Despite the rhetoric on wellbeing, the message that it's "ok to not be ok" reported by a few participants has not yet been normalised.

6.4.2.3 Feeling isolated in the school context but signs the culture is changing

Sometimes participants spoke about feeling isolated, but often this was implied through descriptions of trying to manage stressful times on their own. Others, notably within the smaller setting of subject departments, had been very upfront about struggles and had shared simple wellbeing advice with colleagues such as walking more slowly between lessons, or had already suggested technology solutions to stressful scenarios.

Individual scenarios of isolation

Sometimes teachers described scenarios where stress had been overwhelming and the early warning symptoms of insomnia or nervous tics were ignored. These participants were frequently conscious of work dominating their lives, but in their isolation saw the ability to cope an individual responsibility. Subsequently, their wellbeing suffered, with occasionally devastating consequences such as nervous breakdown or marriage breakdown.

> *I went down to my staff base. I moved myself away from the door so nobody could look in, went to one of the last compartments, and I cried and I cried and I cried. There's nobody you can go to. When you're in this environment there's nobody. There's nobody to be able to download to. There's nobody to say are you alright. You're just completely by yourself. So the feeling of isolation…and actually…quite powerless to do things. P7, 16yrs*

> *I used to bring three bottles of water to school and I could tell if I'd had a bad day because…I've had a sip out of each when I got home and I didn't need to go to the loo. And there'd have been no space. P10, 22yrs*

Tackling isolation within a local culture

Descriptions of subject departments were usually very warm, with Heads of Department describing camaraderie between colleagues that led to a more supportive culture.

> *Yes, I'm known for emailing [my department] and saying use this app, I find it really useful. And I did some work looking at reducing workload and marking and being really sort of honest with staff and saying I'm really struggling with this. I struggle with workload and I want to try and make it better. So I share quite a lot. P6, 20yrs*

> *I set up a support programme for [my colleague], based on my experience. What would really suit you? What are you happy to do? In terms of the aspects that I could control, I came to an agreement and a balance with her, just making sure to check up on her. P14, 15yrs*

The majority of participants believed that the wider leadership sincerely wanted to support staff wellbeing, some referencing an annual staff wellbeing survey, and where some responses had been acted upon.

Raising the profile of teacher wellbeing

All staff being interviewed were or had been in a position of leadership themselves, and some were involved in their schools' plans to raise the profile and provision of wellbeing for staff. Participants were wary about gimmicks; some had noticed mental health posters appearing in their school but without an accompanying narrative. However, the suggestion that leadership could proactively recommend solutions raised genuine interest.

> *My job at the minute in terms of staff wellbeing and staff development is partly because there are changes that I wish to make because I've been here for a long time… I've listened to people, I've got a sense of what people say and wish to do and actually avoiding helplessness, this is something I can actually do and make that happen. P11, 22yrs*

No, I would love [the Senior Leadership Team to recommend a wearable that is really good for managing stress]. I like stuff like that. No, that is fine. P3, 28yrs

Despite expressions of a constraining culture in which stress management was seen as an individual, not an institutional, responsibility, there was still a strong sense of trust in leadership. Most staff had worked at more than one school, and many had moved schools to find a culture in which they felt more supported or valued.

6.4.3 Some digital stress technologies can be used and could be expanded

This overarching theme captured the current use of wellbeing technology, as well as some facilitators and barriers to utility. Teachers described the types of technology used, which were not all designed for stress, and the strategy they supported. Descriptions often evolved as teachers thought about and then described the concepts or strategies that the technology supported and how it helped them. Digital tools did not have to be personally tailored for teachers to think that they should be more widely recognised or recommended to colleagues. The two themes and their subthemes are described below.

6.4.3.1 Stress reduction technologies are considered useful by teachers

Across the participants interviewed, 12 out of 14 already used digital tools for stress management or wellbeing, with 17 apps, five different brands of wearable and one desktop programme named. Descriptions were shared of how and when the technologies were used, or what impeded their use. Most teachers felt the profession would be open to authenticated digital support for stress management.

Both the form of technology and physical workspace influences its use

Smartphones were taken to school by teachers, but time, signal and privacy constraints together meant phones remained in the teacher's bag or coat pocket; just one teacher reported accessing a calming app in the privacy of her office during the

day, and one other accessed the Headspace app via her iPad. Over half of those interviewed used wearable technology (e.g. Fitbit, smart watch) and real-time data to manage their stress and wellbeing.

> *I used [Headspace] when I was in the bath last night…just focusing on breathing and meditation. And I did it the previous night in bed, I just did like five minutes and even just after five minutes I felt quite relaxed and I thought wow, I should just do five minutes a day because it's nothing really… I think if I didn't have that app I wouldn't do it and it now sends me reminders. P2, 17yrs*

> *Anyway, back to the Fitbit. I just love all the features of it. It's got relax as well. Sometimes if I wake up in the middle of the night, I put the relax on. Quick, two-minute session to find a bit of calm. P3, 28yrs*

Teachers are open to schools promoting de-stressing technologies

When asked about their response to the school leadership promoting a digital health intervention for wellbeing, interviewees voiced near-unanimous enthusiasm, and a belief that this would only happen if due diligence had already been done and therefore such a tool was tried and trusted. They might not feel it was for them, but it could be for a colleague.

> *I'd look at that [stress app]. I'd look at anything because it doesn't have to help me does it? It becomes part of a toolkit of stuff that you signpost to people…This is stuff I'm prepared to recommend. Actually this becomes our provision. This becomes what we do. P11, 22yrs*

6.4.3.2 Sequelae of stress targeted by tech intervention informs potential choices

In terms of meeting their own needs, teachers managed stress using strategies that included the setting of boundaries, focusing on holistic wellbeing, keeping a diary or intentional reflection on experiences. Sequelae of stress, such as raised heart rate, shallow breathing or racing thoughts, were often the target of conscious self-management strategies, including via digital health tools. Mindfulness was the most

frequently cited stress reduction technique, both with and without digital support. Those who had wearable technology all expressed an interest in observing their patterns of behaviour and activity, though they did not always welcome the attendant prompts. One interviewee had collated data from the wearable to successfully demonstrate to a line manager the need for changing her schedule due to the potential exacerbation of a health condition. Many wearers did not share their data or advocate for their wearable despite liking the personal feedback. They did however appreciate the data captured by technology tools, which was frequently mentioned as valuable and confirmatory.

Monitoring behaviour or mood patterns to aid reflection

Data gathered was used to aid reflection on reactions or responses to stress, and participants expressed the value of seeing patterns of behaviour through tracking and mapping.

> *So it's about patterns…My wonderful days. It's a diary [app]. And I am supposed to write down every day what I am feeling, but it tends to be just what I have done that day, whether it's longer or shorter or…I can look back at last year. You can see how far you've come – oh my goodness, that was how I was feeling this time last year! [P1, 34yrs]*

> *The only thing I've started, and I'm wearing it at the moment, is a heart rate monitor. That's more for when I exercise, but I've been conscious that it comes up with a sleep pattern. Every morning, it's less than the desired amount of sleep achieved, poor quality of sleep. So, it's really interesting to see that, on a regular basis, I'm not getting the right amount of sleep. P13, 11yrs*

Use of technology to directly self-manage stress sequelae

Participants used apps to access stress management techniques at home, such as dealing with anxiety or relaxing through mindfulness or meditation. Wearables were able to afford real-time intervention or information, such as helping them get back

to sleep at night or bringing down their heart rate through managed breathing during a class.

> *And again, often if I feel myself getting a bit stressed [in class] I will look at my Fitbit and if I can see that my heartrate is above 80, which for me is very high, again, I will either do a breathing exercise or I'll just do something to change what I've got myself into and then just check again in a few minutes. P6, 20yrs*

> *Currently, I like Insight Timer. I like it because I can adapt it to whatever I'm doing…At the end of the day…if I'm wound up about something, there is [a programme I can choose for example] for resentment or anxiety. It's very, very adaptable. P10, 22yrs*

Use of technology for more holistic self-care

Some teachers described indirect ways of reducing stress, managing their time better to impact workload, or building self-efficacy. An example of this was through the use of the research tool, TeacherTapp. This app has been designed to capture data from teachers at the end of their working day by asking them three research questions. By taking part, teachers themselves can review the findings and read associated articles.

> *It [TeacherTapp] also links each day to some kind of educational research …and it also tells me how long it takes to read…it kind of makes me feel more professional and that kind of feeds into the stress and the workload thing doesn't it. So although it's not a wellbeing tool, I think it does work as one. P6, 20yrs*

6.5 Discussion

This chapter presented the findings from the first qualitative study exploring contextual influences on English secondary school middle-leaders' self-management of workplace stress, and of their use of digital health tools for wellbeing. In this section I discuss the findings under the two overarching theme headings.

6.5.1 Educational practice constrains teachers' wellbeing and self-management of stress

The findings from the data analysis formed a detailed narrative of how self-management of workplace stress by senior teachers is subject to constraining contextual and organisational factors. Whilst the concept of constraints has often been cited in the teaching literature (Payne & Fletcher, 1983), with workload the most cited cause of stress (Alarcon, 2011; Avanzi et al., 2018), details of how contextual constraints affect staff wellbeing, or how interventions can help with stress (Jeter, 2012), are sparse. The first of these constraints identified by participants was of relentless demands, which have been described elsewhere (Butler, 2007; M. Smith & Bourke, 1992). Yet when combined with a second constraint of lack of privacy – the ability to be "backstage" or absence of self-care time, a lack of "local privacy" – this absence of refuge from the front-line results in inhibition, stifling of expression or no opportunity to de-stress (Hargreaves, 1990; Palm, 2009). Some schools no longer provided a staff room for teachers to retreat to, yet we know from Maslach's work that stress leading to burnout is most frequent amongst those whose work involves intense, ongoing involvement with other people, such as doctors and teachers (Maslach, 2001).

Stigma of help-seeking was a third constraining factor. This related to teachers' fears of being perceived to be of 'inferior ability' if they ask for help (Butler, 2007), as well as stigma that continues to exist around seeking mental health support. There was a notable exception described by one participant who had a mental illness diagnosis and experienced excellent support and understanding from both school leadership and students. Findings otherwise indicate that cultural normalisation of wellbeing support has not been achieved.

It was more often seen as ironic that recent national policy emphasis on mental health in schools had almost exclusively been aimed at students, not the education workforce, despite evidence of teachers' concerns that if their own emotional needs are neglected they cannot meet those of the students (Kidger et al., 2009; Sisask et

al., 2014). These confidentiality and peer concerns mirror the opinion of healthcare professionals (Montgomery, 2014; Spiers et al., 2017) and anonymity is still cited in research as a strong benefit to online mental health support forums (Smith-Merry et al., 2019). Using online evidence-based therapy or psychoeducation has also been shown to reduce negative perceptions of mental illness, so there is potentially a double beneficial effect with treatment and attitude (Griffiths et al., 2004; Kelly & Colquhoun, 2005; Taylor-Rodgers & Batterham, 2014). These factors of intensity, exposure and apparent side-lining need to inform stress support technology design and implementation for teachers. They should also inform education policy leaders' planning for whole-school mental health initiatives.

"Feeling lonely in a crowded room" was how one teacher described one symptom of their burnout, and it was poignant how symptoms such as isolation, dehydration, hunger and insomnia were frequently described alongside the assumption that it was purely down to the individual to manage causes and manifestations of stress. This individualised responsibility can place a profound burden on a teacher, as such an approach fails to acknowledge the complexity of the origins of stress (Taylor-Rodgers & Batterham, 2014). Aspirations of school leadership to raise the profile of teacher wellbeing could be harnessed through an organisational approach to addressing these common causes. Participants understood that sometimes leadership's hands are tied by external factors such as imposed student number increases and testing. However, the trust expressed in leadership is a valuable opportunity for mutual acknowledgement of the need ameliorate stress at an organisational level.

6.5.2 Some digital stress technologies can be used and could be expanded

Our second organising theme extends previous research on the use of health technology for workplace wellbeing. Smartphones (and hence real-time health apps) were rarely accessed during the working day by teachers. Amongst the 23 mental eHealth (online) at work studies reviewed by Stratton in 2017, only three utilised obviously mobile apps (Stratton et al., 2017), indicating that smartphones were used

in a small minority of studies. Just one eHealth study was conducted amongst teachers, using an online programme. No mention was made of when the programme was accessed during the day or whether it was possible to access via an app (Ebert et al., 2014). Our findings do not rule out teachers' stress management being assisted through an app, but we can for the first time infer that an app on a smartphone is unlikely to be suitable for 'just-in-time' stress relief.

Should the school promote a particular stress-relieving or prevention technology however, the participants were nearly unanimous in their willingness to give it a try. This could be in part a reflection of the high rate of participant use of wellbeing technology already in our sample (12 out of 14 participants), but it was also a clear expression of their trust in school leadership. Most participants believed that school leadership would only endorse a stress-relieving technology that could be valuable and reliable. This could reflect the fact that staff worked at schools that acknowledged staff wellbeing, or that they had chosen to work in a school where they felt valued, which engendered their trust in the leadership.

Current use of technology by teachers demonstrated the potential for combining self-management of stress and the organisational promotion of wellbeing. However, the proportion who used technology (86 per cent) cannot be extrapolated to the whole population, as they self-selected for the interview and were not a random sample. A review of the descriptions given by teachers gave insight into the mechanisms of action utilised for stress management. In a review of health technologies through an 'HCI lens', Nunes et al. described five technology mechanisms for self-care, two being individually oriented: (i) fostering reflection; and (ii) suggesting treatment. Three were communal: (iii) sharing care activity; (iv) enhancing collaboration; and (v) peer-to-peer support (Nunes et al., 2015). The study findings showed how these mechanisms of action are being used in the education workplace, and thus give valuable indicators both for potential support tools and delivering an organisational intervention.

Amongst participants, methods that fostered reflection (i) were the most widely used, both with and without technology. In fact, two participants revealed how

technology had become embedded, realising during the interview that it was their apps that aided reflection. Of the 12 participants who reported using technology to support their wellbeing, eight reported having a wearable band or watch. The real-time feedback and actionable insights of (ii) were felt to be useful and empowering, enabling positive decisions to be taken to manage stress indicators. These included undertaking a breathing exercise to reduce a raised heart rate or taking more exercise. Feedback, and thus insight, on sleep quality was mentioned by several people as provoking a change in behaviour. These examples correlate with the approach of empowerment through meaningful data, facilitating participants to make changes and in a way that also respects their autonomy (Tengland, 2012). Tengland makes the important point that empowerment can be seen as ethically preferable to behaviour change, as the latter is often concealed from the user, whereas empowerment directly informs and assists the individual, enabling better choices to be made consciously by them. Given the value placed on trust in leadership by teachers, any organisationally-directed intervention would have to have been through due diligence and be transparent.

Most teachers did not promote their wearable to colleagues, but two participants did mention enjoying comparing activity with other teachers (v). A recent systematic review of workplace studies utilising mobile health, including wearable interventions to promote physical activity, has shown reasonable evidence for eHealth in a workplace context as "a feasible, acceptable and effective tool" (Buckingham et al., 2019). My findings reveal the contextual value placed on wearables by some teachers and suggest an acceptability of this modality.

Many of the apps used facilitated immediate therapeutic access, most commonly to mindfulness, breathing or meditative tools, combining the (i) and (ii) modalities noted above. Only one teacher reported using online CBT, but some of the apps mentioned by staff used CBT principles. Staff also engaged with both mindfulness and social support (e.g. fit2teach) technologies. All three strategies aligned with the evidence for stress-reduction efficacy amongst teachers (Iancu et al., 2018) and show self-management choices that could also be of value to other senior teachers. Only the online CBT resulted from a professional referral. One participant described how using

the Teacher Tapp app, which has been designed for education research (McInerney, 2019) not only enhanced collaboration, aligning with mechanism (iv), but also made her feel more professional, providing an indirect boost to her wellbeing https://teachertapp.co.uk/. This participant also noted how forums on social media enabled peer-to-peer support. Again, this was for professional sharing, rather than direct stress management, but it still had a positive effect in terms of reducing workload.

Most tools had been adopted serendipitously, discovered through advertising, friends and family or social media, or just occasionally through peer recommendation. Both the inclination of staff and availability of technology suggest opportunities for technology-enhanced stress self-management that both reflect current strategies and could possibly work around described constraints.

6.6 Strengths and Limitations

This was a small-scale study and the participant sample cannot be claimed to be representative of all mid-career senior school teachers. As the sample was self-selecting, it is likely that there was a higher proportion of staff who had experienced crises and time out of teaching than the average population, and it is likely they were more mature teachers who were confident to talk about their experiences. Beyond confirmation of the schools' recognition of staff wellbeing, this study does not investigate the influence of the schools' organisational or leadership attitude on how teachers managed their stress. The participants knew in advance that they were going to be asked about their use of health technology; so although two did not use any health tech, the proportion who did cannot be generalised to the whole teaching population. Additionally, this study was limited by a lack of ethnic or racial diversity and most of our self-selected participants reported positively on their relationship with school leadership. A random sample might not have been so consistent. As a former clinician, my training to understand the individuals' histories, enquire about symptoms and think diagnostically could have meant a more medical bias to the questions and analysis.

All staff were interviewed during term time after at least five weeks back at school after the summer holidays. It was intentional that participants were interviewed whilst in the thick of school activity, and all very much immersed in the demands of school life. This is a strength of the study and an aspect for which I am immensely grateful to the participants. They freely gave their time, courageously talked about stressful situations, and without exception demonstrated commitment and determination. The pride in their students was tangible.

6.7 Conclusions

The purpose of this study was to elicit details of mid-career secondary school teachers' management of stress and the influences on their attempts to self-care. The findings are consistent with previous research among education and healthcare professionals on how context shapes personal stress management. Distinctively, this study enabled me to describe both cultural and physical contextual factors on teachers' ability to self-manage their stress. Factors included seemingly endless job demands with multiple interruptions, lack of privacy away from the frontline, enduring stigma of admitting stress, fear of inferiority, and stress perceived as an individual rather than organisational issue. All these constrained teachers' workplace stress management in different ways.

This study also revealed important signs or correlates of stress for teachers, including dehydration, feelings of isolation and insomnia. This research offered noteworthy and novel insight confirming that digital health interventions are being used for stress management by teachers, and how. It suggests that mobile apps have the most potential for stress support outside the workplace, whilst wearable technologies can provide easy access to data within the school setting.

These findings facilitated a deeper understanding of teachers' experiences of managing their stress. They align with the stress-management practices described in the literature in Chapter 2. They also support the literature on the demanding nature of the educator's role (Hargreaves, 1990, 2003), the relevance and importance of the organisational culture for self-care (Day & Hong, 2016; S. M. Johnson et al., 2012),

described in Chapter 3, and the potential for digitally-supported stress management in the workplace, covered in Chapter 3 and 4 (Agyapong et al., 2023; Carolan, Harris, & Cavanagh, 2017; MacLean et al., 2013; V. Mishra et al., 2020; Paganin & Simbula, 2021; Phillips et al., 2019; Sano et al., 2017; Sano & Picard, 2013; Stratton et al., 2021). Moreover, I have extended the understanding of barriers and facilitators experienced by in self-managing stress with digital support in the workplace and added some knowledge of what technologies are being used by teachers to support their wellbeing.

Overall there was also a willingness to try technology support and a sense that school leadership would be supportive. This study generated useful insight on strategies and influences to inform the next analytical study. At the time of planning Study One, I had considered using the findings to create an online survey to use with a larger cohort of teachers. However, reflecting on the findings in the light of the research questions that remained, I decided that undertaking a study to enable teachers to make an informed choice of DC would be more appropriate. A new ethics application was made to reflect this change and is contained in Appendix B. I was also mindful of previous work covered in Chapter 4, indicating that technologies should be relevant and aligned to the user's characteristics, tailored to the context of use and explicit about confidentiality. The next chapter presents an analytical study that describes how I built on Study One to select candidate tecnolgiess, and then facilitated teachers' choice of these 'Digital Companions' through workshops ahead of the longitudinal Study Three.

Chapter 7 Study Two: Contextually appropriate selection of Digital Companion Technologies

''A good taxonomy is not perfect.'' NASA 2003

Parts of this chapter have been published in JMIR Formative Research 2022 (Manning et al., 2022)

7.1 Introduction

Study One's findings revealed teachers had experience of and a willingness to try technology for stress management support, and a sense that school leadership would be sympathetic toward digital self-support. The plurality of strategies, features and techniques found in that study prompted the decision to allow teachers a choice of consumer technology for the planned longitudinal study. This was for the following reasons:

A. a choice of technology would allow teachers to align their pre-existing stress management strategy with digital support techniques;

B. enabling a meaningful choice would recognise the importance of self-determination with its relevance for motivation and wellbeing (Calvo & Peters, 2014; Peters, Calvo, et al., 2018; R. M. Ryan & Deci, 2000);

C. the digital tool could be chosen according to the strategy, not based on the design intention of the technology. This reflected the use of the Teacher Tapp and Fit2Teach Apps identified in Study One as educational and social support strategies for stress management despite their marketing not specifying stress reduction as a target of use.

D. it would add to the small body of research on teachers' use of consumer technology for stress management (Kocielnik & Sidorova, 2015; Runge et al., 2020);

E. given the widespread availability of commercial tools (Epstein et al., 2020) it made sense to study their real-world use and generate design insights (Peake et al., 2018; Schueller et al., 2021);

F. commercial tools are already being studied to investigate their support stress management (Gjoreski et al., 2017; Pakhomov et al., 2020; Sano & Picard, 2013) and they represent potential low-cost, scalable solutions for prevention and early intervention for stress both in the workplace and for chronic condition management (Goodday & Friend, 2019).

This choice required facilitation through the undertaking of an analytical study that would enable an informed selection to be made. This chapter reports on how candidate technologies for supporting teachers' stress-management were chosen and presented to teachers in a workshop to enable informed choice.

7.2 Motivation

Maintaining trust and integrity were the guiding principles for identifying appropriate technology choices to support emotional wellbeing and stress. This was crucial for the following reasons:

1. teachers in Study One stated their willingness to try digital means to support their stress management if due diligence had been undertaken on the proposed technology (Chapter 6, section 6.4.3.1). This reflects the views of health professionals when questioned about DHI engagement (O'Connor et al., 2016);

2. the psychosocial perception of safety is a crucial determinant of job stress related outcomes (Law et al., 2011), and interventions should avoid introducing risk of uncertainty;

3. stress remains a taboo subject in education (Butler, 2007; Ferguson et al., 2017) also confirmed in Study One (Chapter 6, section 6.4.2.2);

4. during this study the NHS COVID-19 tracking app was causing controversy, later being exposed as premature and insecure (Veale, 2020), thus there was an imperative to assure participants of the integrity of the technology being recommended;

5. whilst some teachers in Study One were already using personally selected technology, anecdotal approval was not considered a sufficient basis for recommending technologies to teachers in an empirical study.

Although public evaluation frameworks and ratings exist, they do not facilitate technology choice based on contextual or individual information, such as occupation or personal management strategies. In Chapter 3, contexts were framed as macro, meso and micro (Figure 3.2). The macro (workplace sector) and meso contexts (e.g. social and work practices) are known to influence use and usability of health technology (Blandford et al., 2015; Fitzpatrick, 2011; O'Kane, 2016; Yardley et al., 2015) including in schools (Oliveira et al., 2022).

In this chapter, a four-step study design is described to establish a process of creating a context-based taxonomy to support systematic choice of DCs for teachers' stress self-management. The macro context is school education, and Figure 7.1 shows how these steps fitted into the overall study. In step one, the dimension of stress self-management and strategic classifications was identified. In step two, the dimension of digital techniques and conceptual descriptions were established. In step three, six criteria for the inclusion of DCs were created. In step four, the taxonomy framework created by steps one and two was used and populated with DCs for stress self-management, as identified in step three.
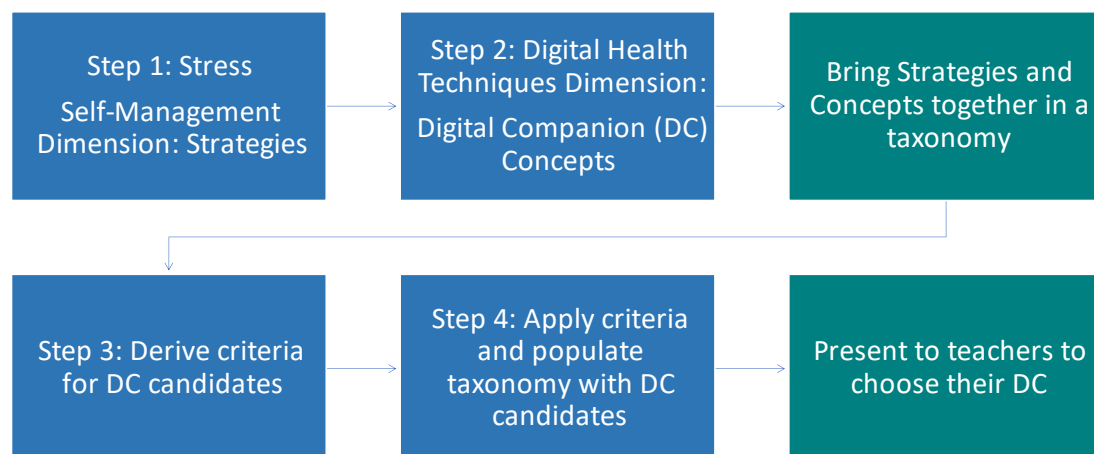
FIGURE 7.1 STUDY DESIGN PROCESS SUMMARY

7.3 Related work

Prior work and evidence that fed into the choice of dimensions, classification and selection are now briefly recapped. This includes research into teachers' stress self-management and previous frameworks and taxonomies on design and selection of technologies.

7.3.1 Teachers' self-management of stress

Recapping the evidence reviewed in Chapter 2, benefits have been shown for teachers from stress awareness education (Unterbrink et al., 2012) and physiological interventions, including adapted mindfulness and relaxation training (Flook et al., 2013; Kaspereen, 2012) and exercise (Austin et al., 2005). Psychological intervention evidence includes programmes based on Cognitive Behavioural Therapy (CBT) (Jeffcoat & Hayes, 2012; S. S. K. Leung, Chiang, Chui, Mak, et al., 2011) and mindfulness embedded in psychoeducation with social support, adapted for teachers (Reiser et al., 2016). Reflective supervision and consultation (Susman-Stillman et al., 2020) and environmental adjustment or social support (Unterbrink et al., 2012) can also help.

Interventions that were self-managed demonstrated positive small to large size effects for stress or burnout symptom reduction, including positive psychology through gratitude journaling (D. W. Chan, 2011) and CBT-based education through bibliotherapy (Jeffcoat & Hayes, 2012).

7.3.2 Digital technolgies for teachers' stress management

Summarising the evidence from Chapters 3 and 4, iCBT seems to be the most studied intervention, utilising websites for delivery. Internet-based Problem-Solving Therapy (iPST), a form of CBT, achieved sustained reduction in perceived stress (Ebert, Lehr, Boß, et al., 2014); unguided online CBT with psychoeducation, in part to reduce stress amongst mostly female teachers, significantly improved sleep (Thiart et al., 2015); and self-administered online CBT-based intervention showed a large effect on reduction in perceived stress (Persson Asplund et al., 2018). Two more recent tailored interventions produced short-term small to medium positive effects with third-wave CBT (Ansley et al., 2021), another delivering online social-emotional competence training decreased occupational stress, although half of the training was via group sessions on zoom (Oliveira et al., 2022). Among other interventions, an online forum delivering social support was well received (S. S. K. Leung, Chiang, Chui, Lee, et al., 2011) and an app supporting third-wave CBT amongst school principals helped increase their awareness of managing workplace stressors (Klap, 2020). Studies enabling teachers' reflection on personal data with wearables are sparse, but they have demonstrated value from data-derived insight into stressors (Kocielnik & Sidorova, 2015; Runge et al., 2020).

7.3.3 Taxonomy creation and digital technology selection

Two approaches were identified in the literature relevant to the goal of creating and populating a taxonomy. One is the evolution of designer and researcher-focused frameworks, seeking to improve efficacy and evidence. The other is more focused on clinician and consumer adoption.

7.3.3.1 Designer and researcher frameworks

Frameworks focused on developing and evaluating technologies have led to better formalising, detailing and defining of DC design. Fogg's persuasive design principles (Fogg, 2003), expanded further by Oinas-Kukkonen (Oinas-Kukkonen, 2013; Oinas-Kukkonen & Harjumaa, 2009) and complemented by Ritterband's design model (Ritterband et al., 2009), all informed the development of Mohr's Behaviour Intervention Technologies (BIT) model for developers (Mohr et al., 2014). This model, along with other theory-based (Abraham & Michie, 2008; Y. Wang et al., 2019) and empirically-based (Stoyanov et al., 2015; Yardley et al., 2015) taxonomies and frameworks have sought to enable both better conceptual design and easier evaluation of DCs. Stoyanov's Mobile App Rating Scale (MARS) for designers has been used extensively in the scientific community and has led to a consumer assessment version, uMARS (Stoyanov et al., 2016). These models informed consideration of the digital techniques dimension of the planned taxonomy.

7.3.3.2 Clinician and individual frameworks

Both the MARS and uMARS scales have been used for evaluating apps, with the latter using less technical language for patients to feed back on the engagement, functionality, aesthetics, information and subjective appreciation of quality and impact. The uMARS scale allows classic HCI features and elements to be evaluated to assist design iteration, but it was not created to inform final user adoption. Three notable expert review evaluation frameworks (EREF) have been created for users. The Organisation for Review of Care and Health Applications (https://orchahealth.com) model is designed to inform adoption of digital health technologies, primarily apps but has some online interventions too. Search is by health condition or DC name. An assessment of data privacy, user experience (UX) and clinical assurance are each given a score (Leigh et al., 2017).

The two other EREFs are focused on psychological health: Mindtools (https://mindtools.io) and Psyberguide (https://onemindpsyberguide.org) websites. Psyberguide is a public-facing website enabling search based on condition or

treatment approach. Its position is that the user understands what concepts or treatment they want to choose (e.g. tracking or social support) and the focus is on apps. Both websites publish assessment scores on credibility, UX and transparency, though Mindtools has not been recently updated. Psyberguide drew on the MARS framework incorporating additional privacy and security considerations.

The main difference between these scales and frameworks and my own intended approach was the starting point. My own goal was to enable DC selection to be framed by someone's occupation, condition and self-management behaviour. For this, a taxonomy derived for teachers and stress was required from which they could identify their self-management strategy and supportive technology concept, then identify a DC that aligned with these to trial in the planned longitudinal study. To reach this goal required: (i) selecting a dimension within which to classify stress self-management; (ii) selecting a dimension within which to classify digital techniques that could support these strategies; and (iii) the creation of a rationale for DC inclusion and selection of credible candidates. This final goal is illustrated in Figure 7.2: a populated taxonomy. This paper describes why the dimensions of self-management strategies and digital companion concepts were chosen, how they were categorised and then the approach to identifying potential candidates.

TEACHERS' DIGITAL STRESS COMPANION CHOICES

Stress Self-Management Strategies ⇒ Digital Companion Concepts ⇓	Educational e.g. knowledge and awareness	Physiological e.g. relaxation, exercise, reminder	Cognitive e.g. problem solving, time management	Social e.g. seeking social support or social skill development
Fostering Reflection via Information: Health or Context	💻 Stress Management at Work 📱 Fit2 Teach** TeacherTapp	⌚ Withings Steel SR	📱 Daylio Fit2Teach PRO**	⌚ Withings Steel SR 📱 TeacherTapp
Suggesting Treatment and Guided Self-Management	📱 Equoo	📱 Headspace* Calm* 📱 Sleepio	📱💻 SilverCloud 💬 Wysa 💻 Big White Wall	💻 Big White Wall
Peer-to-Peer Social Support	📱 Fit2Teach PRO**	⌚ Withings Steel SR 📱 Sleepio	📱 Fit2Teach PRO** 💻 Big White Wall	📱 Fit2Teach**
Utilising Entertainment	📱 Equoo	🎮 Nintendo/PS4 etc***	📱💻 SilverCloud	📱 Equoo

*Only partial encryption of data **Withdrawn due to lack of updates ***User to provide own device

FIGURE 7.2 POPULATED TAXONOMY WITH DIGITAL COMPANIONS FOR TEACHERS' STRESS SELF-MANAGEMENT

7.4 Methodology

7.4.1 Stress Management Dimension

To choose categories for the stress self-management dimension, descriptions were extracted from the qualitative data on the experiences of 14 senior teachers interviewed in Study One. Participants had provided over 70 accounts of how they managed their stress, including technology used, as shown in Table 6.1. These descriptions were complemented by evidence from systematic reviews of occupational stress interventions (E. de Korte et al., 2018; Naghieh et al., 2015; von der Embse et al., 2019). These interventions informed the 'PICO' literature search criteria: Patient and Problem (i.e. teacher and stress), Intervention (e.g. information, tracking, exercise or mindfulness), Comparison (often none), Outcome (e.g. identifying, support, management, reduction). The literature reviews combined critical and scoping reviews with a narrative synthesis (Grant & Booth, 2009), snowballing to identify potential candidate articles (Wohlin, 2014) with literature analytically and conceptually reinterpreted, as described in previous health and digital engagement reviews (Debono et al., 2013; Grant & Booth, 2009; Short et al., 2018). Academic databases, including PsychINFO, Google Scholar, Cochrane and PubMed and literature relevant to teachers' self-management of stress was reviewed until repetition of themes revealed no further insight.

7.4.2 Digital Health Techniques Dimension

For the health techniques dimension, the literature on persuasive design was reviewed together with digital health taxonomies and trends in digital health self-care, again using the snowballing method as described above. Drawing on the different but complementary cultures of HCI and health, definitions of lifecycles, evaluation and implementation inevitably differed somewhat (Blandford et al., 2018). My interest was in producing conceptual descriptions of mechanisms of action that could support the methods of stress management already identified in the

literature and those given by teachers in interviews. These concepts would necessarily comprise elements of design, behaviour and theory, and draw on the evidenced deployment of a DC for health self-management. The aim was to create a conceptual description of the prevalent overarching technique or action of the DC that could be understood without ambiguity or complexity by the end user.

This approach was chosen for several reasons, including: (i) many DCs use multiple techniques and the aim was to facilitate choice by the primary featured enabled action, and (ii) other systematic reviews or assessments of self-management apps had overlooked or found a paucity in the description of behaviour change theory (BCT) techniques (E. de Korte et al., 2018; Whitehead & Seaton, 2016). At the time, this would have made categorisation of DCs by BCT theory harder to achieve though a more recent review has identified the most common BCT strategies deployed in stress-management apps (Alhasani et al., 2022).

7.4.3 Technology selection

To identify candidate DCs, the following steps were taken to inform decisions.

a) Suitability: digital interventions utilised by teachers as described in Study One were the starting point, followed by a review of the literature for other candidates.

b) Availability: accessibility of the technology was reviewed on the two main mobile operating systems and for updates within the last six months.

c) Evaluation: positive rankings for the technology on one of three expert review evaluation framework (EREF) websites for apps and online tools (Orcha.co.uk and Mindtools.io) or apps only (Psyberguide.org) for credibility and evidence base, and UX.

d) Security: privacy and security policies were assessed as to whether the technology used encryption of data connection and in storage (where relevant).

e) Validity: significant, positive clinical trial (published) results were searched, and

f) Cost: given that the commercial model for apps that are 'free' meaning very limited access or a trade in personal data were to be avoided, a bar of a one-off £50 annual fee for smartphone and website apps, and £150 for the wearable, was set.

7.5 Taxonomy creation

7.5.1 Overview

The process of reviewing literature for the creation of the stress management and digital technique dimensions revealed different approaches to classification. Presented below are the findings and rationale that guided decisions on the use of classification strategies and concepts, and then the procedure to enable technology selection. The steps are summarised in Table 7.1.

	Step	Rationale
1	Identify or acquire qualitative data on occupation's needs and approaches to condition management.	Starting with the strategies that people in this occupation have already adopted for their condition management, how, why and when, as well as 'why not', captures invaluable lived experience.
2	Conceptualise condition self-management strategies from qualitative and literature data	Using existing studies, identify the strategies used by individuals to self-manage their condition to capture relevant approaches.

		Existing data may reveal strategies that align with the strategies listed in this paper and (or) they could be used as a starting point for categorisation.
3	Review evidence of occupation's current use of digital tools for condition self-management from in-the-wild studies and literature, or simply use generalised information on digital interventions for condition self-management if occupational context scarce.	Finding studies on existing use of DCs can provide insight into contextual suitability or offer usability insights.
4	Derive and agree relevant Digital Companion Concepts for systematic, broad categorisation.	Beginning either with primary sources or with the DC concepts identified in this paper, consider how or whether mechanisms of action are captured and how to describe them meaningfully.

TABLE 7.1 STEPS FOR CONTEXT-BASED TAXONOMY CREATION

7.5.2 Stress self-management dimension

7.5.2.1 Overview

Three main approaches to the categorisation of interventions specifically for the support or management of stress experienced by teachers were identified. It is worth emphasising that the value and goal of this conceptual categorisation for the taxonomy was in identifying a practical, actionable strategy for the individual (Peters, Calvo, et al., 2018). The classification approaches found were a) the level targeted by the intervention, b) the target of intervention or c) the intervention strategy. Descriptions follow for each of these, together with explanations as to why the intervention strategy (c) was considered to have the most relevance and explanatory power for the stress dimension.

7.5.2.2 Level of intervention

Organisational, individual-organisational or individual-level interventions have been frequently described (Brunton et al., 2016; DeFrank & Cooper, 1987; Greenberg et

al., 2016; Montano et al., 2014; Naghieh et al., 2015), with an additional level of a classroom-focused approach being noted more recently (Ouellette et al., 2017). The level of the intervention appears to be a way of describing the agent or group responsible for the stress management strategy. For example, the school leadership team or Multi-Academy Trust directors would be at the organisational level. As the focus of this study is on self-management, this categorisation would not provide a practical framework for teachers' own stress management.

7.5.2.3 Target of intervention

The primary targets of interventions are the stressors themselves, which could be aspects of the work environment, such as maintaining discipline or time pressures and workload (Camacho et al., 2018). The corresponding stress reduction strategies would then seek to reduce the occurrence of occupational stressors amongst employees, such as workload reduction. This primary preventative approach for individuals should be the priority and a normal part of organisational management, as has long been argued in the healthcare sector (Bergerman et al., 2009; Firth-Cozens, 2003). Whilst many targets are well-described in the teaching literature they are beyond the control of the individual.

The secondary targets are the perceptions or responses of the person to the stressor itself, where interventions are preventative or reactive. By targeting the way someone manages or copes with stress, the aim is to modify in a positive way the individual's response rather than remove the stressor itself. This can include, for example, peer-support groups or cognitive behavioural techniques.

The tertiary targets of intervention are stress symptoms themselves, such as anxiety, insomnia or racing heart rate, where the intervention is reactive. The aim of targeting symptoms is to manage or treat the emotional, cognitive, behavioural or physical changes brought about by stress. Whilst identifying secondary and tertiary targets enables a better understanding of stress, they do not indicate a set of potential self-management choices. For instance, if a teacher becomes aware that their response to stress is a behavioural habit (both a response and a symptom), such as to start

pacing the floor, this knowledge does not provide any signposting to what action an individual can then take to combat the stress. Additionally, stress symptoms are not always obvious to the individual, such as nervous tics or fatigue.

Levels and targets of interventions were used in a prior categorisation of occupational stress management from general employee work (Bhui et al., 2012; Dewe et al., 2010), but in consideration of my study's conceptual framework, they do not always facilitate individual identification of action that could be taken to self-manage stress.

7.5.2.4 Intervention Strategies

The third approach identified was stress management strategies or training approaches (Brown & Uehara, 1999; Cartwright & Whatmore, 2005; Iancu et al., 2018; Lundberg & Cooper, 2011). Five overarching, non-mutually exclusive categories that could be supported digitally were identified: (1) educational, (2) physiological, (3) situational, (4) cognitive, and (5) social.

Previously in occupational health literature, strategies had been described as follows: (a) stress awareness and education, (b) relaxation techniques, (c) cognitive coping, (d) biofeedback, (e) meditation, (f) exercise, (g) lifestyle advice, and (h) interpersonal skills training (Lundberg & Cooper, 2011, p. 105). Several of these could be grouped together along with more detailed activities simply listed as exemplars. Thus, education, awareness, and lifestyle advice were grouped under education; biofeedback, relaxation, meditation, breathing, aerobic activity, or mindfulness were grouped under physiological; and cognitive coping strategies, such as controlling emotions, problem solving, or time management, were grouped under cognitive.

Social support was mentioned but was not listed by Lundberg and Cooper as a category. This goes beyond interpersonal skills training, embracing socialising and the therapeutic value of peer support (Stanford, 2001), and self-enhancing humour (Ho, 2017). This has a social element, which along with descriptions of social support described in teachers' stress management research (Iancu et al., 2018; Reiser et al., 2016; Unterbrink et al., 2012) required a fifth strategic category, which was added in.

Stress Management Strategies

	Educational	Physiological	Situational	Cognitive	Social
Strategy	Knowledge and awareness of stress	Relaxation, exercise	Altering environment	Problem solving, time management	Seeking social support or social skill development
Examples	Reading Teaching websites or literature	Walking Yoga Breathing Mindfulness	Change job or school	Keeping a diary or lists CBT Talking to yourself	Social media or online professional or friendship groups Training

FIGURE 7.3 – FIVE POTENTIAL STRESS MANAGEMENT INTERVENTION STRATEGIES

Variation in the literature was noted in the meaning of mindfulness amongst educators. It could mean the application of the established eight-week 'mindfulness-based stress reduction' (MBSR) programme (Gold et al., 2010; Kabat-Zinn, 2006), or the incorporation of MBSR as part of a stress reduction programme (Reiser et al., 2016), third wave CBT (Hayes, 2004) or simply a meditative component of a multi-strategic stress reduction study (Siu et al., 2014). Whereas other authors have used mindfulness-based interventions for categorisation, for example von der Embse (2019), the ambiguity in use of the term meant a decision was made against using it as a category for strategy. Figure 7.3 depicts the five strategies and examples of each.

The situational adjustment strategy (altering the physical work environment) was removed as it was not deemed to be supported digitally. The decision was made to identify discrete strategies both for the reasons given above and because as individual approaches they had explanatory power, were symptom agnostic and would allow alignment with the digital technique dimension more easily. This decision is reflected on further in the concluding chapter, section 10.2.2.

7.5.3 Digital Technique dimension

The aim here was to create a concise choice architecture that would be meaningful for potential users. Condition-specific intervention reviews demonstrate varying approaches to the classification of technologies. Suijkerbujik et al categorised dementia interventions by purpose focused outcomes, such as support in daily life, safety, meaningful activities or communication (Suijkerbuijk et al., 2019). Singh et al categorised HIV apps and websites by functionality, such as prevention, testing and management (Singh et al., 2017). Having already identified the strategy choices, this study required a categorisation of digital techniques or concept that would explain how the DC would support the strategy.

Reviews of digital workplace interventions for stress are often combined with depression and anxiety, and tend to focus on the type of intervention, such as CBT or mindfulness (Carolan, Harris, & Cavanagh, 2017; Phillips et al., 2019; Stratton et al., 2017) not the technology enabled feature or technique. Details of the mechanism of action, persuasive techniques or concepts used by interventions are only occasionally mentioned in these studies (Carolan, Harris, & Cavanagh, 2017) and are often inadequate in stress management apps (Ptakauskaite et al., 2018). Reviews of wearables for stress in real-world or workplace setting are scarce. Techniques used in wearables have been identified in those worn for physical activity (Cheng Chia et al., 2019; Mercer et al., 2016), and another review identified the most deployed stress sensor type (Hickey et al., 2021) but more helpful were the motivational affordances described by Orji and Moffatt (Orji & Moffatt, 2018). A high-level reconciliation was made between the reviews mentioned and more condensed descriptions used by authors describing digitally supported self-care. This is described in the next section.

7.5.3.1 Describing the digital companion concepts

Nunes et al's focus on self-care opportunities and experiences for patients with long-term conditions (Nunes et al., 2015) essentially conceptualised the 'action-enabled design feature', which was similar to descriptions given by Klasnja to 'life-companion'

apps on mobiles (Klasnja & Pratt, 2012, 2014). Klasnja and Pratt also gave examples of where each concept had harnessed specific phone features (Klasnja & Pratt, 2012). Therefore, I reviewed these descriptions against each other to compare technique concepts. They were then cross-checked with the descriptions given by Orji and Chia to arrive at five comprehensive conceptual themes which are now described below as digital companion concepts and summarised in Figure 7.4.

- o Fostering reflection by making health and contextual information available

Both Klasjna and Nunes described the ability to track health data first and Nunes' definition of "fostering reflection by making health and contextual information available" was retained. This data-enabled reflection on stress has been found to be valued amongst IT workers (K. Lee et al., 2020; Lentferink et al., 2018) and is a frequent mechanism facilitate by stress apps (Ptakauskaite et al., 2018).

- Suggesting care activities or treatment adjustments and guided self-management

Nunes' second description of "suggesting care activities or treatment adjustments" went beyond the mere "increasing accessibility" of health information described by Klasjna, to actual adjustments that an individual can make. However, this category needed to also more explicitly include delivering guided self-management, described in the literature on stress, such as directed breathing or a CBT programme. Hence the second category was adapted to "suggesting care activities or treatment adjustments and guided self-management".

- o Peer-to-peer social support

Nunes specifically describes this trend as "sharing self-care activities and learning from others with the same chronic condition". The limitation of this for the planned taxonomy was the medical emphasis but including the significance of peer relationships was desired. Klasnja talked about "leveraging social influence", capturing the social-sharing concept, building on Oinas-Kukkonen's social support

principles (Oinas-Kukkonen & Harjumaa, 2009), so this category was re-defined as 'peer-to-peer social support'.

    o   Utilising entertainment

Klasnja also described utilising entertainment. This went beyond the gamification techniques recognised by Nunes, which can be used in the technology design of any of his categories. Taking part in a purely fun, tech-enabled activity not intentionally designed for symptom management has been shown to reduce stress symptoms (Babbage et al., 2018).

    o   Involving the healthcare team

Nunes gave a strong emphasis to the patient (not medical) perspective, but two (of his five) categories still recognised the shared-care dynamic between patients and their formal and informal carers. Klasnja and Pratt recognised this shared approach but described it under a single form of intervention (involving healthcare team) and this was considered an adequate description for our purposes (Klasnja & Pratt, 2012).

Digital Companion Techniques

	Fostering reflection via information–Health or Context	Suggesting treatment adjustments or activities, and guided self-management	Wellbeing Support Involving healthcare team	Peer-to-peer social support	Utilising entertainment
Examples	Diary App Step Tracking App or Wearable	Mindfulness App Guided Breathing App	iCBT Online	Fit2Teach Wearable network	PS4 Gamified learning

FIGURE 7.4 FIVE NON-EXCLUSIVE DIGITAL COMPANION TECHNIQUE CONCEPTS

However for the planned taxonomy, the concept of involving the healthcare team was not required due to the focus on self-management. Therefore, the four digital

companion concepts with the four stress self-management strategies were brought together into a matrix to create a taxonomy that could then serve as the framework for digital companion selection. As a stand-alone taxonomy, this framework provides a structure for any educator seeking to choose a tool to support stress management. Figure 7.5 depicts the taxonomy.

Stress Self-Management Strategies ➡ Digital Companion Concepts ⬇	Educational e.g. knowledge and awareness	Physiological e.g. relaxation, exercise, reminder	Cognitive e.g. problem solving, time management	Social e.g. seeking social support or social skill development
Fostering Reflection via Information - Health or Context				
Suggesting Treatment and Guided Self-Management				
Peer-to-Peer Social Support				
Utilising Entertainment				

DIGITAL STRESS SUPPORT TAXONOMY MATRIX

FIGURE 7.5 TAXONOMY MATRIX FOR STRESS SELF-MANAGEMENT

7.6 Taxonomy Population

To populate the taxonomy the technology selection steps were applied. This selection process was important for ensuring trustworthy DC candidates from which teachers in a subsequent study could make an informed choice. The process is summarised in Table 7.2.

The starting point was suitability and availability, based on the findings of Study One (Chapter 6), exploring teachers' familiarity and use of digital tools for stress management. This reflected insight into the influence of context on use and design, as described in usability study methodologies (Yen & Bakken, 2012), and the person-based approach (Yardley et al., 2015). Where that did not provide a candidate, the

literature, NHS App Library (now withdrawn), and Carlo's behavioural health app review (Carlo et al., 2019) and the scientific literature were reviewed. Of the 12 apps originally named by teachers, eight were available on both iOS and Android platforms (Teacher Tapp, Fit2Teach, Headspace, Mindshift, Pacifica (now called Sanvello), Calm, Insight Timer and Happy not Perfect), but one of these (Fit2Teach) had not been updated for over two years. Given that it was uniquely tailored in its approach, and that the associated Facebook group had recently been updated, the developer was contacted but unfortunately there was no response. Neither Fit2Teach or Teacher Tapp had been designed for stress, but both offer education tips and insight, and the opportunity for reflection.

The two apps that used diarising as their prevalent tracking strategy (My Wonderful Days and Now Then Free), were not available on both platforms and another two app descriptions were not complete enough for certain identification. The online Cognitive Behavioural Therapy programme that had been described by one teacher was only available in one English county. The wearables being used by teachers were Fitbit models (Charge, Alta, Blaze), Samsung Gear 2, Polar M340 and Apple Watch. No other candidate technologies were identified from the literature on teachers' stress.

Available DCs were searched for within the positive expert review evaluation frameworks (EREFs), but due to disparities observed between EREF assessments (Carlo et al., 2019) and the concern with privacy and safety, all the security and privacy policies were read through. This was also important for all wearables as none of them are covered in the EREFs. Occasionally, security through encryption was still not evident from the published policy and in these cases the developer was emailed for further information.

	Technology Selection Steps	Rationale
a)	Suitability: Apply the DC concepts to categorise digital interventions utilised by teachers as described in a previous qualitative study	Uses qualitative data to allow occupational physical or environmental and psychosocial contexts to be a starting point.
b)	Availability: Verify whether the technology is accessible on the two main mobile operating systems and had been updated within the last six months	Ensures the technology is available to a wider audience and supported by the developers
c)	Evaluation: Search one of three expert review evaluation frameworks (EREF) to see if the technology is ranked positively	Gives professional or third-party view on the credibility, evidence base and UX
d)	Security: Review the privacy & security policy	Shows whether the data is stored and transmitted securely with encryption
e)	Validity: Search for research papers on the technology	Enables any trials with the technology to be considered
f)	Cost: Assess cost	Considers whether the technology is in budget

TABLE 7.2 SUMMARY OF TAXONOMY POPULATION PROCESS

Many DCs have not been tested through trials, so the step of validity (e) was not necessarily a reason to exclude them, especially wearables where evidence data are sparse. Conversely, some popular apps that did not satisfy the safety inclusion criterion (d) had significant published evidence of their efficacy. For these, this scientific evidence was presented as a reason for inclusion despite no or only partial encryption, with clear warning of the privacy risks. Finally, cost was considered.

The final selection of DCs for presentation to teachers comprised four apps named by teachers in the previous study (Headspace, Calm, TeacherTapp, Fit2Teach) and four alternative apps, three sourced from one or more of the EREFs (Equoo, Sleepio,

Daylio) and one app from the scientific literature (Wysa, an AI chatbot). For websites, one was sourced from an EREF (Big White Wall, now Togetherall Ltd), one from the NHS (Stress Management at Work) and one from the scientific literature (SliverCloud). For wearables, one was identified from the scientific literature using medical grade data assurance (Withings Steel HR watch).

The stress self-management strategies, digital companion concepts and selected apps were brought together in the taxonomy matrix shown in the introduction (Fig 7.2) and reproduced here in Figure 7.6. The asterisks are related to a) the security issue (incomplete encryption), b) the DC being withdrawn and c) the requirement to bring your own device.

TEACHERS' DIGITAL STRESS COMPANION CHOICES

Stress Self-Management Strategies ➡ Digital Companion Concepts ⬇	Educational e.g. knowledge and awareness	Physiological e.g. relaxation, exercise, reminder	Cognitive e.g. problem solving, time management	Social e.g. seeking social support or social skill development
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Suggesting Treatment and Guided Self-Management	📱 Equoo	📱 Headspace* Calm* 📱 Sleepio	📱🖥 SilverCloud 💬 Wysa 🖥 Big White Wall	🖥 Big White Wall
Peer-to-Peer Social Support	📱 Fit2Teach PRO**	⌚ Withings Steel SR 📱 Sleepio	Fit2Teach PRO** 🖥 Big White Wall	📱 Fit2Teach**
Utilising Entertainment	📱 Equoo	🎮 Nintendo/PS4 etc***	📱🖥 SilverCloud	📱 Equoo

*Only partial encryption of data **Withdrawn due to lack of updates ***User to provide own device

FIGURE 7.6 POPULATED TAXONOMY WITH DIGITAL COMPANIONS FOR TEACHERS' STRESS SELF-MANAGEMENT

7.7 Workshops

As explained in the methodology, Chapter 5 section 5.6.2, the workshops were designed to help teachers to make an informed choice of DC-based on understanding their personal stress-management strategy and technology preferences. Having been originally designed to be held in person, they were moved online, utilising Zoom,

PowerPoint and Mentimeter, due to COVID pandemic restrictions. Figure 7.7 shows the set-up for workshop delivery from the author's home and the first slide of the presentation, showing the combined aims.

Three teachers attended the first workshop, two the second and three the third. As planned, two people ran the workshops, a teacher (the researcher's husband) and the researcher. The researcher (the thesis author) ran the workshop following the workshop script. The researcher's husband had taken part in the second pilot and was an experienced Assistant Head with responsibility for teacher wellbeing at a school not involved in the study. He was present to provide any requested contextual support to the participants on the sensitive issue of stress, and to keep the researcher to time.

During the first workshop, the researcher realised that more questions needed to be prepared to stimulate discussion between the participants. Asking for 'comments' was not stimulating enough. Although the presentation was designed to be didactic, when questions were posed there was little response, particularly if they could be answered with nods or shakes of the head! This could also have been because the online format was a novel virtual setting, or lack of face-to-face stimulation of conversation or reticence where the teachers did not know each other. Also, the number of participants in each workshop was fewer than had been originally anticipated, reducing opportunity for interaction. Therefore, more questions were asked in the second half of the first workshop and the subsequent two workshops. Table 7.3 summarises the workshop's agenda and structure and the complete presentation made to teachers is included in Appendix K.

Aims -
As a senior teacher in a busy Academy school:

Space for you to think about how you manage your stress (SMS)

Place for you to think about Digital Tools that you use - including to support stress management

Time for you to be introduced to other Digital Tools and make a choice of what you could use for the next study
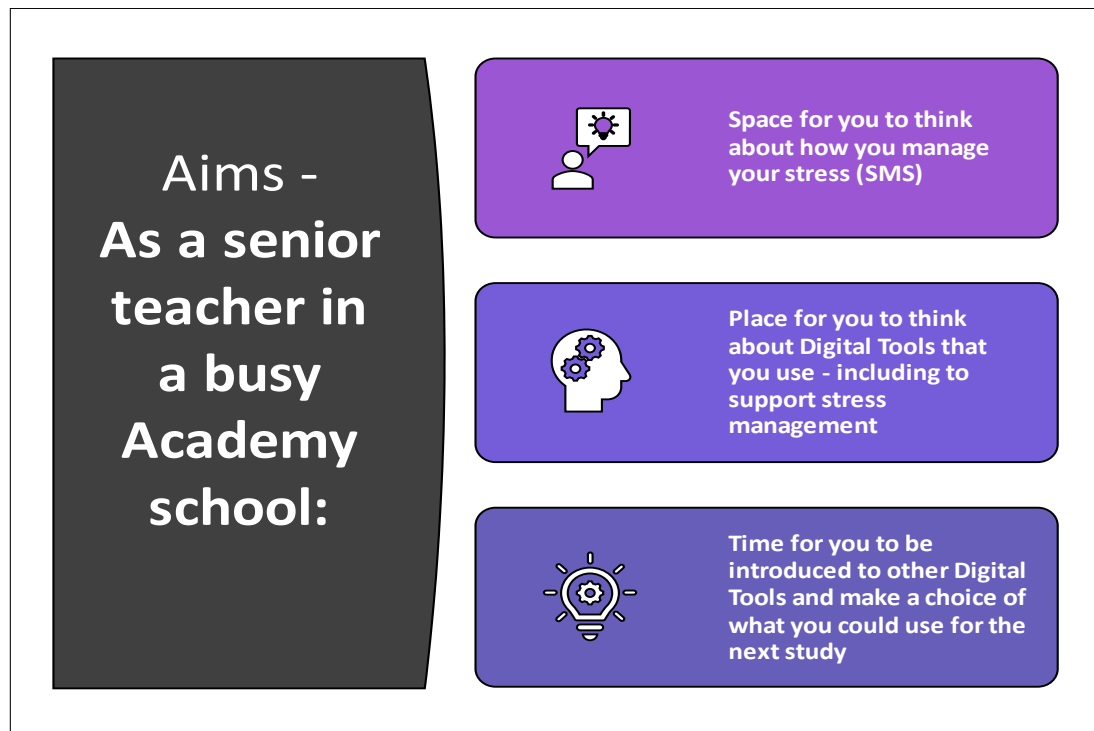
FIGURE 7.7 DELIVERING THE WORKSHOP AND AIMS SHARED WITH TEACHERS

The use of Mentimeter allowed teachers to anonymously share their stress management strategies and what technology they currently used in a way that they could all see in real-time. The participants could make multiple entries of ideas. These data were used purely for illustrative purposes and to stimulate thinking, not

used in the analysis. Examples of responses and the two questions posed are shown in Figures 7.8 and 7.9.

Data were gathered both through feedback forms (as shown in Appendix C) and from the workshop recordings. Transcripts were made of the latter, but the data were mainly reflections on understanding, acknowledgement of stress and contextual information relating to COVID-19 changes. The feedback forms allowed teachers to record their choice of DC and reasons for this, along with when and where they anticipated using it. Participants were reminded only to submit their feedback form if they wished to proceed. All participants did return their forms.

Workshop Summary Agenda		
Item (timings)	Purpose	Outcomes, extra tools used (Zoom and PowerPoint used throughout)
Introductions & Background (15 mins)	Meeting each other virtually, overview of purpose and process	Confidence and reassurance of procedures and confidentiality
Session One – stress management (40 mins)	For you to think about how you manage your stress	Understanding of different stress management strategies and categorisation Mentimeter for brainstorming ideas anonymously
Session One – digital tools used to support stress management	For you to think about Digital Tools that you use to support stress management (not	Understanding of different technology techniques and categorisation

	necessarily designed stress)	Mentimeter for brainstorming ideas anonymously
Short Break (5 mins)		
Session Two – recap and rationale for tech choices (45 mins)	For you to understand how tech candidates were selected	Participant confidence in how DCs have been selected
Session Two – presentation of tech choices	For you to be introduced to different digital tools	To make a choice of potential DC to use in forthcoming practical study
Research next steps (10 mins)	Explanation of Longitudinal 'practical' study	Understanding of Study demands and how DC will be supplied

TABLE 7.3 SUMMARY OF WORKSHOP STRUCTURE

FIGURE 7.8 RESPONSES FROM ONE WORKSHOP TO QUESTION ON STRESS MANAGEMENT

The feedback form also captured some demographic data and contextual feedback, largely related to changes brought about by the pandemic. These data along with the comments from the workshop allowed for some tailoring of the semi-structured interviews according to DC choice as well as the altered teaching arrangements due to COVID-19. Data also informed the contextual information contained in each case study created (as described in Chapter 5 section 5.7.3).

FIGURE 7.9 RESPONSES FROM ONE WORKSHOP TO QUESTION ON TECHNOLOGY USE

After receiving the feedback form, the researcher contacted the participant to arrange (i) for a flat participation fee of £150 to be paid to them to cover the costs of them obtaining the DC, and (ii) schedule the time of their first interview. The staggered timings of the workshops (the first was held on April 3rd, 2020, the second on April 23rd and the third on May 12th) meant that some teachers had their DC ahead of others. One teacher had considered trying an online CBT programme, but on examination reported it as too medical. Another had hoped to use the Fit2Teach Pro App, but at the time DC purchases needed to be made, the app had not been updated within the previous six months, so it was excluded as an option. Another teacher wanted to try both the Withings watch and Wysa App, but as the cost exceeded the flat participation fee, she opted for the Withings only.

Table 7.4 shows the DC chosen by each teacher (designated by participant number) and where the DC fits into the strategy-concept taxonomy.

	STRESS SELF-MANAGEMENT STRATEGIES			
DC CONCEPTS	Educational	Physiological	Cognitive	Social
Reflection	T5 Teacher Tapp (Daily survey)	T2 T3 T4 T6 T7 T8 Withings Steel HR Watch (Physiological tracker & communications)	T1 Daylio (Journal) Wysa (Chatbot)	Teacher Tapp (Daily Survey) Withings Steel HR Watch (Physiological tracker & communications)
Treatment / self-management		Headspace (meditation relaxation)	T1 Wysa (Chatbot)	
Peer-to-peer social		Withings Steel HR Watch (Physiological tracker & communications)		

TABLE 7.4 DC SELECTION BY TEACHER (T NUMBER) AND PRIMARY STRATEGY/CONCEPT CATEGORISATION IN THE TAXONOMY. SECONDARY DC STRATEGY OR CONCEPT SHOWN IN GREY

7.8 Discussion

This chapter presented the process of creating a context-based framework to facilitate DC intervention choice and then described the workshop where the taxonomy was presented. Using the dimension of stress self-management, classifications of strategies were created that were derived from empirical research and the literature. Using the dimension of digital techniques, conceptual descriptions were created of the DCs' mechanisms of action informed by the literature. Bringing these together in a taxonomy gave the framework that could be populated with DCs for teachers' stress self-management according to availability, evaluation, security, validity and cost. It is a starting structure for presentation and selection of contextually appropriate DCs.

Populating the taxonomy presented some significant challenges. The transience of apps or their ratings (availability and evaluation) meant that by the time the taxonomy was presented to teachers, one peer-to-peer supported CBT website had been removed. Likewise, a highly rated diarising app had one of its EREF ratings plummet during the study, although no cause for concern was found on re-checking the privacy policy. Another CBT course with extensive validation through research publications was included as it had been commissioned by the local NHS in the areas where the teachers were employed. However, when one participant tried to access it, a referral from the GP was requested, which precluded pure self-management. Some apps considered were described as designed for stress but included reference to medical conditions such as psychosis and schizophrenia. Due to concern that their inclusion would imply a medical need, or such diagnostic association could be too sensitive for a study focused on occupational stress, they were excluded.

It became clear as candidate smartphone apps were reviewed that a significant number do not offer comprehensive (if any) data encryption, even those where the funding model requires user payment (thus requiring input of more sensitive data). The search was not exhaustive, as that would have been impossible. But in order to increase candidates, certain DCs were included in the taxonomy where scientific studies on app efficacy (e.g. Headspace and Calm) were available, with the caveat that whilst widely used, there was no or only partial encryption of stored and/or transmitted user data.

The sequence of application of the selection criteria was affected for wearables due to their cost. Of the six different wearables described in the teachers' study, price excluded the Samsung Gear 2, Polar 340 and Apple Watch. Obsolescence excluded the Fitbits (Blaze, Alta) leaving the Fitbit Charge. This failed the encryption requirement being non-specific and considered on external evaluation to be inadequate (Orlosky et al., 2019). Database search, paper retrieval and website scrutiny enabled us to identify one wearable from Withings that satisfied all the set criteria, offered support for two of the four stress self-management strategies and fell into the set price bracket.

Importantly, using qualitative field data as a starting point was crucial for identifying DCs that would not have appeared in a search based on the condition of stress. For example, Teacher Tapp was designed as a research tool to voice teachers' opinions (McInerney, 2019). Yet its educational content and sense of peer-connection were considered valuable for relieving feelings of stress. Likewise, Fit2teach, although designed for wellbeing and work-life balance, is listed under 'education' not 'stress' in app stores.

In a world in which automated or unsubstantiated rating systems are prevalent, there is still a need for autonomous, informed, human decision-making that draws on personal knowledge and understanding (Calvo & Peters, 2014). Individuals need to be able to confidently identify their personal preferences to improve chances of adherence (Schueller et al., 2018). Improving app selection by context-informed condition management and conceptual categorisation could logically aid both adoption and potential efficacy of digital health tools and reduce attrition before the desired outcome. This study's findings illustrate however that there is no quick route to informed adoption.

7.8.1 Limitations

The review of the literature was not exhaustive and other research may reveal stress-management strategies beyond those identified. Additionally, there could be disagreement on the way that I have grouped or limited the explanatory power of DC concepts. Further research will be able to substantiate whether these issues are significant.

As noted in the process and discussion, the selection of technology can never be complete and is only ever a reflection of what apps and information are available at the time of the search. Additionally, the starting point for apps was a previous small study where the participants had self-selected; a different or wider cohort could have produced other findings. There is no circumventing the reality that populating a taxonomy will always have to be revisited at the time of use.

Another limitation of this approach is potentially embedding the notion that dealing or coping with workplace stress is just the responsibility of the individual, regardless of the source of the stress. This individualised approach can place a profound burden on a teacher as it fails to acknowledge the complexity of the origins of stress (Taylor-Rodgers & Batterham, 2014). There was no intention to imply that managing stress is only the responsibility of the individual; rather, it is hoped that this context-based approach implicitly acknowledges cultural and environmental occupational influences on teachers that are beyond their control.

Although the workshops had originally been planned as didactic, participants would have been more numerous and more able to interact with each other had they been held in person. Whether this would have stimulated different choices, or influenced teachers' willingness to share data with each other is not known and would be difficult to test in the future, given the unique circumstances in which this research was undertaken.

7.9 Conclusion

In this chapter Study Two's findings and Workshop output are presented. An analytical study was undertaken to create and populate a taxonomy to enable an informed choice of DC by the teachers who had expressed interest in taking part in Study Three. It is possibly the first taxonomy tailored for teachers' digitally supported stress management, and perhaps the first framework for public choice of DC framed by occupation and facilitating identification of personal preferences based on whether the technology fits the individual's current behaviours or contexts. In the HCI literature, customising, personalisation and tailoring (together 'internal choices') are all ways of describing how user engagement *within* DCs for mental health generally can be enhanced (Borghouts et al., 2021; Perski et al., 2017) although less is known about stress specifically. A few studies have now begun to look at these internal choices or persuasive designs for engagement with stress interventions, including in the workplace (Alhasani et al., 2022; Howe et al., 2022). Enabling upfront,

informed 'external' choice of technology for stress is still evolving (Carlo et al., 2019; Goodday & Friend, 2019). This taxonomy adds to this evolutionary journey.

The taxonomy was presented to teachers in workshops, along with descriptions of each of the included candidate technologies. Teachers made their choices based on their personal stress management strategy and supporting digital concept preference.

All of the teachers who took part in the workshop opted to take part in the longitudinal study. Chapters 8 and 9 now present the context and findings of this final study.

Chapter 8 Study Three: Answering RQ 3 – Teachers' Long-term Experiences from using Consumer Technology for Stress Management

"Healthcare systems are complex, and we need new strategies for designing and deploying interactive health technologies that address the needs and values of their diverse users." Prof Ann Blandford, 2019

Parts of this chapter have been submitted as a paper which is now under peer review.

8.1 Introduction and Motivation

This is the first of two chapters that report the findings of the longitudinal study undertaken, whose methods were covered in detail in Chapter 5. This study built on those reported in Chapters 6 and 7 and explored the evolving experiences of consumer technology adoption and use by eight teachers who were mostly teaching from home during the summer term. For six of the eight teachers, the study extended into the autumn term as well. The first distinct question asked of the data is covered in this chapter and focused on teachers' experiences to produce meaningful insight into the value, opportunity and benefits of consumer technology use.

This chapter starts by recapping the gaps in knowledge demonstrated in Part One, and then details how the research question was answered.

8.1.1 Experiences of digitally supported stress management

The few previous studies on digital stress interventions with teachers largely focused on outcomes rather than experiences, and only the wearable studies seem to have used consumer technologies. However, insights generated have included iCBT and wearables enabling personal insights (Ansley et al., 2021; Kocielnik & Sidorova, 2015; Runge et al., 2020), personal data, psychoeducation or colleagues' experiences

creating awareness of stress, and autonomy in strategy choice, timing or use of time was valued (Ansley et al., 2021; Kocielnik & Sidorova, 2015; Leung, Chiang, Chui, Lee, et al., 2011). Mutual social support, connectedness online and anonymity (Leung, Chiang, Chui, Lee, et al., 2011) or informational support via an app (Klap, 2020) have also been reported as valuable. Also, a better understanding of in and out of work stressors was generated through a teacher-tailored online programme (Ebert, Lehr, Boß, et al., 2014). On the negative side, not being able to translate knowledge of stress from collated wearable data into action was reported (Kocielnik & Sidorova, 2015), and that contexts and organisational dimensions can reduce intervention efficacy (Oliveira et al., 2022).

HCI studies have mostly been conducted in the context of office work but have captured some experiences which could be transferable. Findings have demonstrated users appreciating the autonomy digital tools can offer through pre-scheduled or just-in-time and personalisation of stress management solutions (Howe et al., 2022; Sano et al., 2017), flexibility over time and place of access, being reminded to use the intervention and those of short duration (Mak et al., 2015).

Experiences with technology are themselves enabled by the elements and characteristics of features or mechanisms (Mohr et al., 2014). These have been described in a simplified conceptualisation for stress self-management as (i) reflection, (ii) treatment, (iii) social support or (iv) entertainment, based on the mechanism or rationale for interaction (Manning et al., 2022). Firstly, reflection (i) is the fourth stage in the Personal Informatics (PI) model where the data is self-generated (I. Li et al., 2010) although it is not limited to PI as reflection can also be facilitated through apps supporting emotional self-awareness (Litvin et al., 2020; M. E. Morris et al., 2010), chatbots offering guided therapy (Howe et al., 2022; Inkster et al., 2018) or timely reminders (Howe et al., 2022; Morrison et al., 2017; Sano et al., 2017). Self-generated data (PI) has been reported to generate valuable awareness of stress was valued amongst IT workers (K. Lee et al., 2020; Lentferink et al., 2018) and this is an under-exploited opportunity. A study of working age adults already using consumer wearables reported that most had not discovered the stress-tracking feature (Ding et al., 2021), but then also lacked knowledge to then self-manage stress.

Secondly, treatment and self-management for stress (ii) can include iCBT, third wave iCBT, mindfulness, online forums, psychoeducation and internet stress management interventions (often labelled iSMI), often a combination of the aforementioned. Employees appear to be more likely to stick with a tailored stress intervention when given either content or adherence focused guidance and support (Zarski et al., 2016), and reviews tend to agree that employees prefer and do better when given practical support with digital interventions (Phillips et al., 2019; Renfrew, Morton, Morton, et al., 2021; Stratton et al., 2017). Reflection and treatment can be brought together, as demonstrated when machine learning was applied to tracking data, leading to suggested interventions for stress-mitigating planning and action by office workers (K. Lee et al., 2020). Employees described a deeper understanding of stressors, self-awareness, valuing peer insight and importantly, contextually appropriate coping actions.

Thirdly, peer and social support (iii) are powerful because mutual understanding creates solidarity and empathy, and communities that have shared experiences support individual meaning making (Ruthven, 2019). Teachers described this experience from using an online forum in Hong Kong (Leung, Chiang, Chui, Lee, et al., 2011), students when sharing ideas for stress management (K. Lee & Hong, 2018). Also, IT workers found social networks leveraged humour and intimacy that could reduce individual perceived stress levels (Paredes & Chan, 2011). Replicating empathy with artificial agents (chatbots) has been challenging (Ta et al., 2020; Yorita et al., 2020), even when designed for stress in a specific context (Park et al., 2019). Yet empathy has been demonstrated in a public cohort reporting depression (Inkster et al., 2018) and research is expanding in this space (Damij & Bhattacharya, 2022). Finally, signposting to entertainment (iv) through contextually informed machine learning to fun and games web apps has demonstrated increased self-awareness of stress and new ways to deal with it (Paredes et al., 2014). Also, entertainment both through gamification of an app helped tech industry workers deal with stressors (Litvin et al., 2020), and nurses to feel less stressed when using an exercise video and Nintendo Wii (Tucker et al., 2011). Entertainment and gamification seem to be

currently under-exploited in stress interventions (Cheng et al., 2019; Hoffmann et al., 2017, 2019; M. Li et al., 2021).

As described in Chapter 3, section 3.7, given that 'context' is used to describe everything from high level surroundings to individual level characteristics, I drew on multi-disciplinary domains of education, human factor and informatics literature (Ball et al., 2011; Carayon, 2006; Holden et al., 2017; Jumisko-Pyykkö & Vainio, 2010) to define the education workplace as the macro-context; the temporal, physical, social and cultural factors as meso-contexts; and the micro-context was that of the individual's personally chosen strategy.

8.1.2 Summary

Studies on teachers' experiences of using consumer technologies to manage their stress are scarce, but research technology reports have indicated the potential value for awareness and mutual support particularly where they can be used autonomously. Wider workplace studies of digital stress support have revealed flexibility, brevity and personalisation to be valued. Awareness of stress has been generated through both reflection and social support, and sharing experiences of stress and interventions to cope with peers can be meaningful. Simply being more aware of stress does not necessarily prompt self-management, so identifying strategies is important. Therefore, the following questions were posed to generate insight on teachers' experiences with widely available consumer technologies, chosen with some autonomy, to support a specific stress management strategy identified by them in during a workshop (ref Chapter 7, section 7.7).

RQ 3 What were the teachers' experiences with their consumer technologies?

With sub-questions

RQ 3a In the context of their work, how do secondary school Heads of Year experience their chosen technology for stress self-management?

RQ 3b Does digitally supported stress self-management change from when working from home to working back in school?

8.2 Methods and Analysis

Details of the longitudinal study are in Chapter 5, Section 5.7. The study began with a semi-structured interview, then four weeks after the summer half term, participants were sent an online survey, on Monday, Wednesday and Friday at 3.30 pm. Second semi-structured interviews were undertaken at the end of term, and for six of the eight teachers, third interviews were held after six weeks back in school in the autumn. For the six teachers interviewed in the autumn the duration of DC use was for at least 15 weeks, with the longest being 27 weeks.

8.2.1 Semi-Structured Qualitative Interviews

A rationale of the semi-structured interview topics is shown below in Tables 8.1, 8.2 and 8.3, and the full interview script can be found in Appendices E, F and G.

Topic	Description
Background	Setting the scene for work as it is now, still under lockdown, and how a typical working day has changed
Individual DC choice and use	Covering the DC they have chosen and why, any previous experience, their expectations for self-management of stress and familiarity with significant stress symptoms previously described by teachers
Physical Context	Exploring their current environment and how this situation could affect DC use, and potential change back in school
Social Context	Obtaining insight into their relationships with colleagues in school and potential influence on DC use
Cultural Context	Learning the nature of their school climate including aspects of trust and autonomy and potential influence on DC use

TABLE 8.1 ENTRY INTERVIEW RATIONALE SUMMARY

Topic	Description
Background	Recognition of COVID-19 and the impact on work location, experiences of stress and routine
Individual DC choice and use	Covering ease of adoption, features and familiarity. Initial thoughts on support for stress management strategies and stress symptoms
Tailored questions	Prompted by answers from Entry Interview expectations and observations
Contextual Factors	Use, usability and usefulness experience according to physical (situated), social and organisational/school culture contexts
Future	Goals as a result of DC use, ideal DC design as a Head of Year

TABLE 8.2 END OF SUMMER RATIONALE SUMMARY

Topic	Description
Background	Update on personal circumstances; differences between being in school now and pre-pandemic; stress changes
Experience of DC use	Use of DC in school and how it has helped or not, either in the moment or building stress resilience over time
Contextual Factors	Use, usability and usefulness experience according to physical (situated), social and organisational/school culture contexts
Tailored Questions	Prompted by answers from End of Summer interview, specific to their DC experiences and contextual responses
Closed Questions	Agree or disagree on statements about influence of data

TABLE 8.3 AUTUMN INTERVIEW RATIONALE SUMMARY

8.2.2 Materials

From the 12 Consumer technologies presented to teachers during the workshops as Digital Companions (see Chapter 7 for the process of selection), four were chosen to be used by participants during the study. One teacher chose to use the Daylio and

Wysa apps, another the Teacher Tapp app, and the remaining six teachers all chose the Withings wearable smart watch. During the summer term, one of the teachers using a wearable also accessed the Teacher Tapp app. Two of the teachers also accessed the Headspace app during the study. Headspace had been included in the taxonomy because there was not a better, encrypted alternative. It was not a first choice for the participants, but it was used by one teacher in the summer term as an alternative and one in the autumn term with her students in her class. Each of the Consumer Technologies chosen is described below.

Teacher Tapp – Daily Teacher survey and blog.

Teacher Tapp is an app that sends an alert at 3.30 pm every day and poses a few quick multiple-choice questions about an aspect of teaching. After answering the questions, the user has the opportunity to see the previous day's collated results and read an online article that contributes to professional development. Topics cover education, teacher welfare and relevant current affairs, and previous articles can be accessed via the website. The app rewards users with badges that display the number of questions answered, consecutive days of use and points that accumulate towards a book voucher or other bonus. https://teachertapp.co.uk/

Withings – Wearable, connected tracking watch.

The Withings Steel HR is a smart watch that captures steps, activities (personalisable from weights to yoga to skiing), heart-rate (beats per minute through photoplethysmography (PPG)), sleep monitoring (duration, depth, cycles, interruptions, etc.), and calorie expenditure. A companion app gives dashboard displays of data captured over time. Notifications can be selected from email, messaging systems, phone calls, alarms, etc., to be displayed on an embedded digital screen. It can be connected to other apps such as Strava and Apple HealthKit. All data is encrypted in storage and transmission. https://www.withings.com/uk/en/steel-hr

Daylio – Emoticon and activity tracking app.

Daylio is a 'Self-Care Bullet Journal with Goals, Mood Diary & Happiness Tracker'. It can be used to quickly select your mood emoji and then select the activities you have been involved with. Notifications can be sent during the day, personalised to the individual, with the option to add notes and goals, set reminders and collect achievements. A weekly summary is produced and trends over the whole duration of use can be easily viewed in the app. https://daylio.net/

Wysa – AI chatbot app.

Wysa describes itself as "your private reflective space for when you need to get your head straight". It is an AI chatbot app that allows the user to select from self-care exercises, wellness tutorials or have an interactive conversation with the AI bot. It uses CBT-based techniques to help build mental resilience skills and education with the aim of helping the user feel better and increase their psychological resilience. https://www.wysa.io/

Headspace – Meditation app.

Headspace is an app that gives immediate access to guided breathing-focused meditations, animations, articles and videos. It originated as a support for personal guided meditation, and meditations are focused on either personal symptoms, children's themes or work teams. https://www.headspace.com/

8.2.3 Analysis

Details of methods and rationale for the use of case studies have been described in the methodology, in Chapter 5 section 5.7.3, along with the recruitment strategy and overview of the analytical approach. Exemplar Case Studies are included in Appendix L. A summary of my analytical approach for creating case studies is shown in Table 8.4.

Strategy	Purpose	Analytic focus	Product
Analytic immersion in all interviews	Familiarisation with the data	Within all cases	Coding and recoding categories
Analytic immersion in all case data	Triangulation of the data	Within each case	Annotated case files
Immersion in each case file	Identify important aspects of the phenomenon: adoption, evolution of and influences on use	Within each case	Case studies describing the experience of the phenomenon with key quotations
Comparison of key quotations	Identify similarities and differences between the cases	Across cases	Experiences common to all participants and where they diverge; nascent themes
Reconnection of key quotations to interviews	Ascertain fidelity to original accounts	Within and across cases	Verification and refining of themes
Free writing	Reflection and to begin narrative	Within and across cases	Answering the RQ on adoption, use, evolution in the contexts
Review narrative	Explanatory power of themes and statements	Themes	Final narrative

TABLE 8.4 SUMMARY OF ANALYTICAL STRATEGY FOR CASE-STUDIES AND ACROSS-CASES

8.2.4 Study participants

All the teachers who took part in the original study are profiled in Table 8.5. This table summarises their choice of technology, duration of use, chosen and actual stress management strategies and concepts, and any change in role and experience. Each teacher was assigned a number to maintain anonymity; in the results they are referred to by their participant number (T1, T2, etc.) and their technology primary function (Where Key: Primary technology concept in bold; WFH – work from home; FT – full time). Teachers T1–T8 took part in the intended summer study; teachers T1–T6 also took part in the autumn study.

T No.	Technology Choice	Time as teacher	Chosen Stress management strategy / Tech Supported Concept (1st/2nd)	Duration of use (night-time indicated for Withings)	Reported stress management strategy / mechanism utilisation
T1	Daylio and Wysa Apps	>10 yrs	**Cognitive / Reflection** **Cognitive / Self-management**	20 weeks continuous then a few missed days before autumn half-term	Used as planned. Plus self-management learning / empathy applied to others in last 6 weeks (autumn term)
T2	Withings' Watch - Wearable	>10 yrs	**Physiological / Reflection** and Peer-to-Peer Social	22 weeks (including nights)	Used as planned. but unhelpful with sleep
T3	Withings' Watch - Wearable	>20 yrs	**Physiological / Reflection** and Peer-to-Peer Social	22 weeks continuous (night wear quickly discontinued)	Physiological reflection used. Peer-to-peer social not utilised (as predicted by T3 at start)
T4	Withings' Watch - Wearable	< 10 yrs	**Physiological / Reflection** and Peer-to-Peer Social	15 weeks continuous then 4x/week for next 7 weeks (night wear quickly discontinued)	Physiological / Reflection Peer-to-peer social not utilised (T4 thought she would)

T5	Teacher Tapp	>10 yrs	**Educational / Reflection**	7 weeks 2 days continuous then occasional use for 7 weeks in autumn term	Used as planned. Plus learning/empathy applied to others Added Physiological / self-management
T6	Withings' Watch - Wearable	>20 yrs	**Physiological / Reflection** and Peer-to-Peer Social	27 weeks continuous (including nights) included planned health leave for 6 wks	Used as planned. Peer-to-peer social not utilised when back in school (Bluetooth range)
T7	Withings' Watch - Wearable	>10yrs	**Physiological / Reflection** and Peer-to-Peer Social	7 weeks' intermittent wear	Occasional use of physiological reflection Peer-to-peer social not utilised Added occasional Teacher Tapp (Education/Reflection)
T8	Withings' Watch - Wearable	<10yrs	**Physiological / Reflection** and Peer-to-Peer Social	8 weeks continuous	Physiological reflection used. Peer-to-peer social not utilised

TABLE 8.5 OVERVIEW OF STUDY PARTICIPANTS, DURATION AND REPORTED TECHNOLOGY USE

8.3 Results

Of the eight teachers interviewed twice in the summer, only one was working on the school premises, but by the autumn term the six teachers involved in the extended study were all back on site. The participants were ethnically diverse but with just one male teacher in both summer and autumn studies. Covid-19 hygiene rules meant that teachers were moving between classes in the autumn of 2020, year groups were segregated, and the school day was longer due to students' staggered arrival and leaving times.

Two main themes were identified in both the summer and autumn term case studies and one further theme from the autumn analysis. Firstly, in both school terms the data collected by the wearables and contained in the apps powerfully demonstrated the physical and psychosocial demands of work and stressful moments. This data

generated self-compassion prompting permission to destress, validating their subjective experiences and increasing awareness of and generating empathy for colleagues too. Flowing from this permission, the second theme revealed that their stress-management technology could also be a medium for indicating values. Using the technology enabled both a sense of belonging and being part of a community and could engender more trust through the autonomy it could support.

In the autumn term, the final theme built on the first two as teachers described how their understanding of their stress and value of self-care had to an extent become embedded and become more intentional. They still interacted with their technologies but did not always need to before understanding a situation was stressful and giving themselves permission to destress.

A summary of themes is shown in Table 8.6, then each theme and subtheme are described in more detail with the teachers' number, technology and school term indicated.

Theme	Sub-theme
The significance of data gave teachers permission to self-manage their stress	Personalisation evolved through finding goals and boundaries
	Self-compassion lead to intrinsic permission, sustained on the school site
	Self-affirmation from seeing collated data contributed to resilience
	Confidence and empathy came through knowledge, leading to sharing

Technology use could indicate educator values	Connectedness through what was is important to the teacher
	Trust through autonomy and choice could be suggested by technology
Conscious strategies became subconscious behaviours (Autumn term only)	Learned helpfulness meant some reduced reliance on the technology

TABLE 8.6 SUMMARY OF THEMES IN ANSWER TO RQ 3

8.3.1 Theme One: The significance of data gave teachers permission to self-manage their stress

Teachers described how having personalised their technologies, both the data and information on wellbeing and activity enabled reflection on the toll of teaching on them. This consciousness led to self-compassion and a realisation that as well as capturing the demand, the data could also affirm action taken to look after oneself.

8.3.1.1 Sub-Theme 1.1 Personalisation evolved through finding goals and boundaries

All teachers consciously curated the use of their technology over time according to their needs. They had chosen both their stress self-management strategies to be supported and the primary mechanism by which their technology could help them.

> *I was talking to one of my colleagues about it this morning… These apps prompt you to think differently and change your perspective and not go yes, I need to do that, or think about things at the end of the day, but actually reflect as you go through the day, and not just at the end of the day or the end of the week, etc…I guess what I'm doing is just adapting*

the app to think about you as a person because you can be very intentional of the things you put on there… T1, Daylio & Wysa, Summer

Four of the six teachers who had a wearable used it in the summer term to set boundaries through the enabling of notifications, reminders or alarms. Some used reminders to prompt breaks, eating and drinking, or taking exercise as, even though they had more autonomy and time to pause, the work-home boundary was blurred by working from home.

So, I'm constantly checking. I love just having a look at the app in the morning, just to see what the data is, and see what it is for the day. And then I can say, right, I need to do more of this today, or I need (to) try and do that a bit more. T2, Withings, Summer

Some personalised by selecting the information they paid attention to, for instance heart rate or sleep data. Three teachers who were using the wearable chose not to wear the Withings at night, either because they did not want to know about their poor sleep as it made them more stressed, or because once good sleep had been affirmed, they no longer needed the confirmation.

In the autumn, four out of six teachers reported no further tailoring of their technology on top of what had already been undertaken to support stress management. One teacher had described trying the food diary when back in school, although she discontinued use of the meal planner because of the effort and finding it boring. Another reported setting more alarms as she found they were meaningful reminders to drink or take a breath.

8.3.1.2 Sub-Theme 1.2 Self-compassion led to intrinsic permission, sustained on the school site

In the summer term, teachers using the wearable reported that wearable collated data on sleep, calorie burn, heart rate and activity gave them a better understanding of their bodies' responses to work and stress throughout the day. Likewise, the teachers using the apps described taking time to reflect on emotional tracking or

educational information on stress or even questions relating to current circumstances, as heightening their awareness of the need to look after themselves. This understanding prompted self-compassion, seeing themselves as human beings, not just teachers. Combined with the knowledge of their stress management strategies this implicitly gave each of them permission to look after themselves better.

> *The biggest thing about using the apps, is helping me to be self-conscious of me. Even like thinking how I'm running, how I'm doing things, how I'm sitting, how I'm walking… think I have more value for 'me'. In fact, I've probably treated 'me' a lot more harshly [in the past] it was never about me. It was about everybody else. T1, Daylio & Wysa*

All teachers noted that their jobs were less physically demanding during lockdown when they were working from home, but the data still demonstrated the demands of teaching on the body. Making time for exercise had to become more intentional and was motivated by seeing their low movement data. All those using the wearable could see associations between feelings of stress and their heart rate, even when working from home. This underscored the experience of being human with bodies that reacted to stress and strain, not merely teachers doing a job.

> *The other day… I was trying to create a policy, basically, and just thinking about next year. I did my heart rate check and it was like, gosh clearly I'm stressed, it had gone up by like 30. Normally my heart rate is in the 60s, but it had gotten up into the 90s. I was like…I'm going to take a breather. I'm going to go for a walk and then come back and then reassess it. That was actually really interesting because I hadn't, in the moment, I hadn't really recognised that I was getting that stressed. T8, Withings, Summer*

Only one teacher did not report greater self-compassion and had found being out of the school workplace setting a disincentive to using her wearable, as she only wore a watch when going to work.

Three teachers described in the autumn how the permission they had given themselves to look after their own wellbeing to manage stress continued in the school environment. One teacher testified that she now recognised her raised heart-rate as an indicator of stressful situations and this was prompting taking time out to recover – an action of self-care for which she had not previously had the information or insight to trigger.

> *And again, when I have seen my heart rate go higher or I know I've been really stressed, I've been trying, even if it's just for five minutes, just to go and sit in my office and shut the door. Just for five minutes and just do something else or just sit there and just take a minute to just calm down. T4, Withings, Autumn*

This reported self-compassion could then also lead to action and the data generated enabled self-affirmation, described in the next sub-theme.

8.3.1.3 Sub-Theme 1.3 Self-affirmation from seeing collated data contributed to resilience

All six teachers using their wearables in the summer term described how being able to see their data constituted evidence of their efforts to manage experiences of stress. It affirmed when they had permitted themselves to relax, such as by walking or taking time out, or showed when efforts around night-time habits had resulted in better sleep. Those using apps appreciated seeing their tracking or rewards.

> *I felt like the data was telling me that I'd worked hard enough, and I deserved it. So, I was like, well, I've done my bit and I'm just going to step out of it…Making sure I'm in bed and getting the hours that I need, which is quite good because it plots it for you. It says, it's a sweet spot, you've had enough sleep. T2, Withings, Summer*

Teachers still appreciated the patterns they could see in their data as proof of their self-care in the autumn, and one described how the data had become a real-time prompt as well. Seeing the displays of self-care routines were meaningful in terms of

understanding how they essentially contributed to resilience when in the thick of school activity.

> *So, in terms of it helping to remind me what I'm doing, what I need to do, it does in that way because it helps you to keep into a routine…So, if I'm not in routine and I don't do certain things, like yoga, my Bible study…So, indirectly, it does [help with stress management] because it teaches you…It may not be in the moment say on Daylio…[but] it helps me to deal with day-to-day management of different things at school. T1, Daylio, Autumn*

8.3.1.4 Sub-Theme 1.4 Confidence and empathy came through knowledge, leading to sharing

The heightened awareness of the impact of stress meant all participants commented on being more confident to share both the insight and the technology itself in discussions of stress, and this could generate empathy for colleagues experiencing stress.

> *What I love about Wysa, it talks about remedies, and it gives you ideas, and it educates you on why people feel like that…I'm going honest because I know what triggers my stress…I think I've learnt more about other people. T1, Daylio & Wysa, Summer*

Back on the school premises, one teacher reported that her conversations around stress management had been with the students, not fellow teachers. She had seen the relevance for herself of managing stress better through deliberately exercising more, and she also tried to demonstrate to the students the meditation feature that came with her wearable companion app. When this had failed, she demonstrated Headspace (meditation app) instead and found that despite having a challenging class, the students responded positively.

> *So, I thought I'd introduce it [the meditation on the watch] to my Year 10s, but I couldn't do it with them, so I downloaded Headspace and I've*

used Headspace with my Year 10s. So, we meditate in form time and they

love it. I've got the most difficult form group…it's just quite interesting

that [it gets] them calmer. T3, Withings, Autumn

8.3.2 Theme Two: Technology use could indicate educator values

Teachers identified that connecting through the technology was important because it mitigated against a sense of isolation. They described how it could also be a medium for indicating value, both through giving recognition of autonomy and the need for them to be supported. This theme complements the first theme of permission to self-care that teachers had described from having the technology and data.

8.3.2.1 Sub-Theme 2.1 Connectedness through what is important to the teacher

Teachers' nuanced responses revealed the value of being able to choose to stay in touch, either with each other or the wider educational context, or conversely not being disturbed. Withings' messaging provided the ability to stay connected with family or colleagues when working from home, which reduced the stress of potentially missing out. This gained extra salience when teaching from home, where the watch became a 'fail-safe'.

> *So I have three devices set up when I teach. I have my laptop with that*
> *[an electronic pen] attached to it now, to one side of me I have my iPad*
> *[for the chat function] and then I have my phone on as well, [so] that I*
> *can see what they can see…that's where the watch comes into its own.*
> *Because then, anything that comes through, comes onto my watch. T6,*
> *Withings, Summer*

Teacher Tapp alerts were described as helping to frame the school day (going off at 3.30 pm, a reminder of the end of lessons), appreciated particularly during lockdown and working from home, and giving the sense of connection with other teachers, an unanticipated benefit during lockdown.

But over this period, I've used it (Teacher Tapp) a bit more, because I want to see what people are saying about Covid and stuff...I thought, great this is fantastic... it's nice to see what people are saying or what people are thinking during this pandemic. T7, Withings & Teacher Tapp, Summer

Experiences of connectedness varied more in the school environment in the autumn, but being able to see family messages were mentioned by some as reassuring.

So...without having to have my phone out...I could see the content of the message, and I knew it wasn't something that was urgent, but I knew I was informed of what was going on...so in that way, yes, I have been using it in school. T2, Withings, Autumn

8.3.2.2 Sub-Theme 2.2 Trust through autonomy and being valued

Teachers described different levels of trust between themselves, other staff and the school's leadership, with six out of the eight teachers expressing reticence on being open about stress: sharing insight would depend on trusted relationships. With leadership, a climate of trust was associated with both the sense of autonomy given to teachers and how value is shown, for instance through wellbeing support. This included the provision of respite in the workplace from the frontline, be it in the form of protected breaks, opportunities for camaraderie, or off-duty privacy such as a staffroom. A couple of teachers mentioned how leadership offering a digital tool for stress self-management in continuing professional development (CPD) could facilitate autonomy:

You're assigned a CPD and you have to go...While for this (using Teacher Tapp) it would be up to you to engage. You know, do you want to fill out the questionnaires, do you want to do the reading? So there's some autonomy to what's taking place, and you as the individual have control about the success in your outcomes. T5, Teacher Tapp, Summer

One teacher described that stress was perceived as a reason for teachers leaving the profession. As a Head of Year she often felt that she did not know how to help fellow staff but she could now recommend technology for personal stress management.

> *I am quite interested in teacher retention…and think that stress is one of the big causes for drop out…We don't really talk about stress…people frequently tell me they are stressed but I don't necessarily feel that I've got many…strategies to help them…(Now) I might say, this is a tool that's helped me. Yes. Definitely. I think I would probably be quite honest about it and be like, oh yes, it's really helped me managing this stress T8, Withings, Summer*

Without exception, teachers felt that more effort to appreciate their work and stress had been made by leadership during the pandemic. Leadership had demonstrated this by asking about family circumstances, reducing teaching demands, enabling online chats or worry-box emails, wellbeing tips and more line-management support which most described as continuing in the autumn term.

One further finding was derived from analysis of the autumn data which signified an embedding of the learning described in the previous themes.

8.3.3 Theme Three: Learned helpfulness meant reduced reliance on their technology

Teachers returned to school in the autumn having used their technology for at least twelve weeks, including over the summer holidays. Frequency of technology use dropped in the autumn term, with reasons given as of lack of time and opportunity, but most teachers revealed how lessons learned could be applied in the moment.

They described being able to apply learning from the use of their technology and reflecting on the data, although some commented that working from home had given them the opportunity to learn and practice changes in habits, which may not have happened had use begun on the school premises.

I think things that I learnt over the lockdown, and with the technology, I definitely have …tried to actively act on those lessons as much as I can. I think it's probably come from more a place of learning from the tech previously, as opposed to using it at the moment. I'm not sure how I would have used it if I'd have just turned it on at the start of term. I think it was interesting to have those two experiences, actually. T4, Withings Autumn

Learned helpfulness did not always translate into behaviour. One teacher described how her desire to look after herself in school was overridden when in the physical setting, surrounded by occupational demands. To still benefit she would have to plan to use the technology more deliberately. She reflected that she could be more proactive, setting reminders to take a moment for herself, to have lunch or simply having a moments rest.

I think maybe what I might do is set myself a few little alarms as well, daytime alarms, which are triggers for me to go look at my timetable and actually set a time, even if it is to eat…and just take ten minutes or 15 minutes out…Maybe I need to be more organised and be more aware of my wellbeing and what's important for me. And use the data and use the technology more to effectively manage my day. T2, Withings, Autumn

8.4 Discussion

The duration of this longitudinal study presented an exceptional opportunity for a long period of exploration.

The themes generated from the cross-case analysis indicate an overarching virtuous cycle of experience, initiated by extrinsic permission and personal choice of technology. Interacting with the technology generated meaningful data, the existential significance of which permitted self-compassion and empathy, prompting

confidence and self-management strategies, the value of which stimulated further engagement. This is illustrated in Figure 8.1.
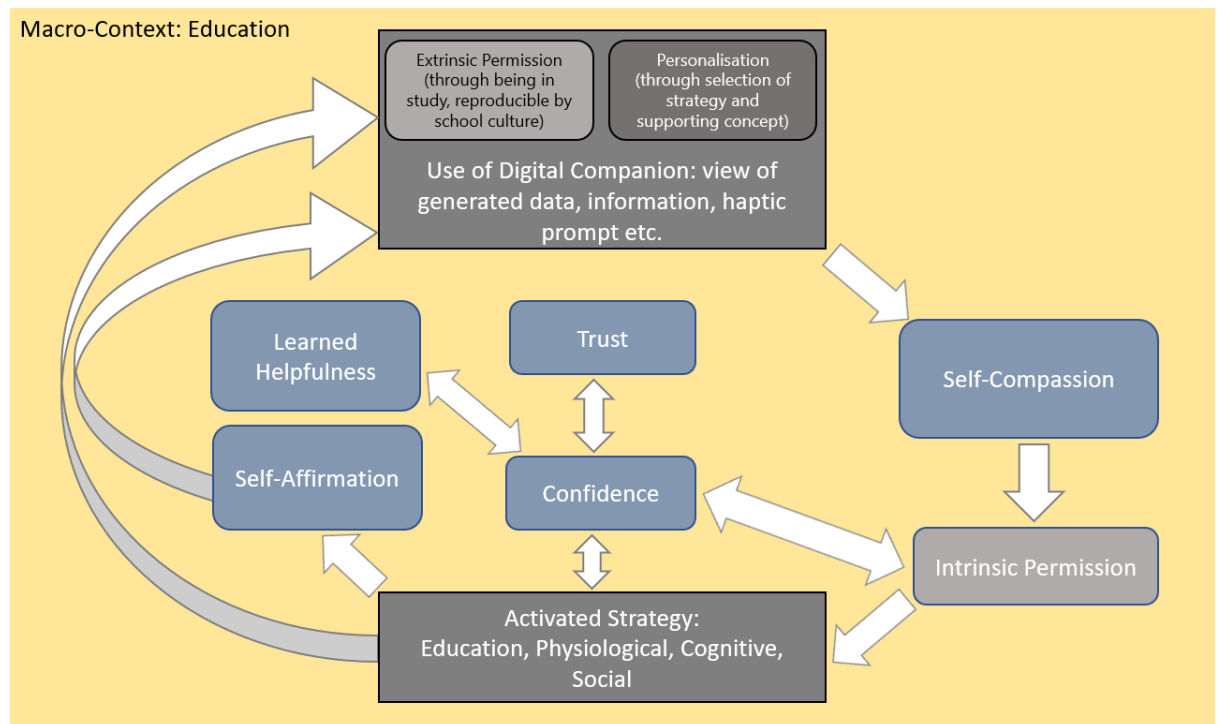
FIGURE 8.1 CYCLE OF EXPERIENCE WITH THE TECHNOLOGY, GENERATING MEANINGFUL DATA LEADING TO SELF-COMPASSION AND INTRINSIC PERMISSION TO SELF-MANAGE AND CONTINUED USE

Together, these findings imply that consumer technologies can have a valuable role in teachers' stress management which we now explore in more detail.

8.4.1 Qualification in context

Data meaningfully captured some of the stress of teachers' roles and permitted compassion and self-care resonates with themes of real-world awareness (Paredes et al., 2014) and permission, which has been reported as a mechanism that facilitated teacher wellbeing in a taught (non-digital) mindfulness study (Schussler et al., 2016). Similarly, self-compassion was found to improve through digitally supported stress management amongst healthcare students, where they were educated about the physiological impact of stress and provided with supported relaxation via an app (Orosa-Duarte et al., 2021). The current study validates this finding and demonstrates

the explanatory power of contextually meaningful data alone, particularly real-time heart rate. Such data is humanised by the context (Lupton, 2016b), and it gains existential significance (Ruthven, 2019). When data quantified the toll of teaching through physical demand or capturing teachers' emotional variations, this deeper, macro-contextual 'educational' understanding of stress on themselves generated self-compassion. A few mixed feelings were expressed on awareness of stress at the personal, micro-level, aligning with previous work highlighting the risk that perception of stress can, for some, lead to increased stress (Kersten-van Dijk et al., 2017; MacLean et al., 2013; Sanches et al., 2010; Yassaee & Mettler, 2019). Similarly, for some teachers in the study, choosing not to wear the Withings at night was motivated by not wanting to know about poor sleep. Future research could also look at whether there is other sensor data that could capture the demands of work that teachers or other public sector workers could find meaningful.

Data also took on the deeper significance beyond quantification to achievement, affirming teachers' use of self-management strategies, creating affective ties (Ruckenstein, 2014) similar to the 'qualified-self' (Boam and Webb 2014 quoted by Lupton (Lupton, 2016a, p. 6)). Here, self-affirmation from thinking through rather than just with data, was supported with visualisations enabling deeper reflection on achievements (Ruckenstein, 2014; Xue et al., 2019). This complements and extends previous research on positive framing of data in PI (Epstein et al., 2016) and that reflection as a component of tracking can come after, not simply before, acting (Epstein et al., 2015). As suggested by Baumer, asking about the benefits reflection provides in a context can be a more useful question than trying to quantify how much reflection is done (Baumer, 2015). These findings suggest the self-affirmation through cognitive re-appraisal for teachers that generated positive emotions could be achieved with personal data rather than relying on abstract self-affirmation statements (Morgan & Atkin, 2016).

8.4.2 Enabling choices for motivation and meaning

Through the populated taxonomy (Manning et al., 2022) teachers were given the choice of technology for stress management and how this could support their self-care strategy. In accordance with self-determination theory (SDT) (R. M. Ryan & Deci, 2000), this autonomy is a key motivator leading to engagement and therefore one possible explanation for the lack of attrition in the current study, with no one abandoning their technology before their final interview. Autonomy has been described as a key component *within* design architecture for engagement (Morrison, 2015). The current findings extend the engagement narrative to *without*, indicating contextually appropriate strategies and concepts should guide user choice of technology. This reflects understanding that there is no one-size-fits-all stress intervention (Howe et al., 2022; Paredes et al., 2014) and the hypothesised personal preferences such as time, location and personal relevance (i.e. external autonomous factors) are important (Perski et al., 2017).

These preferences link to the finding of personalisation. Personalisation through curating frequency, naming and timing of messages and haptic alerts was important, and all directed towards personally meaningful activities or boundaries. The Daylio app allowed some refinement to tracking and teachers made conceptual links between, for instance, heart rate changes on their wearable companion app with the day's events. Personalisation (also called tailoring and customisation) is a well attested facilitator for engagement with apps (Szinay et al., 2021) and a suggested guideline in personal informatics' stress management practices (K. Lee & Hong, 2018). The current study's findings confirm the value of an individual approach to considering what data is relevant given peoples' contexts (K. Lee & Hong, 2018; M. D. Lee et al., 2014).

8.4.3 Relatedness in the school context

Themes also affirm the value of social connectedness, noted in previous digital health research as highly valued (Lupton & Maslen, 2019) and important for engagement as

noted in broader digital mental health studies (Borghouts et al., 2021). For some teachers this study affirmed the concept of relatedness mediating thriving through technology design, as posited by the METUX model (Motivation, Engagement, Thriving in User Experience) which draws on self-determination theory (SDT) (Peters, Calvo, et al., 2018). Both seeing other teachers' responses on Teacher Tapp or messages from colleagues and family generated a sense of connection and belonging. This insight emphasises the importance of occupational and social connection at times of separation, which will be worth remembering should teachers ever have to work remotely again. Due to the COVID-19 restrictions, the current study was not able to verify the mutual support for activity through shared data previously shown with wearables offering social connection (Seo et al., 2020), including amongst teachers (Ertzberger & Martin, 2016). Digital connectedness to colleagues was less important when back on the school premises, where the shared environment permitted social (meso-contextual) conditions for relatedness, even with COVID-19 restrictions on staff movement.

Teachers' confidence in understanding stress was demonstrated through compassion towards colleagues. Meso-level (e.g. culture) and micro (e.g. personal) contextual level perceptions of trust and support are predictors for lower stress and burnout amongst teachers (Richards et al., 2018). Personal confidence was generated because the data was contextually situated and interpreted. Of note were the teachers who used the Teacher Tapp and Wysa apps. The participant who chose Wysa found it both empathetic, as designed (Inkster et al., 2018), but also that its use generated empathy for others, a transferability that appears to be novel, although hinted at when a gamified, visually responsive avatar was used in an online stress self-help system (M. Li et al., 2021). It also complements our other findings on relatedness. The two participants who accessed Teacher Tapp during lockdown appreciated knowing how other teachers were feeling in uniquely isolated conditions. The digitally enabled outcome of confidence can be seen to be mediated by both connectedness and competence, components of SDT.

The final theme corroborates conclusions from other studies that a reduction in use of technology does not necessarily equate to abandonment (Epstein et al., 2016).

Resilience without reliance on activity tracking should be considered a strength of personal informatics and it is important not to expect ongoing dependency on technology (D. Harrison, 2020; Renfree et al., 2016).

As a counter to Seligman's 'learned helplessness' (Seligman, 1972), five teachers in the autumn described an embedded notion of 'learned helpfulness', as they were able to apply stress-management strategies back in school without using technology in the moment. This does not contradict the initial need for sustained engagement (Stawarz & Cox, 2015; Zakariah et al., 2021), but it does raise questions about duration for effect, and designing in the opportunity to reminisce (Epstein et al., 2016). The current study benefitted from a long extension that allowed the study of evolving meaning making and demonstrated some embedding of positive habits, which has been shown in other shorter studies on stress management in the workplace (Paredes et al., 2014).

8.4.4 Strengths and limitations

To my knowledge this is the first qualitative study of High School Heads of Year experiences of technology enabled stress self-management. Rich, contextualised data from situated experiences and evolution of use was collected over an extended period enabling deep and detailed insight into its existential significance. Eight teachers completed the summer study out of sixteen who had been approached pre-pandemic, and just two were lost to follow-up in the extended period. This longitudinal study provided evidence of the value of technology to teachers for stress management support and the value of digitally supported self-care in an occupation renowned for its stressfulness.

A potential weakness is that participation meant there was some extrinsic motivation and would have raised awareness of stress and self-care, so a digital placebo effect is a possibility but possibly less of a concern given our focus on experience rather than efficacy (Firth et al., 2017; Jones et al., 2021; Stratton et al., 2021). Most participants had time to adopt their technology in a quieter environment due to most working from home at the start of the pandemic, even though their working days could still

be long and contain different sources of stress from usual. Further research could test explore experiences of technology adoption whilst in school under usual circumstances. Another limitation was the restricted choice of consumer technology. A limited choice was given in order that assurances could be given on suitability, availability, usability, security, validity and cost. There was thus a trade-off between assurance and full autonomy, something that could be explored further. Additionally, apart from Wysa, teachers did not choose technologies that offered treatment and guided self-management or were entertainment based. This could be due to a small number of participants, or a preference for the immediacy of a wearable, or in the case of treatment not wanting to see stress as something to be medicalised, as one teacher commented. This too could be further investigated.

8.5 Conclusion

Stress remains a significant problem for most teachers, including those in leadership roles. This research set out to understand teachers' experiences of using consumer technology to support their stress coping strategies. By enabling an informed choice of technology and investigating teachers' experiences and evolution of use, this analysis showed that both apps and wearables can generate data that creates a holistic understanding of occupational stress. Such knowledge is personally and professionally meaningful and motivational and was more so given the ability teachers had to compare stress-management when working from home as well as when back in school due to the pandemic. Understanding the significance and value of data and personal technologies is important for designers considering how best to enable people to self-care in different occupational environment and for different health conditions. Working together, developers, employees and policy makers too could better ensure consumer technologies can improve workforce health outcomes.

The next chapter continues to explore the data collected in this longitudinal study.

Chapter 9 Study Three: Answering RQ 4 – Facilitators and Barriers to Teachers' Engagement with Consumer Technologies for Stress Management

"We have to be very careful, and humble, when we think we know what is best, especially when it involves another human life". Professor Rosalind Picard, MIT

Parts of this chapter have been submitted as a paper and is now under peer review

9.1 Introduction and Motivation

Chapter 8 reported the findings from empirical research exploring teachers' initial experiences of selected stress-support technology and how these evolved over time. The second distinct question asked of the data is covered in this chapter and focused on facilitators and barriers to use of the technologies by the teachers. This chapter starts by recapping the gaps in knowledge demonstrated in Part One, and then details how the research question was answered.

9.1.1 Understanding of workplace digital stress support

We know that stress is a determinant of wellbeing, defined as 'the adverse reaction people have to excessive pressures or other types of demand placed on them' (NICE, 2022, p. 24). Digital platforms mean that personal stress management interventions are now accessible through the working day, via web and computer-based programmes (Heber et al., 2017), apps (Hoffmann et al., 2017; H. Hwang et al., 2022; Ly et al., 2014; Ptakauskaite et al., 2018) and wearables (Hao et al., 2017; E. N. Smith et al., 2020). Additionally, popular websites have been repurposed to provide stress management interventions (Paredes et al., 2014) and machine learning now has the

potential to help predict and plan for stressful events (Kim et al., 2022; Magtibay & Umapathy, 2023).

Some of these digital tools can enable both self-report and automatic detection of stress. Manually this can be achieved though ecological momentary assessment (L. Chan et al., 2018) and popular consumer apps such as Daylio and Moodkit allow reflection on captured feelings or symptoms associated with stress and wellbeing (Potapov et al., 2021; Schueller et al., 2021). Automatic detection can be through wearable sensors utilising galvanic skin response (GSR), also known as electrodermal activity (EDA) (Sano & Picard, 2013), through photoplethysmography (PPG) to detect heart rate variation (HRV) (Hao et al., 2017; Pinheiro et al., 2016) and from smartphone text language (Byrne et al., 2021). Equivalence of stress detection in the real-world has been demonstrated between manual self-reports and both automated GSR or voice-based analysis (P. Adams et al., 2014). Some workplace studies have illustrated occupational associations changes in use of a mouse or keyboard shown to be a valid proxy for stress (Hernandez et al., 2014), smartphone sensors have also detected stress through the human voice (P. Adams et al., 2014; Lu et al., 2012) and phone usage data is also correlated (Vildjiounaite et al., 2018). However, these examples also show their contextual sensitivity and irrelevance for, say, teachers in their noisy, dynamic, didactic environments.

Human-computer interaction (HCI) analysis only occasionally extends to a distal understanding in the value chain of how interventions work in context and why (W. Smith et al., 2014). Yet this is important for people using stress management interventions in the workplace, both with novel designs (Kim et al., 2022; MacLean et al., 2013; Sanches et al., 2010; Sano et al., 2017; Stepanovic et al., 2019; Xue et al., 2019) and consumer devices (Ding et al., 2021; Gjoreski et al., 2017; Pakhomov et al., 2020; Sano & Picard, 2013) as only real-world implementation and interaction enable understanding of contextual and design features that can then inform further evaluation, iteration and utility. The way contexts were framed was summarised in Chapter 8, at the end of section 8.1.1 with the aim of giving a little more clarity to what sort of context is being described.

9.1.2 What we know about facilitators and barriers

Personal data collection has facilitated correlations between stress and real-world stressors for teachers from their wearable data (Kocielnik & Sidorova, 2015; Runge et al., 2020); and enabled anticipation of stress for mitigation planning amongst students (K. Lee et al., 2020). Timing and choice of stress intervention or prompts can facilitate engagement. Desk-based workers described preferring prompts at the start of a task or day, lunch breaks or during the post-lunch circadian rhythm dip of 2-3pm (Sano et al., 2017). Autonomy to choose interventions has been linked to enhanced motivation and adherence to mental health interventions (Renfrew, Morton, Morton, et al., 2021). Where CBT, mindfulness and tailored stress-management therapies have been delivered digitally to employees from a variety of occupations, they have fared better in the workplace when supported or guided than not (Renfrew, Morton, Morton, et al., 2021; Stratton et al., 2017; Zarski et al., 2016). One population specific stress intervention role-playing game (RPG) showed design could be relatable to a specific cultural context (M. D. Lee et al., 2014).

In education, despite some extensive trials with teachers (Ansley et al., 2021; Ebert et al., 2014; Kocielnik & Sidorova, 2015; S. S. Leung et al., 2009; Persson Asplund et al., 2018; Runge et al., 2020; Thiart et al., 2013, 2015), qualitative insight on facilitating features of digital stress interventions are few. However temporal flexibility of intervention (Ansley et al., 2021; S. S. K. Leung, Chiang, Chui, Lee, et al., 2011); informational support (Klap, 2020); and anonymity and enabling peer social support (S. S. K. Leung, Chiang, Chui, Lee, et al., 2011) have all been credited as facilitators. In other workplaces, interesting content and interactivity, short completion time, and progress tracking for reflection and reminders (Carolan & De Visser, 2018) and personalisation in apps were appreciated (Alhasani et al., 2022; Howe et al., 2022) and flexibility, goals and calming strategies desired (Blankenhagel et al., 2019). Synthesising this workplace literature, facilitating themes for digitally supported stress management emerge as personal choice over timing, supported reflection and relevance.

Barriers to digital workplace stress interventions are from heterogenous sources but include concepts relevant to teaching. They can include lack of information: not understanding how to respond to data or lack of instructions and the need for 'communities of practice' (Ding et al., 2021; Kocielnik & Sidorova, 2015; Lave & Wenger, 1991; Tucker et al., 2011). Meso-contextual barriers have included time pressures (Blankenhagel et al., 2019; Counson et al., 2021; Sanatkar et al., 2022), lack of privacy (Tucker et al., 2011) and cultural stigma from having to admit a need or the intervention being for 'mental health', or lack of active management support for intervention deployment (Carolan & De Visser, 2018; Havermans et al., 2018; Peters, Deady, et al., 2018; Tucker et al., 2011). Personal barriers include being unmotivated (Carolan & De Visser, 2018) or lacking autonomy or choice over design intervention (Havermans et al., 2018; Stratton et al., 2020).

9.1.3 Summary

Studies have shown the opportunity for both manual and automatic stress detection, with some insight from the workplace on teachers being able to correlate data with stressful circumstance, and that flexibility of intervention timing, social and educational support, and anonymity facilitate use. Conversely lack of support, time, choice and privacy stymy digitally supported stress management.

Therefore, the following questions were posed to create a deeper understanding of the barriers and facilitators of teachers' technology use, both in terms of technology features and in terms of the contexts of use.

RQ 4 How can consumer technologies facilitate stress management in the school environment?

With sub-questions:

RQ 4a What were the facilitators and barriers to teachers engaging with their technology?
RQ4b How could the school support use of consumer technology for stress-self-management?

These questions were posed firstly to generate thick descriptions with the aim of understanding how to improve interaction to support stress management. The second aim was to generate insight into teachers' self-management in the macro-context of education and how schools could better facilitate digitally supported stress management.

9.2 Methods and Analysis

Details of methods were described in Chapter 5 section 5.7 and summarised along with the materials in Chapter 8 section 8.2. All eight teachers were included in the analysis, as summarised in Table 9.1, with participants denoted as T1 to T8. There was additional autumn interview data for T1–T6.

Each participant chose their technology based on the stress-management strategy they wanted to support, and the conceptualised mechanism that was enabled by the design. One teacher had hoped to use an additional app, Fit2Teach, but the lack of updates and contact from the developer meant this had to be ruled out. Another teacher was initially interested in the SilverCloud online programme, but on signing up she was put off by the clinical nature of the presentation.

T No.	Technology Choice	Time as teacher	Chosen Stress management strategy / **Tech** Supported Concept (1st/2nd)	Duration of technology use (from download or receipt and night-time use)	Extra Features desired (or already present but undiscovered)
T1	Daylio and Wysa Apps	>10 yrs	**Cognitive / Reflection** **Cognitive / Self-management**	20 weeks continuous then a few missed days before autumn half-term	Better data visualisation Congratulatory messaging
T2	Withings' Watch – Wearable	>10 yrs	**Physiological / Reflection** and Peer-to-Peer Social	22 weeks (including nights)	Ability to link raised heart rate with correlations in a diary (Raised heart rate warning)

T3	Withings' Watch – Wearable	>20 yrs	**Physiological / Reflection** and Peer-to-Peer Social	22 weeks continuous (night wear quickly discontinued)	Ability to track gardening / not just sport activity
T4	Withings' Watch – Wearable	< 10 yrs	**Physiological / Reflection** and Peer-to-Peer Social	15 weeks continuous then 4x/week for next 7 weeks (night wear quickly discontinued)	Link between calorie expenditure and nutritional advice Slimmer - Too bulky to wear at night (Naming alarms)
T5	Teacher Tapp	>10 yrs	**Educational / Reflection**	7 weeks 2 days continuous then occasional use for 7 weeks in autumn term	Mindfulness section and link to Yoga workout as reminder to take breaks
T6	Withings' Watch – Wearable	>20 yrs	**Physiological / Reflection** and Peer-to-Peer Social	27 weeks continuous (including nights) included planned health leave for 6 wks	Longer range Bluetooth connectivity More than three alarms (Naming Alarms)
T7	Withings' Watch – Wearable	>10yrs	**Physiological / Reflection** and Peer-to-Peer Social	7 weeks' intermittent wear Also picked up Teacher Tapp intermittently	None
T8	Withings' Watch – Wearable	<10yrs	**Physiological / Reflection** and Peer-to-Peer Social	8 weeks continuous	Indicators of normal parameters with solutions focus/signposting in the Withings' App (Raised heart rate warning)

TABLE 9.1 SUMMARY OF TEACHERS, STRESS MANAGEMENT STRATEGY AND EXTRA FEATURES DESIRED

The data was richer for the six teachers who took part in the extended study and were interviewed in the autumn term, given both the longer duration of technology use and their experiences of supported stress management once back on the school premises. These data allowed for a comparison of practice and familiarity and further design insights. Of the two teachers who did not participate in the extended study, one Head of Year responded to the final interview request but then cancelled and did not rearrange the interview. The other teacher (an Assistant Principal) did not respond to email or text messages. It is important to note that schools and teachers

remained under intense pressure, including now having to incorporate in-school COVID-19 hygiene restrictions.

9.3 Results

A total of eight teachers completed the summer interviews and six were involved in the extended study in the autumn of 2020. Most teachers were working from home during the summer term due to Covid-19 restrictions. They were all back in school in the autumn but in 'bubbles' segregated by year group, moving between classes instead of students moving around the school and with extended school days due to staggered student arrival times. The sample were ethnically diverse, with just one male participant in both summer and autumn studies.

Teachers described how they began to use their technologies and which features facilitated their interaction with the technology and awareness of their stress. Quick and discreet interactions were complemented by passive data collection, making use simple, convenient and private. Automated prompts and data collation facilitated easy engagement and awareness of stress patterns and associations. However, the teachers described having to be persistent with adoption, as inadequate instructions required them to experiment and use social media to discover more features. There was a particular issue reported with the Withings measuring sleep when they were awake, and a desire that this wearable could detect automatically when activity was related their job or their stress-relieving exercise. For fuller use and benefits to be realised, teachers described creating a culture in which it is socially acceptable manage and talk about stress, where privacy was facilitated, and self-care with technology was normal and personalised from the start of a teacher's career. This would legitimise experiences of pressure and permit self-care.

A summary of themes is shown in Table 9.2, then each theme and subtheme are described in more detail. The participant code is included at the end of quotations in the form of teacher number (T1, T2 etc), the technology and the term (summer or autumn) from which the quotation was taken.

Theme	Sub-theme
Technology design facilitated interaction for teachers	Passive collation of data is convenient
	Brevity of interaction simplifies usability
	Discreet appearance encourages use
Data presentation enabled teachers' stress awareness	Automated reminder for cognition or reflection
	Correlating patterns in the macro-context of education
	Ability to relate to colleague's stress
Barriers with instructions, accuracy and other limitations	Inadequate information supplied on technology adoption
	Insufficient instructions on technology features and limited strategy options
	Variation in usefulness, accuracy and accessibility
	Need for differentiation for data relating to stress management strategy
	Competing workplace demands can overwhelm use

Managing meso-contextual barriers could offer a framework for a caring school culture	A physical environment that facilitates taking a break and privacy
	Making it socially acceptable to talk about stress
	Normalising and personalising self-care with technology from the start

TABLE 9.2 SUMMARY OF THEMES IN ANSWER TO RQ4

9.3.1 Theme One: Technology design facilitated interaction for teachers

This theme captured how the design and features supported rapid technology use, and teachers conveyed a sense of confidence that interaction could therefore take place without anyone knowing.

9.3.1.1 Sub-theme 1.1: Passive collection of data is convenient

Although Withings can be set to record activities, it also automatically registers when the wearer goes for a walk. Teachers appreciated this convenience and the option to either reflect on data in the moment or at a time of their choosing. Teachers using the Withings watch liked the fact that it was 'just there' on their wrist, and this of itself could motivate activity.

> *I go from here to work and walk or I do a walk, it will still register when you download it as a walk. Or you can then programme it and it will still register it as a walk. So that's good in the fact that it knows it's not just general walking around, it does it as an activity even though I haven't put it and logged it as an activity. T3, Withings, summer*

In-the-moment reflection was facilitated by setting haptic notifications; one teacher described being able to set an alert triggered by her heart rate.

> *I know if I'm getting totally stressed, I'll have a look at [the watch] now.*
> *And I'll go, hold on, it's not worth this, just slow down… you can set an*
> *alarm when your heart rate goes over a certain amount…Just a buzz, and*
> *it tells you where your reading is. T6, Withings, autumn*

9.3.1.2 Sub-theme 1.2 Brevity of interaction simplifies usability

Several teachers spoke not only of the convenience of passive data collection but of this being complemented by the brevity with which data could be viewed. This cognitive ease of viewing Withings was true for two apps as well, even though the data collection design required active engagement.

The contrast between working from home and in school can be seen in a teacher's report of using her app in the summer and then towards the end of the autumn half-term, when even the brief interaction could be overwhelmed by ongoing workplace demands.

> *As soon as [I] turn my phone [on] you see all the faces that come up*
> *straight away…And (later) I hear the brrrrng… I look down… I just do it*
> *quickly. T1, Daylio, summer*

> *But I know that I've missed days, not from not wanting to do it, but I*
> *forgot to do it. I'm using it then I say okay, I'll do it in a minute…I think*
> *the last two weeks, I've been really tired, really, really tired. T1, Daylio,*
> *autumn*

Another contrast could be seen between apps that offer tracking or treatment. Whilst both were accessible, only the former was usable in school, although the understanding facilitated by the latter was appreciated.

I like Wysa. But…You can't just do a quick fix…I was using Wysa, and it must have been about 45 minutes later [I thought] I've got to go to bed!...as a result of that…I don't use Wysa as much. T1, Wysa, summer

9.3.1.3 Sub-theme 1.3: Discreet appearance encourages use

The concept of cognitive ease also included the ability for discreet use, including using the messaging feature of the Withings to triage notifications, with the sender and start of message view enabling teachers to decide whether the whole message or email needed immediate attention or not. The subtle design of both the wearable and tracking app was commented on by most participants.

… I'm not typing in anything. It's very simple to use… You can actually press the buttons and then press okay and then it just goes away straight away. Nobody needs to know why you are using [it] or what that's for. T1, Daylio, summer

The brevity of interaction or unobtrusive haptic notification built into the Withings worked together with discreet design to facilitate use.

I know now if my arm's vibrating, I can just take a quick look. And if I think it is something that I need to address, then I can, and if it's not, just ignore it. I got into trouble for having my phone out before. T2, Withings, autumn

9.3.2 Theme Two: Data presentation enabled teachers' stress awareness

The essence of the first theme was cognitive ease, and this was also true for data presentation. Use was further described in terms of how prompts and patterns made interacting with data simple, and teachers reported their data was a useful quantification of their stress and they could see information relevant to educators.

9.3.2.1 Sub-theme 2.1 Automated reminder for cognition or reflection

As teachers used their technologies, both automation of questions linked to data collation and seeing raw data with the chance to capture other activity were appreciated as prompts to take further action. For the teachers using Daylio and Teacher Tapp, the automated reminders to record emotional state or answer education-oriented survey questions facilitated the opportunity to stop and think, although the frequency of doing this was significantly curtailed when they were back in school full-time. Some attributed this entirely to the ongoing pandemic.

> *Looking at it, and then it'll prompt you, if you like, so how many more steps do you want to do, what have you done? It congratulates you, it just does nice stuff on it. T6, Withings, summer*

> *Teacher Tapp was asking you your thoughts, or…there were a couple of times it asked you specific stress questions as well…that made me think, okay, what am I doing? Should I try some mindfulness? Should I take some time off? Am I reflecting on my work?…During COVID and being (out of) school, [I used Teacher Tapp] almost 99–100%. Now that school's started, completely the opposite, I'd say I've probably used it ten times…if I was back to school and it wasn't a pandemic, I'm still adamant I would use it. T5, Teacher Tapp, autumn*

9.3.2.2 Sub-theme 2.2 Correlating patterns in the macro-context of education

Throughout the study, many teachers mentioned the patterns they could see in their data as being informative and relevant. This could simply be the visual display of their activity readings or tracking display, as shown in the Withing's Health Mate companion app or on the Daylio app. It could be data showing a raised heart rate and making post-hoc correlations between it and with a stressful situation during the day or episodes of a particular in-school activity.

> *I'm looking at the data like steps, heart rate, because you can track it during the day when you go onto the app, and you can see your heart*

rate throughout the day. You can see where things, you can say, yes, that

was where I was…dealing with a stressful situation T6, Withings, Autumn

As the Daylio app allowed the tracking through emoticons, the teacher using it was able to see the connections between a less satisfactory day and her physical wellbeing.

I actually started to note the days that I'm not feeling physically well are

the days, and I note it as a 'meh' day, so you can see where the pattern

is when I do that. T1, Daylio, Summer

Awareness of these patterns in the data was interlinked to the theme of relating data to fellow teachers.

9.3.2.3 Sub-theme 2.3 Relevance of information to situation

Teachers described the data not only quantifying their stress but facilitating education about their colleagues' stress as well. Two described Teacher Tapp survey results as providing relevant data on the broader educational system. The teacher using the chatbot described how the interactions equipped her with the language to talk to fellow staff and this was an unanticipated benefit:

What Wysa has helped me with is managing other people because of all

the tools that it gives you. So, even today, somebody was feeling a bit

down... And I said I'm sorry that you feel like that. It's something that

Wysa would say!... …Wysa is very educational, it's been more of an

educational tool of helping me to understand. T1, Wysa, autumn

9.3.3 Theme Three: Barriers with instructions, accuracy, and other limitations

Contrasting with the facilitating features of design, barriers were first evident from descriptions of the designers apparent assumptions that consumer technologies use could be entirely intuitive. This created some friction in their use. Usefulness of the

technology was hindered by lack of information, with some participants believing that features were not available when they were, and vice versa. Barriers also included a lack of automatic data differentiation and connectivity limitations. Again, these subthemes are interconnected.

9.3.3.1 Sub-theme 3.1 Inadequate information supplied on technology adoption

Five out of six teachers who used the Withings wearable commented on the lack of information provided with the watch. They all looked for more information on YouTube. Some teachers had found a feature that others thought was missing, but there was a strong sense that clearer instructions for all the technologies would have been appreciated.

> *I think for me, doing this has been more of a trial and error, and working out, oh this is what you do. But if there was a better instruction manual, it'd be easier to work through things…The YouTube things are great because I'll watch [and] they can [show you how to] do this and that. T1, Daylio, summer*

The inadequacy of instruction was related not only to the functional use of the Withings watch but also to what data constituted 'normal' for the user, and how data could vary. Some teachers were worried by their raised heart rate or commented that seeing their personal data and variation in isolation was worrying.

> *Also, the only thing with the watch and its limitations is, you don't really have a national comparison…As in, I find there's ten beats per minute difference between me at the weekend, and me at school. So, on the weekend I average 73, 74 resting heart rate. Whereas in school, it's 83, 84. And I'm like, is that normal?...Obviously, I'm more stressed, you'd expect that, but is that the same average (for other) people? T8, Withings, summer*

9.3.3.2 Sub-theme 3.2 Insufficient instructions on technology features and limited strategy options

Alternative stress-management features, narrowness of existing features and lack of signposting were described by teachers as insufficiencies in their technology. The desire for a greater plurality of features often related to alternative stress management strategies that teachers described when on the school premises. Instructional insufficiency was seen when one teacher, asked about improving the Withings, said that she would like there to be a food diary. Yet this was already a feature on the companion app that another teacher had mentioned. Another example was where two teachers described the haptic notification function and how they would appreciate being able to set it to alert if their heart rate was raised, yet another teacher described that she had done this. However, the teacher that had managed this also expressed disappointment that the alarms she had set up as reminders to drink could not be named, yet other teachers had described naming their alarms.

> *What would I like the watch to be able to do?...Set multiple alarms more than I'm doing now, I think. You can set multiple alarms [but I would want to name] an alarm to say, have a water break....I don't set it for anything else [now] other than [as a] cue to have a drink, make sure I'm drinking. T6, Withings, autumn*

The point was also made that having exercise limited to sport was a missed opportunity to label data on activities such as gardening or cleaning. Sometimes secondary technology concepts supported alternative stress-management strategies such as social connection, unanticipated before the social isolation of lockdown. However, some of the teachers wanted more strategies supported by their technology.

> *Maybe Teacher Tapp could be changed...I just found as someone that likes to read and get information it...brought me into that mindset that I was still working...I'd definitely make a part where there's yoga or*

mindfulness sections allowing people to get away, just a different
strategy. T5, Teacher Tapp, autumn

9.3.3.3 Sub-theme 3.3 Variation in usefulness, accuracy & accessibility

Comments on accuracy of the data collected were mostly positive, with one participant who had previously used another activity tracker stating that she "couldn't cheat" with the Withings, as she had been able to increase her activity reading simply through shaking her old tracker. However, inaccuracies were mentioned by several teachers, including the Withings recording them as sleeping when they were not.

One thing that I was confused about…It measured me sleeping when I
actually wasn't… T7, Withings, summer

Accessibility of the technology was a theme that meant different things to teachers. Teachers with the wearable reported appreciating that the watch was 'just there' on their wrists and easy to view during the working day, but one needed spectacles to see it. Using a smartphone app during the school day required forward planning for proximity, either to simply access the app or for the short-range Bluetooth required for message transmission between the phone and watch.

Normally I used to just put [my phone] in my bag. But what I've done,
I've bought a pouch… so if I'm wearing a dress or it's something that
hasn't got pockets, then I can put it in my pouch and keep it on me… T1,
Daylio, summer

I haven't got the connection [in school] to [receive messages]…You
have to be within a certain distance, and I'm never within that
distance…maybe… if I put my phone in my laptop bag…so that it's with
me, but the kids don't know I've got it. Because I don't like to have my
phone around. T6, Withings, Autumn

Most teachers liked the presentation of data, but it was observed that a more visual display of data could be more compelling and relatable to the associated activity.

It [Daylio] gives you all the data, it breaks it down, say, how many times you've done this, how many times you've done this, etc…but I guess it would be good to have a visual...where you have a bar chart or something that's blatantly obvious… a sunshine, or something, I don't know. Feel good. Happy. Oh, wow, there's that sunshine, that rainbow, wow…So, you've had these good days because you've done X, Y, Z. T1, Daylio, autumn

9.3.3.4 Sub-theme 3.4 Need for differentiation for data relating to stress management strategy

Descriptions of how the data were relevant to participants' working lives as teachers included capturing the demands of the day. However, for some differentiation between stress self-management activity from activity intrinsic to the job required remembering to activate specific tracking as it was not automatic. One teacher described it as an additional task, although possibly unrealistic as five out of six teachers described a decrease in interaction with technologies overall in the autumn term.

I think for me…[the technology] was a really useful reminder for me to keep fit, to keep active…I think that really made a big difference to my mental wellbeing in the lockdown…[but] there's no breakdown on where that activity is coming from in the day…I need to get better at…turn[ing] the activity on…to differentiate how much of my activity is actually coming from something good, and then how much of it is from walking around. T4, Withings, autumn

The decrease in interaction in the autumn relates to the final theme of managing technology use in the meso-contexts of school life.

9.3.4 Theme Four: Managing meso-contextual barriers could offer a framework for a caring school culture

Barriers to engagement were also external to the technology. All the teachers using their technology in the physical school environment expressed a clear sense of competition between technology interaction and occupational demands. Also, the ongoing pandemic meant that routines were not the same and the extra or different demands on teachers' time sometimes eclipsed use of the technology. Some wondered how their interactions would have been different had they begun using their technology whilst on school premises. Despite the meso-contextual barriers of time, space, and social and culture norms, teachers' raised awareness of stress management through technology notifications or data meant some did still try to activate stress-management strategies during the school day.

Teachers considered that by leveraging personal technologies, schools could embed self-care from the start of a teacher's career. The aim would be a school culture and environment in which self-management of stress became normative.

9.3.4.1 Sub-theme 4.1 Competing workplace demands can overwhelm use

Teachers described a frenetic working environment in school in the autumn, which had not been the case during lockdown and working from home. Four teachers talked about responding to technology alerts or notifications on the school premises, three of whom described this being done 'on the run' between activities – if they responded at all. This was despite participant unanimity on the data-facilitated opportunity to reflect on personal wellbeing. This temporal barrier to interaction was possibly more noticeable due to teachers experiencing the contrast of job demand between working from home and working back in school.

> *I feel motivated when it beeps to tell me that I've done so many thousands of steps in the day, but I'm running around like a headless chicken so much that it [the technology] could be ringing or [alerting] emails or texts, and I don't even notice it. T2, Withings, autumn*

Teachers still used their technology but most interacted with it less when back on school premises, some putting this down to the ongoing disrupting effects of COVID-19. Wysa was described as needing a 'quiet space' and both Wysa and Teacher Tapp needing time and 'work' for interaction.

> *But because there's a pandemic and things arise, you don't have the routine…The [Teacher Tapp] alarm goes off at 3.30 but I'm always caught in the middle of something…with people getting sent home or staggered departures or parents wanting to meet you, it just fell behind. T5, Teacher Tapp, autumn*

9.3.4.2 Sub-theme 4.2 A physical environment that facilitates taking a break and privacy

Staff talked about the need to have brief respite from being in public view, or always 'performing', but having no staff room to facilitate this. To gain just a few minutes' peace, five out of eight teachers in the summer described (pre-pandemic) having hidden in the toilets, or in the comer of a classroom or in a colleague's office or going outdoors where they could not be found. One teacher said there was no point trying to have a break during the school day as she would always be disturbed. Now they wanted to use their technology or act on the data to de-stress, they described being more aware of the physical barriers to doing so. Others talked about making an extra effort in the autumn to act on the knowledge gained from their technology in the summer when there were few physical constraints.

> *I think things that I learnt over the lockdown, and with the technology, I definitely have brought into this term...(I am) trying to take a lunch break…I'm just trying to take at least 15 minutes of the day to just sit down because I wasn't even sitting down, really, before. Ever. T4, Withings, autumn*

For one teacher, teaching in a new environment having moved school in the autumn, the added structures in place meant that having a break was more realistic.

I think just better structures, so different things happening at the different times that you know about and everybody just sticks to what they're supposed to do…But break, lunch, I am on duty sometimes but I make sure I'm supporting the staff. But yes, to get a break, again, that's down to structure and routine so I'm more able to get a break [now]. T5, Teacher Tapp, autumn

9.3.4.3 Sub-theme 4.3 Making it socially acceptable to talk about stress

From the start of the study, teachers had reported a reluctance to talk about stress in school or to share sentiments of stress with some of their colleagues.

I think teachers' stress is still quite taboo, to be honest, within the workplace…I think it can be seen as a sign of weakness. T4, Withings, summer

Having used their technology, some teachers considered that data could be used to demonstrate objectively to the leadership where situations in school were more stressful. If leadership encouraged discussion of stress based on data this could facilitate both technology use and targeted problem solving.

I think if you could show them the value of using it, [say] with the tool, these [data show] where I'm most stressed, this is where I'm not… if you put me in here this is where I stress. …if we could show that there's ways of tracking stress, I don't know, they might value it. T6, Withings, Autumn

9.3.4.4 Sub-theme 4.4 Normalising and personalising self-care with technology from the start

Some participants described technologies as an opportunity to introduce self-care right from the start of the profession. If the school leadership facilitated this it would send the cultural message from the outset that teachers' self-care is important.

> *Yes…I think that we should start to use them [technologies] earlier on in [our] teacher career, because then it helps you to focus on your wellbeing as an individual, and help you with your stress, your work/life balance…As a teacher, you don't actually look after you, you look after everybody else's people. But if you can't look after yourself, it's going to be very difficult for you to look after others. T1, Dalyio and Wysa, autumn*

Some considered that using technology for self-care would also remind teachers that they had a responsibility to look after themselves: not that they bore the entire burden of stress management, but that they had an important part to play.

> *I think there's a lot to be done, and I think technology is certainly a way that we could manage that, because I think it's very easy, and I recognise this in myself big time…to blame the job, blame the role, blame SLT, blame the marking, blame the kids, which obviously is a huge factor. But I think actually there's a lot more we could do as individuals, just to take that time to dedicate to ourselves, reduce our stress levels in whatever way that might be. T4, Withings, summer*

9.4 Discussion

To the best of my knowledge this is the first study to describe facilitators and barriers to personally chosen technology support for stress self-management in the educational context, along with insight into how schools could facilitate such interventions.

As shown in the findings, the themes generated indicate specific features, data collation and technology supported concepts that facilitated teachers' use during their working day. Contrastingly the barriers to use centred around lack of information and signposting, and external, school related meso-contexts that inhibited use or putting their stress-relieving action into practice as planned. These themes are now unpacked further.

9.4.1 Insight into design facilitators of technology use by teachers

Teachers expressed their appreciation of the wearable appearing to be a watch, not an obvious tracking device. They also liked the rapidity with which Withings data could be viewed and the Daylio app could be used, thus preventing potentially stigmatising exposure. These themes reflect the persistent taboo of experiencing stress, and teachers' fear of not being perceived to be able to cope. Discreet *design* has been noted before as a facilitator for recording feelings (Barker, 2021; Schueller et al., 2021) and for use of technologies by employees for stress management (Carolan, Harris, Greenwood, et al., 2017; Carolan & De Visser, 2018), and that the aesthetic of design of wearables is important (H. Yang et al., 2016). Added to the knowledge that short interventions are important for stress management for provider and user (Blankenhagel et al., 2019), including in constrained workplaces (Counson et al., 2021), we suggest designers should ensure that where perceived risk of stigma in the workplace remains, design camouflage would encourage engagement for teachers.

Immediacy is increasingly being facilitated by wearables and sensors (Woodward et al., 2019). The Withings watch enabled stress awareness with cognitive ease both through passively collated data and through haptic notifications. Haptic stimulation has been shown to have a positive influence on attitude to accompanying messages and that such a physical cue is motivational (Hadi & Valenzuela, 2021). Our findings suggest that for teachers in their polychronically demanding environments, such a physical cue facilitates engagement up to a point, dependant on the individual and competing demands. The exception to immediacy was Wysa, which required deliberate, sustained engagement. Temporal constraints precluded use in school, but Wysa (the chatbot) was described as a 'best friend' for giving contextually applicable advice that was both educational and transferable. Such high-effort, problem-solving interventions have been found to be more effective for IT workers than low-effort, positive distractions (Howe et al., 2022). Therefore, we suggest that cognitive ease can also enable digitally supported stress management by virtue of ease of application of learning, not just the immediacy of information.

This applicability of the chatbot advice also links to the finding of the importance of contextually mediated reflection on patterns for engagement. This aligns with research hinting that more contextualisation facilitates engagement (Park et al., 2019) and the noted lack of contextualisation in mood-tracking apps used by the general population (Schueller et al., 2021). A combination of data patterns that could be correlated by the teacher to their circumstances, and the legitimacy of the intervention as facilitated by the school leadership, enabled teachers to reflect on their stress, associations and plan mitigating actions.

Teachers identified automated prompts for taking more steps or meditating, or messages of affirmation when an activity had been undertaken, as helpful. This complements teachers' reports of appreciating congratulatory text messages of support via WhatsApp (Cansoy, 2017). Elsewhere, police officers using wearables to track activity (Buckingham et al., 2020) and working-age women with technologies meeting self-set goals (Lupton & Maslen, 2019) have also reported the motivational aspect of digital messages of encouragement. Prompts or reminders for stress management can be pre-planned or automated through algorithmic analysis of data (Lee 2020, Kim 2022). Conversely when prompts are not received, stress awareness amongst Chinese adults was reduced as was their ability to manage their stress (Ding et al., 2021). Even for people in less restricted roles than teaching, receptivity to automated supportive messaging is highly dependent on contextual variables (Bhattacharjee et al., 2023). Future research could consider how messaging could be refined to enhance stress management amongst employees in temporally demanding roles.

9.4.2 Barriers to technology use described by the teachers

This study validated the established need for good data visualisation with improvements suggested for the Daylio app and readability of the Withings digital display screen. Stress data visualisation has been tested at the organisational level (Stepanovic et al., 2019) but this would be difficult to translate to schools. Paucity of set-up information supplied with the Withings was commented on by five out of the

six users. Teachers resorted to YouTube (not the Withings website) for guidance, although not knowing what constituted 'normal' data remained a problem for two of them. Social sensemaking with PI has demonstrated that value can be gained from contextualising data through comparison with peers (Puussaar et al., 2017), but covid-19 would have been a barrier to this. The app users also cited apparent design assumptions of intuitive use, particularly with Daylio, which delayed full adoption. These barriers to adoption extend the finding of inadequate technical instruction in a digital mental health review (Borghouts et al., 2021), adding a specific example of a wearable consumer technology adopted for stress management (only two papers out of 208 were for wearables in Borghout's review and these were for tracking serious mental illness). Wearable connectivity was found to be limited by Bluetooth range, a challenge noted generally with digital stress support (Goodday & Friend, 2019), which for teachers specifically related to the proximity of their smartphone, often not kept with them (Manning et al., 2020). Designers therefore need to remember that users still need comprehensive navigational advice and that they cannot assume proximity between wearables and smartphones for all occupations.

Some teachers were disappointed that the data indicated sleep when they were awake, despite Withings' reputation for accuracy (Kaewkannate & Kim, 2016). This has been noted in studies of Fitbits (Liang et al., 2017; Liang & Ploderer, 2016). Liang et al suggested the companion app should allow the user to edit their inaccurate data, an important consideration because inaccurate data is generally a reason for abandonment (Attig & Franke, 2020). This remains a consideration as users have perceived stress algorithms to be at odds with their subjective experiences (Sillevis Smitt et al., 2022).

No other inaccuracies were noted by teachers in this study. Several teachers wished that their technology offered alternative strategies, e.g. relaxation as well as education, partly because stress symptoms can change over time. This adds to similar reports for greater plurality of features or strategies from other studies (Carolan & De Visser, 2018; Christmann et al., 2017; Konrad et al., 2015; K. Lee & Hong, 2018). However, this must be balanced against extent of choice (Schwartz, 2000), as too much choice in digital tools could be overwhelming (Yardley et al., 2015).

Temporal constraints led to reduced frequency of interaction with technology for most of the staff when back in school, a barrier to interaction which can only be discerned in real-world evaluations (Sarker et al., 2014). Notably this was only detected because of the extraordinary circumstances of teachers able to compare working from home with working back in school, and because sustained engagement was still demonstrated months after initiation. The text-heavy Wysa (never accessed in school) and Teacher Tapp apps (significantly reduced interaction in school) were most affected. Counson found vocational intensity was a barrier to engagement with a stress management app co-created with doctors (Counson et al., 2021) and professional demands constrain time and enthusiasm for digital health interventions generally (O'Connor et al., 2016). Thus organisation-level solutions are likely to be required as well, connecting to the final finding, that teachers' desire is for a workplace culture that facilitates self-care and caring. Such a culture requires facilitation of meso-contexts such as time and physical environment. Although other studies have utilized machine learning to judge the best timings for stress interventions for students and in offices (K. Lee et al., 2020; K. Lee & Hong, 2018; Paredes et al., 2014; Sano et al., 2017), the polychronic nature of teachers' work would make finding patterns in behaviour and just-in-time interventions more challenging. In addition, during the school day stress management can require privacy, for example in the form of a staff room, with lack of privacy being a known deterrent to interaction generally for digital mental health (Borghouts et al., 2021).

9.4.3 Implications for the school workplace

The findings on both facilitators and barriers to teachers' engagement suggest that school leadership could leverage technology to support stress management. Some alerts can prompt teachers' just-in-time stress relief strategies or simple self-care such as having a drink. Yet teachers also need supportive meso-contexts such as private space in which to relax, protected time when they are undisturbed and a culture in which stress is seen as a warning and not a weakness. This need for a positive organisational culture for stress support has been noted before by office workers considering use of personal digital tracking and e-coaching (Lentferink et al.,

2018). As several teachers commented, what is the point drinking water to keep hydrated, if there is no time or provision (in their building) or even acceptance that they will then need to use the toilet.

9.4.4 Strengths and Limitations

In addition to the strengths and limitations detailed in Chapter 8, Section 8.4.4., a key strength of this analysis is that it shows the acceptability of consumer technology to teachers for stress management support and which features were of value for self-care in an occupation renowned for its stressfulness.

Another strength was that it was undertaken with teachers who taught many socio-economically deprived students, typically a more stressful setting. Teachers in more affluent areas or working with more economically advantaged children are known to experience less stress (Abel & Sewell, 1999; Camacho & Parham, 2019; Shernoff et al., 2011). Thus, the findings should benefit teachers in more challenging situations. It was poignant to hear of teachers in the autumn term talking about children returning to school after the pandemic without even a pen, let alone lunch money.

A limitation is that the participant sample cannot be claimed to be representative of all secondary school Heads of Year, although this study makes an important contribution, given the dearth of research with middle managers. The sample were self-selecting and only one Head of Year was male, but the racial mix was diverse. Also, the range of technologies was diverse and only four were trialled. Whilst the online programmes gave teachers the option of more complex and comprehensive interventions, none of them were chosen, and the single reason given for rejection, of Silvercloud's perceived medical nature, is salient and worth further exploration. In fact, of all the treatment, guided self-management or entertainment-based technologies, only Wysa was selected. This study invites further investigation of reasons and possible assumptions behind the choice of intervention made.

Given the paucity of information on teachers' use of digital interventions for stress or wellbeing, the ability to choose interventions was considered a strength of this

longitudinal qualitative study. Generating real-world insight from teachers using apps and wearables for stress management appears to be completely novel, and therefore useful feedback for developers, educators and policy makers.

9.5 Conclusion

Where consumer technologies are quick, easy and discreet to use, offer encouragement and enable personalisation they could have an explicit role in facilitating teachers' understanding of and managing their stress. Developers should not make design assumptions of users intuitively discovering all features, and the ability to manually amend some data should be facilitated. School leadership has an important part to play in facilitating stress management, and technology use could contribute to a culture in which self-care is normative and discussions of stress are socially acceptable. The convenience and ease of technology engagement could be leveraged at the organisational level to integrate stress support. This invites the proposition that a teacher's ability to act on technology data is a proxy measure for a caring school culture. This would require both protected time and space on the school premises.

Chapters 8 and 9, which have detailed the second empirical study, conclude the second part of my thesis, Studies and Analysis. In Part Three, Chapter 10 presents an overarching discussion and highlights implications for research, policy and practice and avenues for future research.

Chapter 10 General Discussion

"Context is for Kings." Captain Lorca, Star Trek Discovery, 2017

10.1 Introduction

Motivated by the potential of consumer technology to support teachers experiencing consistently high levels of stress, this thesis was Informed by the literature and studies from the fields of digital health and HCI self-care, education and psychology. It was a small-scale qualitative investigation intended to generate insight into contextual and design factors influence on teachers' use of commercially available tools to self-manage their stress. To this end, chapters 6 to 9 reported the findings of three sequential studies designed to answer the following questions.

In Chapter 6

RQ 1 What is influencing teachers' current stress management?

In Chapter 7

RQ 2 How can teachers make a rigorously informed and supported choice of digital companion technologies to support their self-management of stress?

In Chapter 8

RQ 3 What were the teachers' experiences with their consumer technologies?

And in Chapter 9

RQ 4 How can consumer technologies facilitate stress management in the school environment?

Little research of this nature has been undertaken amongst teachers, despite many studies recommending that harnessing the potential of technologies requires a

targeted approach, such as a defined population, condition and clarification of contextual influences on use and design. Indeed, the strength of an HCI lens in healthcare has been described as an understanding of everyday self-care practices to improve the quality of life through the use of technology (Nunes et al., 2015).

In this final chapter, the main findings are summarised from the studies presented in the thesis and then discussed in relation to answering the overall research question.

10.2 Summary and contributions to knowledge

10.2.1 Contribution 1: A contemporary understanding of how secondary school teachers manage their stress and the contextual influences on their stress management and use of digital health tools.

To answer the first research question, Study One (Chapter 6) was designed to gain an understanding of the influences on stress management among teachers who have or have had pastoral management responsibilities. The findings revealed how meso-contexts could constrain stress management, that teachers mainly used secondary physiological and cognitive strategies, and most were already familiar with digital tools but had not always made the connection between the tool and supporting their stress management.

The qualitative study built on the approach of asking open-ended questions and conceptualising teachers' descriptions (A. Carroll et al., 2020; Richards et al., 2018; Sharplin et al., 2011). No attempt was made to disentangle occupational stress from stress per se, but the emphasis was conceptually framed as the adverse reaction teachers with pastoral responsibilities have to excessive pressures (NICE, 2022).

Temporal constraints were confirmed, already well attested in the teaching literature, with doubts expressed on the ability of teachers to adopt some stress-management strategies outside of research studies, given they are so 'time-poor' (Beames et al., 2023; Hargreaves, 1990). However, this study added detail on other contextual influences. Physical constraints included the inability to withdraw from

the frontline to a private space; social barriers included the enduring stigma of help-seeking; culturally, teachers felt their welfare was second place to students' and their stress management was purely an individual responsibility. However, school leadership was trusted, and constraints were understood to be sometimes beyond leadership control. Contextual stress indicators were also described, such as experiencing dehydration and isolation. Additionally novel insight into teachers' use of digital technologies included the inaccessibility of smartphones and apps during the teaching day; how digitally facilitated concepts of reflection, treatment and social support were supporting stress self-management; and that both diary and professionally focused apps not designed for stress management were being used. More than half used a wearable to support their wellbeing.

Reflections

These findings demonstrated a plurality of strategies and technologies adopted and valued by teachers to self-manage stress and indicated that exploring experiences with a single solution would be restrictive. Respecting autonomy has informed the HCI and health technology literature (Burnell et al., 2023; Morley & Floridi, 2019; Peters, Calvo, et al., 2018; Pieritz et al., 2021; Wagner, 2019) and is central to leveraging sustained motivation and wellbeing according to self-determination theory (SDT) (R. M. Ryan & Deci, 2000). Digital health developers can now draw on design heuristics derived from SDT principles (autonomy, competence, relatedness) to inform strategic support for wellbeing (Peters, 2022), and investigate the tensions between frustrating and satisfying design factors as mediated by the different spheres of experience (Burnell et al., 2023). But in the absence of evidence for any obvious pre-existing teacher stress management technology at the time, I decided to respect the principles of SDT by facilitating teachers' choice of technology even if in a limited way. Other reasons for this are explained in Chapter 7, section 7.1. The other decision made was to present consumer technologies to teachers as 'digital companions' (DCs) as explained in Chapter 3, section 3.6.

Both the findings and reflections meant that although not anticipated from the beginning of this research, the next step was to create a taxonomy that would enable

teachers to make an informed choice of consumer technology to support their stress management strategy. This analytical process to create and populate the taxonomy answered the second research question and was an innovation that is discussed in Section 10.3.

10.2.2 Contribution 2: Considerations for teachers and designers that can inform meaningful engagement with consumer technologies for stress management.

In answering the third research question on teachers' experiences of using their technology, data from the longitudinal study was used to construct case studies. Through conducting cross-case analysis, insight was generated into teachers' situated experiences of adoption and what use meant to them as it evolved in the summer when mostly working from home. Data from six teachers obtained from interviews in the autumn enabled their case studies to be extended.

The following statements form a set of considerations that can inform users and design features.

1. Explanatory power of contextually mediated data – teachers find quantified biometrics or self-tracking data are humanised by the context of work and this existential significance is enough to prompt action (Chapter 8 Section 8.4.1)

2. Awareness of stress is not always desired – seeing sensor data capturing heart rate or sleep quality is an individual preference, but other sensor data could be investigated for its utility in supporting teacher stress management (Chapter 8 Section 8.4.1).

3. Some users value the achievement that data represented, which can create affective ties – deeper reflection came from thinking through not just with data (Chapter 8 Section 8.4.1).

4. Some autonomy of both initial technology choice and within design architecture seems to support teachers' engagement (Chapter 8 Section 8.4.2).

5. Personalisation is important to all teachers, enabling them to choose meaningful activities and boundaries (Chapter 8 Section 8.4.2).

6. Some teachers find social connectivity meaningful, either in terms of instilling a sense of belonging or staying in touch (Chapter 8 Section 8.4.3).

7. Teachers' confidence from seeing their stress experiences quantified can generate empathy for colleagues, and some think data validated experiences could lead to more mutual trust between teachers and leadership (Chapter 8 Section 8.4.3).

8. Teachers learn from their experiences with the technology, meaning some will not need to rely on continued use over time (Chapter 8 Section 8.4.3).

Reflection on the SDT derived METUX model

This study acknowledged the importance of autonomy and competence by allowing the teachers some informed, personalised choice of technology, albeit limited. Competence and relatedness were enabled through both stress-management strategies and technology concepts, as suggested in the SDT-derived METUX model (Peters, Calvo, et al., 2018). The power of these psychological needs was affirmed through the generation of intrinsic permission. However, the findings indicate there is a power-play for teachers. There was an inclination for the teachers to perceive the meso-level contexts as powerful 'controlling contexts' (R. M. Ryan et al., 2012) with greater influence on their autonomy to self-manage stress when in school compared to when working from home. This perception of contextual constraints aligned with the findings of the first study, where technology choice was reported as largely unguided. An adaption to the METUX model is proposed, to demonstrate that the mediating concepts of SDT are themselves mediated by the meso-contexts in which they are experienced. This is depicted in Figure 10.1. Other recent work with the

METUX model also acknowledges how different spheres of user experience influence need satisfaction and proposes a way of measuring them (Burnell et al., 2023). Both findings invite designers, researchers and policy makers to better understand the effects of technologies within contexts or 'spheres of experience'.
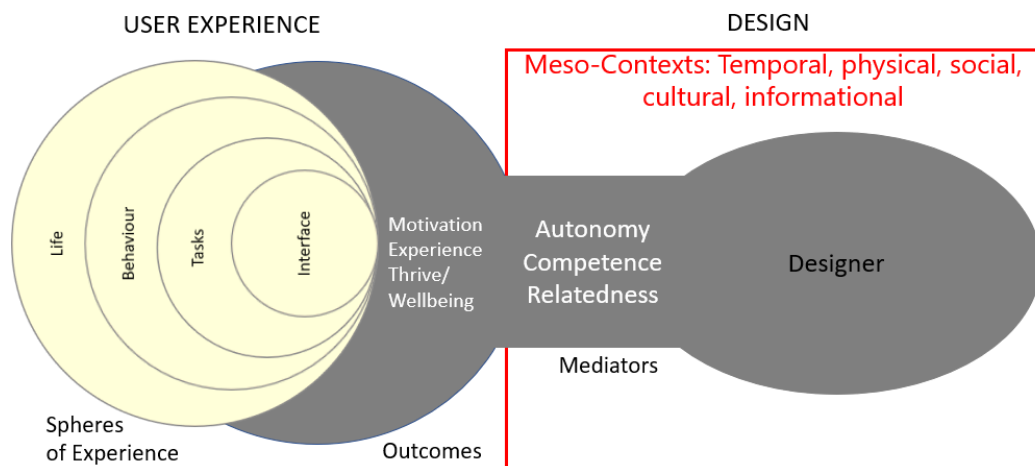
FIGURE 10.1 MY ADAPTION OF METUX MODEL IN RED, SHOWING PSYCHOLOGICAL NEEDS OF AUTONOMY, COMPETENCE AND RELATEDNESS MEDIATING POSITIVE USER EXPERIENCE OUTCOMES ARE THEMSELVES MEDIATED BY THE CONTEXTS IN WHICH THE TECHNOLOGY IS TO BE USED. (ADAPTED FROM PETERS ET AL 2018.)

This study also confirmed the indication from Study One that the technology does not have to be intentionally designed for the condition to be of support. Teacher Tapp was not designed to help with stress management, but its educational content conveyed relatedness to colleagues. This was particularly when separated during the pandemic and valued as a stress management intervention. Identifying such technologies was achieved by categorising the technology by strategy and design features, underscoring the potential of identifying interventions in this way.

10.2.3 Contribution 3: Insight for schools and designers into facilitators and barriers of technologies used for stress management by teachers

The final research question on the facilitation of stress management with the technology was answered through a second thematic analysis of data collated in the

longitudinal study, presented in Chapter 9. Reports on how design either facilitated or inhibited use and potential improvements were explored. Additionally, the question of how a school could support their use was investigated.

The following statements highlight the key findings and form a further set of considerations that can inform designers, and be of interest to teachers, school leaders and policy makers.

9. Discreet and rapid interaction design facilitates use in an environment where users don't want to draw attention to their use in the workplace (Chapter 9 and Section 9.4.1).

10. Cognitive ease facilitates interaction, both in terms of immediacy of access to data or information, and in terms of ease of application of learning of relevant advice (Chapter 9 and Section 9.4.1).

11. Prompts and congratulatory messaging are perceived as helpful through the working day where teachers are surrounded by polychronic demands (Chapter 9 and Section 9.4.1).

12. Linked to the affirmatory messaging, displaying data in a way that makes the user feel good would encourage ongoing use (Chapter 9 and Section 9.4.1).

13. Despite their familiarity with digital tools, users still require comprehensive navigational guidance if they are to benefit from all the technology features. This includes practical guidance on proximity between the wearable and smartphone for messages to be transmitted (Chapter 9 and Section 9.4.2).

14. Designers should allow some data to be edited for labelling and accuracy, so that users are not deterred by automated mistakes (Chapter 9 and Section 9.4.2).

15. Some users would like the technology to offer features that can be personalised more, such as an alert to their elevated heart rate. Alternative

stress management strategies within a technology would allow for changes in preferences over time (Chapter 9 and Section 9.4.2).

16. Users could use technology more easily if school leadership created a school culture in which self-care becomes normative. This could include encouraging use of technology at the start of the teachers' career and staff discussions on stress (Chapter 9 and Section 9.4.3).

17. Teachers could be more inclined to use technology if they felt their strategies to destress were supported by leadership. This could include provision of and expectation that teachers need a quiet, protected space to unwind and take a break (Chapter 9 and Section 9.4.3).

10.3 Reflections

10.3.1 Taxonomy as an innovation

Chapter 7 answered the second research question on how teachers could make a rigorously informed choice of consumer technology (digital companion) to support their stress management. The analytical study taken to create a specific taxonomy was described. This was tailored to teachers and their stress management to facilitate strategic and conceptual choices, and the corresponding technologies. The chapter also described the selection of technology by teachers and suggests that elements of the taxonomy creation approach should generalise as principles for the creation of taxonomies for other occupations or conditions. Taxonomies as such could then be a valuable resource for individuals understanding what technology could be most appropriate in their personal context.

The taxonomy itself was not subject to evaluation in the subsequent longitudinal study. It was used as a tool in the workshop to explain and illustrate the technology choices available to teachers. A future study could explore the utility of this specific taxonomy, ideally with a larger cohort of teachers. Its development was for the reasons set out in Chapter 7, section 7.1, the evidence indicating the need to retain

trust set out in Chapter 7, section 7.2 and the limitations of existing evaluation frameworks. Trust was also a guiding principle for choosing to frame these technologies 'digital companions' in the workshop, as described in Chapter 3, section 3.6. This framing sought to acknowledge the users' autonomy (Calvo & Peters, 2014), emphasise the mediating, collaborative role of the technology (Morley & Floridi, 2019) rather than one of consumption or paternalistic empowerment. It was also a useful catchall at the time for apps, wearables, chatbots and online programmes but was not interrogated as a concept. 'Companion' has also been proposed in HCI to broaden discussion of technologies as social agents (Niess & Wozniak, 2020), to describe tangible user interfaces to communicate emotions (Jingar & Lindgren, 2019) as well as for chatbots in healthcare (Ahmed et al., 2021). However, no participant referred to their technology by anything other than its name or the generic term (such as app or watch). As technology becomes ever more embedded in daily life, and potentially indistinguishable from human interaction, HCI could have a significant role to play in exploring the public's perception of and intimacy with technology.

The findings in Chapter 9 revealed the inadequacy of technology instructions, leading to some features being undiscovered. A static, populated taxonomy could not overcome this informational shortcoming in isolation but situated adaptions and solutions have been crowdsourced before, such as www.Patient-Innovation.com. 'Designing for appropriation' was suggested by Nunes et al (2015) and goes beyond transparent, comprehensive instructions to include flexibility or produce multiple versions for different conditions or self-care practices.

10.3.2 Individual stress management strategies

Individual stress management strategies were chosen for the reasons given in section 7.5.2, and to allow teachers a clear understanding of the behaviour the technology was designed to support. The workshop had presented common examples that teachers could relate to, such as walking as a physiological strategy, or keeping a diary as a cognitive approach. The strengths of this approach were that (i) strategy categorisation drew on evidence of single interventions in the teaching literature, (ii)

each stress management category was clearly articulated and had explanatory power, (iii) each strategy could be related to the supporting technology concept or mechanism in the digital dimension of the taxonomy, (iv) it made identification of suitable candidate technologies easier and (v) it meant analysis could focus on the participant's chosen combination of strategy and supportive digital mechanism. The limitations of this approach were that (a) it focused the participant on one stress-management strategy, when they would generally use multiple strategies in a working day, (b) it meant insight into technologies that supported multiple strategies and which could have offered more comprehensive support may have been excluded, and (c) insight into the complementarity of strategies was missed. However, given the diversity of the technologies chosen, most did support more than one strategy. The online programmes in particular offered quite complex interventions, although none of these were chosen by participants.

Four final strategies were selected for the domain of stress management: education, physiological, cognitive and social. The situational adjustment strategy (altering the physical work environment) was excluded on the basis that this could not be supported digitally. However, in the longitudinal study (Chapter 9), the temporal and cognitive ease with which the Withings' data could be viewed and understood meant there were occasions when teachers rapidly reacted to viewed data. They immediately changed their physical location or engaged in an activity based on the data, for instance leaving a stressful task, having a drink or engaging in deep breathing. This was also facilitated when working from home, where teachers had greater temporal and spatial freedoms, a pandemic circumstance that could not have been foreseen. However, changing their situation was also reported by two teachers in the autumn. Given the findings in this study, my thinking is that situational adjustment should be included in the taxonomy as a recognised stress management option – and potentially for other conditions and occupations.

10.3.3 Diversity of technologies

The final taxonomy included apps, wearables and online programmes of varying interventions and complexity. They all facilitated ongoing interaction through the techniques they deployed. Each was presented and described to the teachers at the workshop. No intervention was restricted by synchronicity (designated time of access). This range of interventions reflected several deliberate decisions that prioritised autonomy and insight:

A. the desire to give an informed choice of intervention technique with clear strategic relevance;

B. the opportunity to gain rich and deep insight into both experiences and facilitators, possible given that the study was longitudinal and the methodology qualitative;

C. the chance for teachers to choose a technology that supported their stress-management strategy, regardless of whether there was a consumer technology explicitly designed for it.

The range of technologies and delegation of choice to participants was deliberate and given the reduced number of participants due to covid, guaranteed not all would be chosen. The online programmes gave teachers the option of more complex and comprehensive interventions (treatment rather than detection). None of these were chosen, and the single reason given for rejection, of Silvercloud's apparent medical nature, is salient and worth further exploration. In fact, of all the treatment, guided self-management or entertainment-based technologies, only Wysa was selected. Wysa, like Silvercloud, is based on CBT so although the reasons for non-selection were not explored they would be worth investigating another time. Given the paucity of information on teachers' self-selection of digital interventions for stress or wellbeing, the diversity of interventions was considered a strength of this longitudinal qualitative study. Generating real-world experiential insight from teachers using apps and wearables for stress management as detailed in sections 10.2.2 and 10.2.3

appears to be completely novel, and hopefully useful for developers, educators and policy makers.

10.3.4 Categorisation of technologies

The findings of the longitudinal study give some indication of the appropriateness of the technology categorisation. Withings, Teacher Tapp and Daylio all enabled strategic reflection which aligned with their primary conceptual categorisation in the taxonomy. The Withings conceptually and strategically also offered social support as well as reflection but for this to be a two-way interaction, the relevant messaging app would need to be accessed. This only happened when the teachers worked from home, not when back in school. Additionally, Withings does not enable social skills. For both these reasons, 'social support' is arguably not an individual digital strategy in Withings. A change to the categorisation is shown in Table 10.1 (Withings removed from Social Strategy, shown red) and it could be indicated on the taxonomy that the social concept requires smartphone access as well as the wearable.

Teacher Tapp was one of the two apps offered, and one not designed for stress (McInerney, 2019). Describing 'education' as primary strategy, and the fostering reflection conceptual categorisation seems to be appropriate, as was the secondary strategy of social support. Possibly because of COVID-19, there was more education on stress management which meant Teacher Tapp also fulfilled the concept of guided self-management. Indicating that Teacher Tapp offers this should be done with caution as it could have been purely circumstantial.

Daylio provided a primary cognitive strategy through reflection on data logged during the day on mood and associated activities (Schueller et al., 2021). There were no other obvious concepts or strategies that it automatically supported, although the activities could be physiological and the ability to set goals could be seen as self-management. However, such categorisation could be misleading in a taxonomy.

Wysa's primary categorisation combined cognitive strategy with self-management (Inkster et al., 2018) and this was validated through the way it was used in the study.

The findings indicated that reflection also arose from understanding the relevance of the materials and thus Wysa was viewed as an educational tool given the macro-context of the school workplace. All these changes have been indicated in Table 10.1, in which Table 9.1 from Chapter 9 is reproduced with the changes (described in the findings) shown in red, where detail is added and removed (crossed out).

Of the four digital techniques offered to participants, only the 'utilising entertainment' concept was not chosen by teachers, and all eight opted for concept of reflection as their first choice. Whilst not considered a critical concept for engagement in a health apps study (Peng et al., 2016), a finding mirrored in the small number of stress management apps that exploit gamification (Hoffmann et al., 2017), gamification is well received by users when combined with stress management methods (Hoffmann et al., 2019). Many designers believe gamification in wellbeing and mental health technologies will promote engagement and enhance the intervention effects (Cheng et al., 2019) but a larger scale study would be required to test this for teachers, and it generally remains an underexplored feature in technologies for mental health and wellbeing (Eisenstadt et al., 2021).

	STRESS SELF-MANAGEMENT STRATEGIES			
TECHNOLOGY CONCEPT/TECHNIQUE	Educational	Physiological	Cognitive	Social
Reflection	**Teacher Tapp (Daily survey)** Wysa (Chatbot)	**Withings Steel HR Watch (Physiological tracker & communications)**	**Daylio (Journal)**	Teacher Tapp (Daily Survey) ~~Withings Steel HR Watch (Physiological tracker & communications)~~
Treatment / self-management			**Wysa (Chatbot)**	
Peer-to-peer social support		Withings Steel HR Watch with smartphone		

		(Physiological tracker & communications)		

TABLE 10.1 CHANGES TO THE TECHNOLOGY ALLOCATION IN THE TAXONOMY. PRIMARY STRATEGY/CONCEPT CATEGORISATION SHOWN IN BOLD. SECONDARY TECHNOLOGY STRATEGY OR CONCEPT SHOWN IN GREY (ORIGINAL) OR RED (ADDED OR REMOVED BASED ON FINDINGS)

10.3.5 Contexts

Since this thesis research was undertaken, an attempt has been made to apply Jumisko-Pyykko and Vaino's (2010) Context of Use framework, as described in Chapter 3 section 3.7, to identify components of context in UX specifically at work (Simsek Caglar et al., 2022). Although their emphasis is on technology *for* work, their review affirms that lack of shared understanding and definitions of context (noted in Chapter 3) remains an issue. Additionally, they note that social contexts are rarely connected with the findings and physical contexts do not obviously contribute to the analysis. Future work would have to explore whether this is the same for UX of consumer technologies for self-care *in* the workplace.

This study's findings add to the definition of the facilitating conditions dimension in Venkatesh's model of UTAUT (Venkatesh et al., 2003). These conditions were originally conceived as individually and system focused (personal resources, knowledge, interoperability and support), akin to the competence dimension in SDT. They are not extended beyond the user and technology. The present study's findings indicate contextual variables need factoring as determinants of stress management interventions, also indicated in recent UTAUT-framed research on public acceptance of stress management apps (Apolinário-Hagen et al., 2019). These variables are multiple and complex but there are many examples where lack of consideration leads to technology rejection, even where the costs and stakes are very high such as in the NHS (Bincalar, 2020). For the dimension of Facilitating Conditions to be uninformed by the macro and meso-contexts misses potentially significant influences on behavioural intent and subsequent use. And as use gets underway, all the perceptions influencing intent become informed by actual UX. For teachers' stress

management with informed technology selection, the UTAUT model could be modified showing that antecedents of intention (with Performance and Effort expectancy reflecting design features) and actual use are all mediated by facilitating conditions. This is illustrated in Figure 10.2. This aligns with the finding that data is contextually mediated (Contribution 2) and is hinted at by Williams where facilitating conditions are seen as both an influencing construct of UTAUT and a separate direct influence on actual use (Williams et al., 2015). This observation merits further exploration.
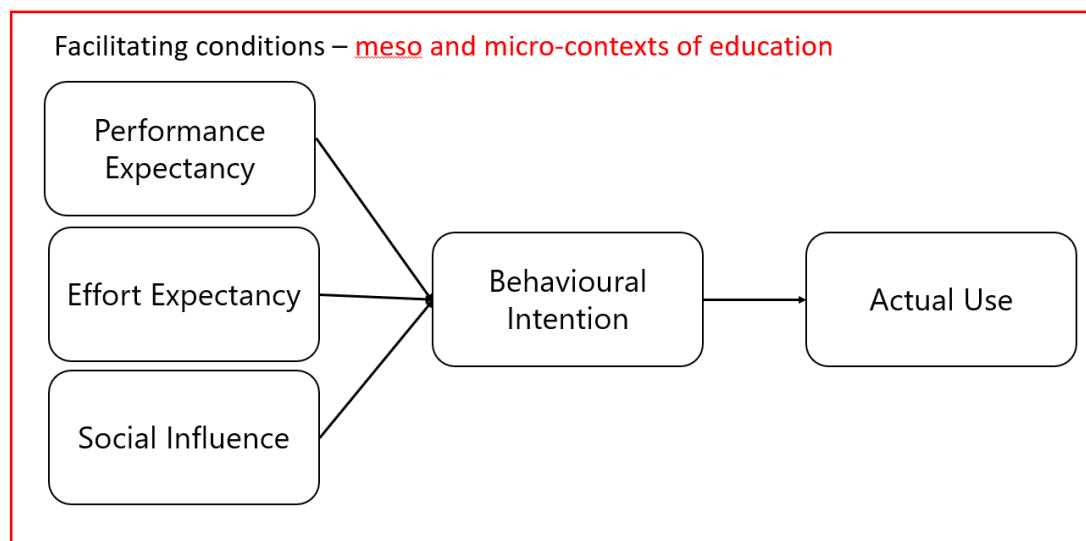
FIGURE 10.2 VENKATESH'S UTAUT (2003) MODEL ADAPTED TO SHOW FACILITATING CONDITIONS OF THE MESO- AND MICRO-CONTEXTS FRAMING THE OTHER ANTECEDENTS OF INTENT

We know both employees and employers are interested in using consumer technology for wellbeing in the workplace. The findings of this research indicate that the simple framing of contexts as macro, meso and micro could be useful to distinguish relevant conditions. Although their relative importance was not investigated, considering potential influences of context could enable more targeted or appropriate choices.

10.4 More personal reflexivity

One strength of a constructivist approach is the awareness of praxis and reflexivity, the researcher's influence on the production of knowledge. I had given considerable

thought to my effect as a clinician on the studies and reflected on this in Chapter 5, section 5.8.5. However, as I analysed the data and continued to reflect, I realised this contributed significantly to my interest in health outcomes for teachers. This does not undermine the approach or the findings, but a health self-care bias was dominant, meaning that I viewed the HCI health literature through a patient outcome lens as I considered health technology design. I made comparisons with stress management by clinicians, but not simply a result of my preferences as there are already comparisons between medics and teachers in the literature (Iancu et al., 2018; Kotera & Gordon, 2021), and the similarities in rostered or scheduled environment with sequential vocational demands in a regulated public sector prompted me to make the comparison.

A robust approach to planning, delivery and analysis meant that high standards of rigour and competency were maintained (Patton, 2015, 2017). There will inevitably always be several bodies of literature relevant to an interdisciplinary thesis and it would be impossible to cover all publications. That said, I did not uncover literature during the research that would have changed the studies in this thesis.

10.4.1 Strengths and limitations

This section provides a reflective overview of the strengths and limitations of the key findings and research in addition to those considered at the end of each of the study chapters 6 to 9.

This thesis has several methodological strengths. Although a small range of qualitative methods was used, they were relevant to the research aims, and the contextualisation of data was built in throughout. The interdisciplinary nature and evaluation meant that several perspectives were considered which provided richer insight. Also, the real-world situations and stages of engagement with participants in the longitudinal final study (intended and extended) as opposed to a hypothetical or retrospective-only study constitute key strengths.

In line with Levitt et al's recommendations data adequacy was established by ensuring data were collected from groups of teachers who were able to report their experiences of stress management and digital technology (Levitt et al., 2018). Additionally, the interview questions were all framed by a clear understanding of the research goals. The findings were rooted in the data obtained, ensuring they were supported and grounded.

Given the nature of the research question, the evidence gathered was based on self-reported data, therefore a potential weakness is that experiences can be misremembered. Participants may share what they think is a good answer rather than an accurate one, or trust has not been established for full disclosure. Also on review, some of the semi-structured questions were not as 'open' as they might have been, resulting in limited or reduced data quality. However, the longitudinal study gave more opportunities for data rigour through mixed methods (interview, written feedback and survey data) and repeated methods (successive interviews). This built rapport and enabled triangulation, comparison with peer reports, and thus assessment of fidelity (An, 2022; M. Q. Patton, 2015). Additionally, although barriers to use were a focus of enquiry, factors could have been missed because due to the variety of interventions comparisons between similar mediums were not made. For instance, no one mentioned battery life of the watch, crucial for continuity, which attests to its long life compared to other wearables. A comparison of wearables for teachers' stress self-management could be the subject of another study.

A further criticism could be that this research did not examine individual character differences in adoption and use of technologies, and base recommendations on this. This could be the approach of future research, but it is an approach that could be seen as paternalistic and was partly addressed by virtue of the autonomous self-selection of technology by each teacher.

As with all qualitative mixed methods research, the empirical studies were not set up to generalise to a wider population. The constructivist approach taken enabled a deep understanding of specific cases rather than generating hypotheses. That said, one can never assert that there are no generalisations, it is a contradictory statement.

What can be proposed is that there will be many Heads of Year in similar schools, with similar roles, responsibilities and contexts, and the findings could be transferable based on their relevance. This conclusion inevitably has to be made with caution. Firstly, due to the longitudinal study being undertaken during a global pandemic, the local, national and international circumstances were unprecedented – hence the recommendation for future work including a repeat of the longitudinal study with teachers starting their technology use in school. Secondly, the longitudinal study was undertaken with teachers who taught many socio-economically deprived students. Teachers in more affluent areas or working with more economically advantaged children report less stress (Abel & Sewell, 1999; Camacho & Parham, 2019; Shernoff et al., 2011). It was poignant to hear of teachers in the autumn term talking about children returning to school after the pandemic without even a pen, let alone lunch money.

That said, meso-contextual constraints on self-care were noted in Study One, undertaken before the pandemic, which suggests that they constitute an ongoing existential problem that requires addressing. Additionally, many of the findings on teachers' interaction with and experiences of the technology are irrespective of the pandemic. The ability of teachers' data to be humanised and given meaning in the macro-context of education by the technology, the inadequate technology instructions, and the support the technologies gave for autonomy, connectedness and relatedness could all be reasonably sees as transferable to other teachers.

10.5 Implications for research and policy

A mutually supportive framework of recommendations is proposed for research, policy and practice. Building on this study's findings and drawing on current UK government policy some recommendations are made. They are not exhaustive but indicate where more knowledge could be generated to potentially facilitate better outcomes.

10.5.1 Research

This thesis sought to fill some of the gaps in knowledge on how teachers could use digital tools to self-manage their stress. It has added some details on important contextual factors that influence adoption and proposed a systematic approach to choosing a technology. Validating the taxonomy itself and applying it outside of a pandemic scenario would be valuable, as would applying the findings on contextual influences at face value and comparing adoption and use of technology in schools. There were ideas for technology improvement articulated by participants in the longitudinal survey. Some have inspired the recommendations below. The suggestion of extending the Bluetooth range of the Withings has not been included as it could not be achieved without reducing the battery life of the watch (V. Vercamer, personal communication, November 11, 2021), which is a highly valued feature (Connelly et al., 2021; Kaewkannate & Kim, 2016). The evidence in this thesis points towards the further research recommendations shown in Table 10.2.

Recommendations for Research	
How could the taxonomy be improved or iterated?	Repetition of creating or populating the taxonomy for stress to determine its rigour and reproducibility.
	Addition of the situational strategy and quantitative evaluation of teacher choice of technology-supported strategy with behaviour and outcomes.
	Qualitative study with larger cohort (schoolwide?) of teachers to aim for greater diversity of technology choice.

	Application of taxonomy creation principles for other conditions and occupations to establish whether they generalise or need adaptation.
Implementation of technology for stress support	Adoption and evolution of technology use in a full-time school setting to compare experiences, including with other cohorts such as early career teachers or the senior leadership team.
	Testing technology stress support against an active control in the school environment with mixed methods to review efficacy and experience.
	Exploring technologies and school culture: incorporation of technology support for stress management by school leadership with meso-contextual adaptions suggested in this thesis (facilitating conditions).
	Examining the incorporation of technology-supported stress management in teacher training with active control (against non-technology supported).
	Optimal duration or frequency of an intervention for sustained stress alleviation.
How might the development and design of technologies for occupational stress be improved?	Design features to be explored include: (i) differentiation of daily activity and stress-relieving exercise recorded by Withings; (ii) automating alignment of reading material on Teacher Tapp to the day's survey; (iii) reviewing sleep monitoring accuracy

	on Withings; (iv) aligning advice on companion app more closely to data and facilitation of correlations through (e.g.) a diary component.
	Regular reviews with target user group on experiences; test updates in information and instructions with occupational groups.
	Identify key symptoms, e.g. insomnia and dehydration, for targeting of design features to support stress self-management.

TABLE 10.2 RECOMMENDATIONS FOR RESEARCH

10.5.2 Policy

The findings in this thesis raise questions for education policy makers and have implications for digital health policy which are timely, given the UK government strategy launched in June 2022 (Department of Health and Social Care, 2022).

My research was focused on individual stress management support, but the findings demonstrate that no matter how aligned the technology was to strategy or how effective the user found the supporting concept, in school the cultural context can overwhelm the strategy if the culture does not reinforce the strategy. Participants indicated that 'protected' (i.e. non-teaching) time was not always respected and in some schools there was no provision of private space away from the frontline. Other employees have reported that lack of privacy is a deterrent to using technologies for stress management in the workplace (Carolan & De Visser, 2018) or privacy protection concerns a deterrent to sharing personal information (Peng et al., 2016). Policy makers should consider how the new Education Staff Wellbeing Charter can be fulfilled without mandating provision for breaks or privacy https://www.gov.uk/guidance/education-staff-wellbeing-charter.

Many teachers in both empirical studies reported that stress was still a taboo subject, indicating some form of inadequacy. Self-care is not an entrenched concept in schools or teacher education. The power of the technology data was quantifying or capturing the physical and emotional demands of teaching. Technologies offer school leadership the potential to help teachers identify and support their stress management strategies and normalise self-care within the school environment. Just as clinicians are being urged to consider digital self-care (Department of Health and Social Care, 2022), employers should also be thinking about where the health of their workforce can be supported with technology. A recent publication on cultivating teacher resilience only fleetingly mentioned any form of supportive technology (Mansfield, 2020).

With the withdrawal of the NHS App store in December 2021, and expert review evaluation frameworks (EREFs) going behind paywalls or becoming obsolete, professionals and the public still lack guidance on how to choose digital health technologies. Policy makers are now seeking to clarify the evidence standards and approval process for digital health through the self-assessment Digital Technology Assessment Criteria (DTAC) (NHS Transformation Directorate, 2021) and the NICE Evidence Standards Framework for Digital Health Technologies (NICE, 2021), as proposed in the recent government policy paper (Department of Health and Social Care, 2022). This is of relevance to designers and potentially NHS commissioners but will not directly facilitate technology choice by clinicians or patients. Therefore, clinical speciality-led development of the taxonomy is also required to provide a framework that can be populated by technologies that satisfy the new standards.

Recommendations for policy	
How may existing policy be improved or new policy considered to enable	Review of where technologies could support recommendations of the Education Staff Wellbeing Charter – specifically improving access (8), designing

technology support for teachers' stress management?	in wellbeing into policy tests, training, standards and guidance (4 and 7), reducing stigma (6) https://www.gov.uk/guidance/education-staff-wellbeing-charter
	Mandate: staff rooms or private spaces for teachers to withdraw; scheduled breaks and rigorously protected learning time; technology options for stress-management in teacher training; reviews of school practices and associated stress as part of teachers' professional development.
	Consider where technologies can enable recommendations of the Thriving at Work review – specifically on the use of Digital tools (Farmer & Stevenson, 2017, p. 7,11).
How could targeted technology design and choice be enabled?	Include contextual factors in the usability standards being developed by NHS Transformation Directorate and NICE for the DHSC (Department of Health and Social Care, 2022).
	Clinical speciality led development of the taxonomy for common conditions and occupations to enable clinical and patient choice of digital health support, in

	addition to the standards being developed above.

TABLE **10.3** RECOMMENDATIONS FOR POLICY

10.6 Conclusion

In this thesis I set out to examine the influence of context on consumer technology use and design for the ability of senior school Heads of Year to self-manage their stress. Despite the potential stress support through the detection and management offered by apps, wearables, online programmes and increasingly chatbots, and the recognition of teaching being one of the most stressful professions (HSE, 2020), the possibilities of teachers' technology supported self-management of stress has been little explored.

Analysis of data from semi-structured interviews, surveys, feedback and workshops contributed to reducing this research gap. It showed teachers are already using consumer technologies and that where teachers were able to make an informed choice of a technology, based on their chosen stress management strategy and technology characteristics, technology use was informative and valued. Self-compassion was generated through seeing the contextualised relevance of their data and understanding in new ways the toll of teaching. This motivated intrinsic permission to manage their stress, activating their strategy and building confidence to self-care, either in the moment or over time, which contributed to resilience. This was despite the effort required due to instructional insufficiency. Technology engagement and design features of the technology were contextually mediated, indicating that the educators' environment and working conditions have a significant influence on self-determination and utility of technology. School leadership has a significant role to play in making stress management normative for technology potential to be realised. These findings demonstrate that there is a potential role for technologies to support teachers' 'adverse reaction to excessive pressures or demands' (NICE, 2022). Also, they can be used to encourage recognition and

facilitation of support for teachers' stress management and their self-selection of consumer digital tools, and developers' digital health design decisions.

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Appendix A Study One Information and Consent Form

DIVISION OF PSYCHOLOGY AND LANGUAGE SCIENCES
UCLIC, University College London
66 - 72 Gower Street
London, WC1E 6EA
United Kingdom

UCL

CONSENT FORM FOR ADULTS IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: Investigating the use of mobile fitness apps for stress management
Department: Computer Science
Name and Contact Details of the Researcher(s): Julia Manning, UCL Gower Street, London WC1E 6BT, United Kingdom, j.manning.17@ucl.ac.uk, 07973312358

Name and Contact Details of the Principal Researcher: Paul Marshall, UCLIC Gower Street, London WC1E 6BT, United Kingdom Paul.marshall@ucl.ac.uk

Name and Contact Details of the UCL Data Protection Officer: Louise Gaynor, UCL Gower Street, London WC1E 6BT, United Kingdom, l.gaynor@ucl.ac.uk, +44 (0)20 3108 7050.

This study has been approved by the UCL Research Ethics Officer: Project ID number:
UCLIC/1718/013/Staff Marshall/Manning

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

I confirm that I understand that by ticking/initialling each box below I am consenting to this element of the study. I understand that it will be assumed that unticked/initialled boxes mean that I DO NOT consent to that part of the study. I understand that by not giving consent for any one element that I may be deemed ineligible for the study.

			Tick Box
1.		*I confirm that I have read and understood the Information Sheet for the above study. I have had an opportunity to consider the information and what will be expected of me. I have also had the opportunity to ask questions which have been answered to my satisfaction and would like to take part in the interview study.	
2.		*I understand that I will be able to withdraw my data up to 31/12/18 after which it will be anonymized.	
3.		*I understand that no personal information about me will be collected.	
4.		*I understand that my data gathered in this study will be stored pseudonymously and securely, and once it has been aggregated it will be anonymous. It will not be possible to identify me in any publications. **Limits to confidentiality** • Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrongdoing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies. • Please note that confidentiality will be maintained as far as it is possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this. • Please note that confidentiality will be maintained as far as it is possible, but where the participant sample is small (i.e. in the interview) study, it is difficult	

		to completely guarantee it, but as the research involves many different locations, the risk is small.	
5.		*I understand that my information may be subject to review by responsible individuals from the University for monitoring and audit purposes.	
6.		*I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason and will be fully compensated if I choose to withdraw.	
7.		I understand that the data will not be made available to any commercial organisations but is solely the responsibility of the researcher(s) undertaking this study.	
8.		I agree that my anonymized research data may be used by others for future research. [No one will be able to identify you when this data is shared.]	
9.		I understand that the information I have submitted will be published as a report and I wish to receive a copy of it. Yes/No	
10.		I hereby confirm that I understand the inclusion criteria as detailed in the Information Sheet and explained to me by the researcher.	
11.		I hereby confirm that: (a) I understand the exclusion criteria as detailed in the Information Sheet and explained to me by the researcher; and (b) I do not fall under the exclusion criteria.	
12.		I consent to my interview being audio/video recorded and understand that the recordings will be destroyed within 3 years after the data has been collected or following transcription.	
13.		I understand that the interview study will be audio recorded and that the transcripts of the audio recordings made during this research will be used only for analysis and for illustration in conference presentations and lectures. No one outside the project will be allowed access to the original recordings. All of the data will be fully anonymized once aggregated.	

If you would like your contact details to be retained so that you can be contacted in the future by UCL researchers who would like to invite you to participate in follow up studies to this project, or in future studies of a similar nature, please tick the appropriate box below.

Yes, I would be happy to be contacted in this way	
No, I would not like to be contacted	

_____   _____   _____
Name of participant   Date   Signature

_____   _____   _____
Researcher   Date   Signature

<u>Participant Information Sheet For Adult Participants</u>

UCL Research Ethics Committee Approval ID Number: UCLIC/1718/013/Staff Marshall/Manning

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET TO KEEP IF YOU CONSENT TO TAKE PART IN THE STUDY

Title of Study:
Understanding teachers' experience and management of stress at work and the ways in which digital health technology could support them.

Department: UCL Interaction Centre

Name and Contact Details of the Researcher(s): Julia Manning
Room: 2.06, UCLIC, 66 - 72 Gower Street, London WC1E 6BT, United Kingdom
j.manning.17@ucl.ac.uk
+44 7973312358

Name and Contact Details of the Principal Researcher: Dr. Paul Marshall
UCLIC, 66 - 72 Gower Street, London WC1E 6BT, United Kingdom
paul.marshall@ucl.ac.uk
Phone: +44 (0) 117 33 15352

1. Invitation Paragraph
You are being invited to take part in a PhD research project investigating the potential use of smartphone apps for personal stress management in school by teachers. Before you decide, it is important for you to understand why this research is being done and what participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Thank you for reading this.

2. What is the project's purpose?
The education sector is a demanding workplace and staff wellbeing is important both personally and professionally. Schools often don't have the resources to offer professional face-to-face support to teachers experiencing symptoms of distress. Evidence-based smartphone health applications have been developed to help manage wellbeing and associated factors in the short term (e.g. stress) which can negatively affect a person.
Whilst recent research has examined the benefits of using smartphone health apps by people with long-term conditions (e.g. diabetes), little is known about the benefits of health app use in the workplace, or for 'self-care' (meaning an app that doesn't have to be medically prescribed or supported, and can be used by anyone who downloads it).
Such apps could in theory offer an easily accessible opportunity to help teachers in supporting their management of wellbeing. This study aims to:
1) gain a detailed understanding of how teachers in the school setting manage their wellbeing and whether they currently use any digital health tools;
2) determine which smartphone apps or digital tools intended to help manage stress seem to have the most potential for teachers.

3. Why have I been chosen?
You were chosen because you meet the inclusion criteria for this study, i.e. you are a teacher in a secondary school.
The study will include two different activities in which you could choose to participate:
A) a short interview on your experience of stress at work, and your experience of health technology tools already used, if any (e.g. Fitbit, smartwatch, apps);
B) an online questionnaire about your experiences of stress in the workplace and potential app attributes to support wellbeing.
About 15 interviews and 300 questionnaires are being aimed for.

4. Do I have to take part?
Your participation in this study is entirely voluntary. It is up to you to decide whether or not to take part.

Interview participants: If you do decide to take part in the interview, you will be given this information sheet to keep and be asked to sign a consent form. You can withdraw at any time without giving a reason and without it affecting any benefits that you are entitled to. If you decide to withdraw you will be asked what you wish to happen to the data you have provided up that point. The interview will be recorded and transcribed but any distinguishing data (describing you, a place or someone you know) will be anonymised.

On-line survey participants: as you will be participating in an anonymous survey, the submission of a questionnaire will imply that you have given us consent. We will not be able to withdraw your data after you have submitted it. The survey will also ask for some basic, non-identifying data such as gender and age. If you would be prepared to take part in a further study to test an app or digital tool in the workplace, there will be a link to a separate sign-up site.

5. What will happen to me if I take part?

Interview participants: You will take part in a face-to-face interview for an in-depth exploration of your work context, how you manage your personal wellbeing and experiences of stress, and your current use and experience of digital health tools. The interview will be recorded and transcribed but any distinguishing data (e.g. describing you or someone you know) will be anonymised. The interview will be approximately 30-40 minutes long and take place in school during working hours.

On-line survey participants: The findings from interviews will be analysed to inform an anonymous survey with a larger cohort of teachers to find out how far they generalise across a wider user population, and will also present possible app choices based on teacher's needs and aspirations. This online questionnaire study will last for no longer than 20 minutes.

6. Will I be recorded and how will the recorded media be used?

The interview study will be audio recorded. The transcripts of the audio recordings made during this research will be used only for analysis and for (anonymous) illustration in conference presentations and lectures. No identifying data of the participant or school will be retained, and no one outside the project will be allowed access to the original recordings. The recordings will be securely stored on a password protected laptop. All data will be collected and stored in accordance with GDPR and the new Data Protection Act 2018 (DPA 2018). You may withdraw your data from the project at any time up until it is anonymised for use (31/12/18).

7. What are the possible disadvantages and risks of taking part?

There is a possibility that talking about experiences of stress could cause distress. If so, you will be referred to, or can contact directly, the support services offered by the Education Support Partnership (ESP). The ESP is a national charity that offers free phone counselling specifically for teachers, and wellbeing support to all education staff. https://www.educationsupportpartnership.org.uk/ and their helpline is 08000 562561.

8. What are the possible benefits of taking part?

The benefit for those people participating in the project will be seeing the aggregated information on the experiences of teacher's stress management in schools and teacher's current use of digital health technologies. It is hoped that this research will contribute to the understanding of stress management technology in the school workplace, what works, how and why.

9. What if something goes wrong?

Should you wish to raise a complaint please contact the Principal Researcher paul.marshall@ucl.ac.uk
If you feel that your complaint has not been handled to your satisfaction by the principle researcher, you can contact the Chair of the UCL Research Ethics Committee – ethics@ucl.ac.uk

10. Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be kept strictly confidential and anonymised. You will not be able to be identified in any ensuing reports or publications.

11. Limits to confidentiality

- Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrongdoing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies.
- Please note that confidentiality will be maintained as far as it is possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this.
- Please note that confidentiality will be maintained as far as it is possible, but where the participant sample is small (i.e. in the interview) study, it is difficult to completely guarantee it, but as the research involves many different locations, the risk is small.

12. What will happen to the results of the research project?

Results of this research will be disseminated in standard academic outlets and will be a part of a PhD thesis. A policy white paper on technology for self-management is also planned. Results may also be disseminated via general interest magazines / newspapers / journals and associated events. You will not be identified in any report or publication.

Should you wish to obtain a copy of the publication related to this study, please contact Julia Manning j.manning.17@ucl.ac.uk at least 6 months after taking part in the study.

13. Data Protection Privacy Notice

Notice:

The data controller for this project will be University College London (UCL). The UCL Data Protection Office provides oversight of UCL activities involving the processing of personal data, and can be contacted at data-protection@ucl.ac.uk. UCL's Data Protection Officer can also be contacted at data-protection@ucl.ac.uk.

Further information on how UCL uses participant information can be found here:

www.ucl.ac.uk/legal-services/privacy/participants-health-and-care-research-privacy-notice

Your personal data will be used for the purposes outlined in this notice. The categories of personal data used will be as follows for those who indicate in the second study that they wish to take part in further research:

Name
Email Address

The legal basis that would be used to process your *personal data* will be performance of a task in the public interest.

Your personal data will be processed until the end of this research project (01/01/2022). If we are able to anonymize or pseudonymize the personal data you provide we will undertake this, and will endeavour to minimise the processing of personal data wherever possible.

You have certain rights under data protection legislation in relation to the personal information that we hold about you. These rights apply only in particular circumstances and are subject to certain exemptions such as public interest (for example the prevention of crime). They include:

- The right to access your personal information;
- The right to rectification of your personal information;
- The right to erasure of your personal data;
- The right to restrict or object to the processing of your personal data;
- The right to object to the use of your data for direct marketing purposes;
- The right to data portability;
- Where the justification for processing is based on your consent, the right to withdraw such consent at any time; and
- The right to complain to the Information Commissioner's Office (ICO) about the use of your personal data.

If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at data-protection@ucl.ac.uk.

If you remain unsatisfied, you may wish to contact the ICO. Contact details, and further details of data subject rights, are available on the ICO website at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/

14. Who is organising and funding the research?

This research is organised by University College London.

16. Contact for further information

Please contact Dr Paul Marshall, paul.marshall@ucl.ac.uk or on Phone: +44 (0) 117 33 15352 for any further information

Thank you for reading this information sheet and for considering to take part in this research study.

Appendix B Study Two and Three Information and Consent Form

DIVISION OF PSYCHOLOGY AND LANGUAGE SCIENCES   ⚏UCL
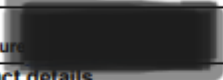
Ethics Application Form for Non-Invasive Research on Healthy Adults

SECTION A	APPLICATION DETAILS

Project details

A1 Project Title: Understanding how the management of stress at work by senior, pastoral, inner-city comprehensive school teachers is influenced by the workplace, and the design requirements of digital health technologies that could provide support: an in-the-wild evaluation

Date of submission: 2ⁿᵈ Dec 2019

Proposed start date: 9ᵗʰ Dec 2019

Proposed end date: 31ˢᵗ Dec 2022
(this can be up to 5 years from start date):

A2 Principal researcher

(Note: A student – undergraduate, postgraduate or research postgraduate – cannot be the principal researcher for ethics purposes).

Full name: Professor Ann Blandford

Position held: Professor of Human Computer Interaction

Research Department: Computer Science

The principal researcher must read and sign (electronic signature or scanned pdf with signature are acceptable) the following declaration. Please tick the box next to each of the statements below to acknowledge you have read them and provided all required information.

• I will ensure that changes in approved research protocols are reported promptly and are not initiated without approval by the Departmental Ethics Committee, except when necessary to eliminate apparent immediate hazards to the participant.	✓
• I have completed a risk assessment for this programme of research and hereby confirm that the risk assessment document will be discussed with any researcher/student involved in this programme of research (currently or in the future). I will ensure that all researchers/students sign the risk assessment form following this discussion. **Risk assessment forms for projects can be downloaded from the Ethics section of the PaLS Intranet.**	✓
• I have completed the Information Governance training provided by ISG	✓
• I have obtained approval from the UCL Data Protection Officer stating that this research project is compliant with the General Data Protection Regulation. **My Data Protection Registration Number is: Z6364106/2018/10/06** You can find a data protection registration form at: http://www.ucl.ac.uk/legal-services/research **Note**: your data protection number could cover a whole programme of research. It is not always necessary to request a data protection number for each individual project.	✓
• I have included examples of the Information Sheet and Consent Form for the proposed research. It will be made clear to the participants that they can withdraw from the study at any time, without giving a reason.	✓
• I will ensure that all adverse or unforeseen problems arising from the research project are reported in a timely fashion to the UCL Research Ethics Committee.	✓
• I will undertake to provide notification when the study is complete and if it fails to start or is abandoned.	✓

• I have met with and advised students on the ethical aspects of this project/programme of research.	✓
• I am satisfied that the proposed research complies with current professional, departmental and university guidelines.	✓

Signature ████████████   **Date: 9/12/19**

A3 | **Contact details**

Principal Researcher

Full name: Prof Ann Blandford

Position held: Professor of Human Computer Interaction

Research Department: Computer Science

Email: a.blandford@ucl.ac.uk   Telephone: 0203 108 7049 (x 57049)

Additional applicant 1

Full name: Julia Manning

Position held: Research Student

Research Department: Computer Science

Email: j.manning.17@ucl.ac.uk   Telephone: 07973312358

Additional applicant 2

Full name:

Position held: (undergraduate/taught master's/MRes/research student/postdoctoral/staff):

Research Department:

Email: Telephone:

(Add further details on a separate sheet if there are more applicants to be covered by this form)

A4 | **Approval from the Departmental Ethics Committee**

(Approval cannot be given by the principal researcher of this project – if necessary the application must be sent to an Ethics Officer from a different Research Department, or to the College Ethics Committee, for approval)

Declaration by the Research Department Ethics Chair:

I have reviewed this project and I approve it. X

The project is registered with the UCL Data Protection Officer and a formal signed risk assessment form has been completed.

Allocated Departmental Project ID Number for the approved application:

_____UCLIC_1920_004_Staff_BlandfordManning_____

2

Name of the Research Department Ethics Chair (type in):   Nadia Berthouze

Date: 15/01/2020

SECTION B	PROJECT DETAILS

B1 **Summary of Research**

It is particularly important to provide sufficient detail of the research protocol and the measures that will be used, to enable evaluation of the application on ethical grounds. It is also important to clearly demonstrate that the proposed measures are 'innocuous' and fall within PaLS Ethics remit.

The proposed studies are a continuation of the research begun with Dr Paul Marshall which is currently covered under UCL Research Ethics Project UCLIC/1718/013/Staff Marshall/Manning. As forthcoming studies are now with Professor Ann Blandford as principal researcher, and as changes have been made to the proposed methods since the inception of this research, a new ethics application is being made.

Background
Persistent psychosocial stress is endemic in the modern workplace, including amongst secondary school teachers in England. Teachers with extra management responsibilities have to find ways of managing their stress if they are to avoid experiencing burnout. The prevalence of stress and the shortage of support services have attracted intense interest from digital technology developers who have created apps, wearables and online programmes for the self-managed prevention and early intervention of stress. However, little is known about how the context of a specific workplace setting, in this case the school, influences the adoption of such digital companions, the integration of these technologies into the teacher's daily life, the mediation of their stress through technology or the contextual or technical adaptations that would enhance the digital companion's efficacy. The programme of research proposed would address these questions. Below we describe the primary methods to be employed in this research. All of the studies involve employed, adult senior teachers who through their presence in the workplace are judged well enough to be currently working in secondary schools.

Aims
This research aims to: 1) understand how senior teachers with pastoral responsibilities in the context of the inner-city school setting self-manage their stress and introduce them to categorisation of their approaches and any digital health support tools used; 2) introduce them to digital companion technique (DCT) concepts and what choice of technology could best suit them; 3) evaluate their use of a digital companion over the course of half a term through the lens of three forms of school contextual influences: cultural, physical and organisational. Additionally, we will look for correlations between stressors, strategies and symptoms.

Participants and recruitment
Eighty per cent of schools' senior staff ('leaders') suffer from work related stress (Education Support Partnership ESP 2018). These senior teachers are in the middle of their careers, covering those with seven to thirty years of practice with involvement as co-ordinators, heads of department, heads of year and in personal development (Huberman 1989; Anderson and Olsen 2006). Evidence points to these mid-career teachers having more tasks and investing more effort, including in training, than colleagues who are at the beginning or end of their careers (Klassen and Chiu 2011). Those teaching in the 'inner-city' are by definition dealing with children who experience higher relative levels of deprivation, poverty and vulnerability (Smith 1979). London's official Department of Education figures show 43 per cent of all new teachers leaving within the first five years. Thus, we will be recruiting senior teachers in London such as Heads of Year, Heads of Department and Assistant Heads who have survived the early years and should have stress management strategies in place. Additionally, they will be those with pastoral roles who are being expected to provide for the wellbeing of students, both so that managing wellbeing is not a new concept and so they have the opportunity to reflect on their own wellbeing needs. Recruitment will be through the researcher's own networks and/or through the schools involved with the Education Support Partnership or Anna Freud Centre charities.

Procedures
The studies will use mixed methods including workshops, interviews and experience sampling. The following procedures will be used:

Details of the methods that will be used in-situ to capture the influences, situations and responses around stress self-management and potential digital support are as follows:

Semi-structured Interviews Workshops

Workshops will be run with senior teachers to explore: What workplace stress management approaches are used by senior pastoral teachers in inner-city comprehensive schools (SPTICS). What stress management category they fall into. What is their familiarity with digital technologies, what they are and when they are used, and whether any are used consciously or not to help support their stress management? These technologies will also be categorised by 'digital companion technique' (DCT). Pre-selected technologies that align with the stress and DCT will be presented with their enabling features, and their potential use and contextual factors will be explored to aid choice of DCT for the in-the-wild study. Participants will be encouraged to chose one of the technologies that aligns with one of their existing approaches to stress management in order to take part in the in-the-wild study.

It will be made clear that there are no risk free, absolute guarantees of efficacy and safety of any DCT but that the following criteria have been applied to give the highest possible level of assurances. For online, only those programmes listed on the NHS.net website and which are free to use have been included. For apps, only those that had been given a medium to high score for safety by one of the three public facing Expert Review Evaluation Frameworks (MindTools.io (Israel), PsyberGuide (USA) and Orcha (UK)) will be included. For wearables, where individuals choose to use their own model, they will be considered to have already accepted the terms and risks for use. Where individuals want to try using a wearable de novo, only wearables that can either verify data encryption or have FDA clearance will be offered.

The presentation of technologies will include information and links to available supporting information so that the teachers have the opportunity to examine their chosen technology in more detail before taking part in the in-the-wild study. Their choices will be recorded and where necessary, the DCT will be acquired. The availability of the Education Support Partnership, a charity specifically aimed to support teachers at times of distress or illness, and their helpline will be emphasised, should anyone feel the need to seek tailored, professional care as a result of distress prompted by taking part in these studies.

In-the-wild study

Essential to achieving our aims will be to understand experiences of DCT use support stress management in everyday working life. This study will take part over the course of six weeks within half a term (the minimum length of consecutive working weeks in a half-term period). The senior teachers taking part in the study will receive a one-to-one explanation of the aims of the study, a short induction to the chosen technology and take part in an intitial semi-structured qualitative interview and review of the consent form. Both the researcher's and Education Support Partnership's contact details will be highlighted again, particularly as this study is taking place in real-time in their professional workplace setting where they will be actually experiencing stressful situations. Knowing that they can opt-out or seek trained advice or counselling at any stage will be an important practical reassurance. The study will end with another one-to-one interview at the end of term (in week six of the study). At a few points during the study weeks, responses to three multiple choice type questions will be requested via an app to their smartphone at a set time outside teaching hours, e.g. 3.30pm. It will be emphasied that no personal data from the technology itself will be collected.

Both before and after the in-the-wild study, the teachers will be interviewed face-to-face for an in-depth exploration of the educational work context and their use of the digital health companion. This will use heuristics of comparisons and contrast such as how they thought they would use the DCT v how they actually used the DCT; where they thought they would use the DCT v where they actually used the DCT; when they thought they would use the DCT v when they actually used the DCT; what stressors they thought the DCT would help with v what stressors the DCT actually helped with. In addition to this will be a full analysis of how contextual factors - including culture, physical and organisational – have influenced their behaviour and choices. At both the one-to-one interviews where experiences of distress are discussed, the availability of the Education Support Partnership will be highlighted.

Experience sampling

The experience sampling method (ESM) is one in which in-the-moment data is collected at particular times. This has the advantage of reduced reliance on recalling past experiences, collecting the data in situ and being able to identify long-term patterns in the data from multiple samples. Using ESM in the educational work context will enable us to capture variations in daily experience and analyse this data for systematic observations of participants' stress-management.

Our questions will cover contextual factors of culture, physical and organisation and, following the model of Teacher Tapp, ask three multiple choice questions at a set time over a period of workdays via

a mobile app.

B2 | Will the results be disseminated outside the standard academic outlets?   [X] Yes [ ] No
If you answered 'yes', please specify:

The results of the study will be shared through presentations at education practitioner events concerned with teacher wellbeing, and workplace wellbeing conferences. A white paper will be written for policy makers who are considering the opportunities for self-care in health through technology. Findings will also be presented at NHS health technology summits and blogposts.

B3 | Please outline any ethical issues that might arise from the proposed study and explain how they will be addressed.

The purpose of this study will be explained to all participants in a written information sheet. Two potential ethical issues might arise.

Firstly, some teachers may fee distressed at talking about stressful situations. If this is the case, the participant will be referred to the support services offered by the Education Support Partnership (ESP). The ESP is a national charity that offers free phone counselling specifically for teachers, and wellbeing support to all education staff.

Secondly, some participants may feel concerned about the privacy of their data and the risk of handling of sensitive data. Responses from the online survey will be anonymous. This data along with the interviews will be stored on an encrypted external hard drive. Responses will be aggregated and any personally identifying information removed once data has been analysed. To prevent identification of the school, the type of school will be described, but not the name or location.

If the participants are still unhappy with these security measures, they will be able to opt out of the study at any point and their data will be deleted.

SECTION C	PARTICIPANT DETAILS

C1 Participants to be studied

Number of volunteers:	About 30
Upper age limit:	65
Lower age limit:	28 (7 years experience minimum)

C2 Payment

Will payment or any other incentive (e.g. a gift voucher or free services) be made to any research participant?

Yes [x] No [ ]

C3 Recruitment

(i) Describe how potential participants will be identified: Participants need to be senior pastoral teachers in inner-city comprehensive schools (SPTICS). Schools will be identified via the researchers' personal networks, social media, the Anna Freud Centre for Mental Health's Schools networks and through the 900 schools with which the Education Support Partnership Charity is involved. Teachers will be asked to volunteer to take part.

(ii) Describe how potential participants will be approached and recruited: The Headteacher or Principle of each school will be approached following agreement with the overarching Academy Trust or other school sponsor. The School will be asked to communicate the opportunity of taking part in the study with potential volunteers and assign a lead with whom we can liaise. Details of the studies will be shared with potential volunteers and arrangements made with those who express an interest in taking part.

C4 Will the participants participate on a fully voluntary basis?   Yes [x] No [ ]

Will UCL students be involved as participants in the research project?   Yes [x] No [ ]

C5 Deception

Will any form of deception be used that raises ethical issues? If so, please explain.
NO

C6 Will you provide a full debriefing to the participants?   Yes x   No

If 'No', please explain why below.

C7 Information Sheets And Consent Forms

You must attach the final information sheet and consent form for your participants with this application. This will already have received approval from the Data Protection Team. Templates are available on the PaLS intranet (please note that these changed at the end of 2017, so as to be compliant with new Data Protection regulations [GDPR]). The information sheet needs to contain sufficient detail to enable informed consent. However, the information must be provided in **lay language** and should look different from the summary of research provided in section B1.

The template information and consent forms should give you an idea of the level of detail required. NOTE THAT MAILING AND E-MAIL ADDRESS SHOULD BOTH BE INCLUDED IN RESEARCHER CONTACT DETAILS. All

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information sheets and consent forms should include a) Institutional headed paper, b) information regarding the RD Ethics Chair who approved your study, c) project ethics ID. N.B. Where consent will be obtained online, the information sheet and consent form should be accurate to reflect that.

When applying for an ethics approval for a broader research programme, you should provide an example information sheet and consent form for a representative study/experiment. You do not need to provide further examples, unless future studies/experiments substantially depart from the proposed programme of research

DIVISION OF PSYCHOLOGY AND LANGUAGE SCIENCES
UCLIC, University College London
66 - 72 Gower Street
London, WC1E 6EA
United Kingdom

UCL

CONSENT FORM FOR ADULTS IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: Investigating the use of digital health technology for workplace stress management
Department: Computer Science
Name and Co ▮▮▮▮▮▮▮▮ Manning, UCL Gower Street, London WC1E 6BT, United Kingdom ▮▮▮▮▮▮▮▮

Name and Contact Details of the Principal Researcher: Ann Blan ▮▮▮▮▮▮▮▮ Computer **Interaction** UCLIC Gower Street, London WC1E 6BT, United Kingd ▮▮▮▮▮▮

Name and Contact Details of the UCL Data Protection Officer: Louise Gaynor, UCL Gower Street, London WC1E 6BT, United Kingdom, l.gaynor@ucl.ac.uk, +44 (0)20 3108 7050.

This study has been approved by the UCL Research Ethics Officer: Project ID number: UCLIC_1920_004_Staff_BlandfordManning

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

I confirm that I understand that by ticking/initialling each box below I am consenting to this element of the study. I understand that it will be assumed that unticked/initialled boxes mean that I DO NOT consent to that part of the study. I understand that by not giving consent for any one element that I may be deemed ineligible for the study.

		Tick Box
1.	*I confirm that I have read and understood the Information Sheet for the above study. I have had an opportunity to consider the information and what will be expected of me. I have also had the opportunity to ask questions which have been answered to my satisfaction and would like to take part in the interview study.	
2.	*I understand that I will be able to withdraw my data up to 31/07/20 after which it will be anonymized.	
3.	*I understand that no personal information about me will be collected.	
4.	*I understand that my data gathered in this study will be stored pseudonymously and securely, and once it has been aggregated it will be anonymous. It will not be possible to identify me in any publications. **Limits to confidentiality** • Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrongdoing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies. • Please note that confidentiality will be maintained as far as it is possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this. • Please note that confidentiality will be maintained as far as it is possible, but where the participant sample is small (i.e. in the interview) study, it is difficult to completely guarantee it, but as the research involves many different	

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	locations, the risk is small.	
5.	*I understand that my information may be subject to review by responsible individuals from the University for monitoring and audit purposes.	
6.	*I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason and will be fully compensated if I choose to withdraw.	
7.	I understand that the data will not be made available to any commercial organisations but is solely the responsibility of the researcher(s) undertaking this study.	
8.	I agree that my anonymized research data may be used by others for future research. [No one will be able to identify you when this data is shared.]	
9.	I understand that the information I have submitted will be published as a report and I wish to receive a copy of it. Yes/No	
10.	I hereby confirm that I understand the inclusion and exclusion criteria as detailed in the Information Sheet and explained to me by the researcher.	
11.	I hereby confirm that: (a) I understand the exclusion criteria as detailed in the Information Sheet and explained to me by the researcher; and (b) I do not fall under the exclusion criteria.	
12.	I consent to my interview being audio/video recorded and understand that the recordings will be destroyed within 3 years after the data has been collected or following transcription.	
13.	I understand that the interview study will be audio recorded and that the transcripts of the audio recordings made during this research will be used only for analysis and for illustration in conference presentations and lectures. No one outside the project will be allowed access to the original recordings. All the data will be fully anonymized once aggregated.	

If you would like your contact details to be retained so that you can be contacted in the future by UCL researchers who would like to invite you to participate in follow up studies to this project, or in future studies of a similar nature, please tick the appropriate box below.

Yes, I would be happy to be contacted in this way	
No, I would not like to be contacted	

_____   _____   _____
Name of participant   Date   Signature

_____   _____   _____
Researcher   Date   Signature

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<u>**Participant Information Sheet For Adult Participants**</u>
UCL Research Ethics Committee Approval ID Number: **UCLIC_1920_004_Staff_BlandfordManning**

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET TO KEEP IF YOU CONSENT TO TAKE PART IN THE STUDY

Title of Study:
Understanding how the management of stress at work by senior, pastoral, inner-city comprehensive school teachers is influenced by the workplace, and the design requirements of digital health technologies that could provide support: an in-the-wild evaluation

Department: UCL Interaction Centre

Name and Contact Details of the Researcher(s): Julia Manning
Room: 2.06, UCLIC, 66 - 72 Gower Street, London WC1E 6BT, United Kingdom

Name and Contact Details of the Principal Researcher: Prof Ann Blandford
UCLIC, 66 - 72 Gower Street, London WC1E 6BT, United Kingdom

1. Invitation Paragraph
You are being invited to take part in a PhD research project investigating the potential use of digital technology to support individual stress management in school by senior teachers. Before you decide, it is important for you to understand why this research is being done and what participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Thank you for reading this.

2. What is the project's purpose?
The education sector is a highly demanding workplace and staff wellbeing is important personally, organisationally and professionally. In the 2018 Education Support Partnership survey of senior teachers, 80% stated that they experienced work related stress. For a variety of reasons, most schools don't have the resources to offer professional face-to-face support to teachers experiencing symptoms of distress. A recent review and analysis of 23 controlled international workplace trials that looked at technology support for 'mental health and stress symptoms' was cautiously positive but emphasized that achieving the best outcomes relied upon providing the right intervention to the right population. There are hundreds of publicly available apps, online and wearable technology solutions to help with stress management but little is known about the benefits of each solution, why, for whom and in what circumstances. Most importantly for our studies, the cultural, organisational and physical context in which technologies are used are known to make a significant difference to use and usefulness.
Therefore, these two studies aim to:
1) gain an understanding of how senior teachers with pastoral responsibilities in the context of the inner-city school setting self-manage their stress and introduce them to categorisation of their approaches and any digital health support tools used;
2) introduce these teachers to digital companion technique (DCT) concepts and the choices of technology that could best suit them;
3) evaluate their use of a digital companion over the course of half a term through the 'lens' of three forms of school contextual influences: cultural, physical and organisational. Additionally, we will look for correlations between stressors, strategies and symptoms.

3. Why have I been chosen?
You were chosen because you meet the inclusion criteria for this study, i.e. you are a mid-career teacher (at stages three and four in Huberman's widely accepted five stages of teacher career development model, covering those with seven to thirty years of practice) in an urban, London-based secondary school and have pastoral (wellbeing) responsibilities.
These studies are not applicable to anyone who is being treated for a clinical stress disorder such as PTSD or acute stress disorders and will therefore be excluded simply to retain the study focus on workplace stress. The studies comprise two consecutive parts, Study Two and Study Three in which you could choose to participate:

Study Two
> *Workshop*

Collaborating with other senior teachers the workshop will explore:
- What workplace stress management approaches you use.
- How these approaches of stress management can be categorised.
- What is your familiarity with digital health and wellbeing technologies, what they are and when they are used, and whether any are used consciously or not to help support your stress management?
- How these 'digital companion techniques' (DCTs) can be categorised.
- What our first study found and your thoughts on the findings.
- Some pre-selected technologies that align with the stress and DCTs, their enabling features, and their potential use and contextual factors to aid your choice of DCT for the half of term school study.

Study Three
> *Second half of term technology study*

In order to understand real-world experiences of DCT supported stress management, over the course of half a term you will be using your chosen technology.
The technology will be shared with you in week one and you will have a short one-to-one semi-structured interview about your expectations for use and experiences. The study will end with another one-to-one interview after six weeks. . At a few points during the study weeks, responses to three multiple choice type questions delivered via an app to your smartphone will be sent at a set time outside teaching hours, e.g. 3.30pm. No personal data from the DCT itself will be collected.

-

4. Do I have to take part?
Your participation in this study is entirely voluntary. It is up to you to decide whether to take part.

Study Two
Workshop participants: If you do decide to take part in the workshop, you will be given this information sheet to keep and be asked to sign a consent form. You can withdraw at any time without giving a reason and without it affecting any benefits that you are entitled to. If you decide to withdraw before the 31/07/20 you will be asked what you wish to happen to the data you have provided up that point. The workshops will be recorded and transcribed but any distinguishing data (describing you, a place or someone you know) will be anonymised. Only the record of which individual has chosen to use which technology will retain identifiers.

Study Three
Half-term duration technology study: If you do decide to take part in this real-world study, starting with an interview, you will be given this information sheet to keep and be asked to sign a consent form. You can withdraw at any time without giving a reason and without it affecting any benefits that you are entitled to. If you decide to withdraw before the 31/07/20you will be asked what you wish to happen to the data you have provided up that point. The interviews will be recorded and transcribed but any distinguishing data (describing you, a place or someone you know) will be anonymised.
App survey: as you will be participating in the technology study, the submission of answers to questions will imply that you have given us consent. We will not be able to withdraw your data after you have submitted it as it won't contain any personal identifiers and will be aggregated with all the other data received.

5. What will happen to me if I take part?
Study Two
Workshop participants:
Session One
Teachers will have a verbal introduction to the study and the researcher.
Teachers will then be asked to write down individually all the different ways they can think of as to how they manage their stress in a typical week, at whatever time they do it (A). They will then be asked to write down what health and wellbeing tech they use to support these strategies and when (B). There will be one item per post-it note.
A whiteboard/ flip chart will then be presented which categorises stress management approaches by strategy (1-5). These categories will be described to the participants.
The Researcher will then ask for those post-it notes (A) that describe actions that fall under the first strategy, e.g. Educational (1), and collate them on the board. Then for second strategy (2) etc. until all strategies have been covered. Any changes that need to be made (e.g. relocating what appeared to be strategy (1) into strategy (4)) will then be made).

The Researcher will then ask for the post-it notes that describe the health technology approach (B) and these will be allocated to the relevant Digital Companion Technique categories.
The findings of Study One undertaken in 2018 will be presented for consideration and discussion.

Session Two
From session one, staff will already have been introduced to the concepts of different DCTs. These will be represented in a simplified matrix that covers all strategies and the DCT categories, along with examples of potential technology tools.
Each of these pre-selected technology tools will be presented to staff with a brief overview of the features of each one.
Teachers will be asked to choose which tool they would like to trial in Study Three. The presentation will be made available to them afterwards to enable them to read accompanying information on the technology of their choice, with links to relevant websites, evaluation and other details. Individual's preferences will be noted but participants will be free to change their minds before the third study commences.

Study Three
Half-term duration technology study
   a) **Interviews:** You will take part in a pre-trial face-to-face interview for an exploration of your stated stress-management strategies and given an overview of the DCT that you have chosen to trial. Consideration of questions on how, where, when and what help you anticipate using the DCT will follow. The interview will be recorded and pseudonymised (before later anonymisation) to allow for reconciliation of the before and after interviews to take place. The post-trial interview will explore actual DCT use and questions on the influence of contextual factors - including culture, physical and organisational – on behaviour and choices.
      The interviews will be approximately 30 minutes long and take place in school during working hours.
   b) **App survey:** Questions will be sent via an app at an agreed time and frequency e.g. three questions at 3.30 for the first and last weeks of the trial. Results will be collated and aggregated.

6. Will I be recorded and how will the recorded media be used?
The workshop and interviews will be audio recorded. The transcripts of the audio recordings made during this research will be used only for analysis and for (anonymous) illustration in conference presentations and lectures. No identifying data of the participant or school will be retained, and no one outside the project will be allowed access to the original recordings. The recordings will be securely stored on a password protected laptop. All data will be collected and stored in accordance with GDPR and the new Data Protection Act 2018 (DPA 2018). You may withdraw your data from the project at any time up until it is anonymised for use (31/12/20.

7. What are the possible disadvantages and risks of taking part?
There is a possibility that talking about experiences of stress could cause distress. If so, you will be referred to, or can contact directly, the support services offered by the Education Support Partnership (ESP). The ESP is a national charity that offers free phone counselling specifically for teachers, and wellbeing support to all education staff. https://www.educationsupportpartnership.org.uk/ and their helpline is 08000 562561.

8. What are the possible benefits of taking part?
The benefit for those people participating in the project will be
   1) A clearer understanding of their approaches to self-management of stress
   2) An introduction to DCTs and the potential for stress management support
   3) The influence of their workplace context on their stress management
   4) Contributing to the understanding of stress management in the school workplace
   5) A "thank you" gift voucher

9. What if something goes wrong?
Should you wish to raise a complaint please contact the Principal Researcher a.blandford@ucl.ac.uk
If you feel that your complaint has not been handled to your satisfaction by the principle researcher, you can contact the Chair of the UCL Research Ethics Committee – ethics@ucl.ac.uk

10. Will my taking part in this project be kept confidential?
All the information that we collect about you during the research will be kept strictly confidential and anonymised. You will not be able to be identified in any ensuing reports or publications.

11. Limits to confidentiality

- Please note that assurances on confidentiality will be strictly adhered to unless evidence of wrongdoing or potential harm is uncovered. In such cases the University may be obliged to contact relevant statutory bodies/agencies.
- Please note that confidentiality will be maintained as far as it is possible, unless during our conversation I hear anything which makes me worried that someone might be in danger of harm, I might have to inform relevant agencies of this.
- Please note that confidentiality will be maintained as far as it is possible, but where the participant sample is small (i.e. in the interview) study, it is difficult to completely guarantee it, but as the research involves many different locations, the risk is small.

12. What will happen to the results of the research project?

Results of this research will be disseminated in standard academic outlets and will be a part of a PhD thesis. A policy white paper on technology for self-management is also planned. Results may also be disseminated via general interest magazines / newspapers / journals and associated events. You will not be identified in any report or publication.

Should you wish to obtain a copy of the publication related to this study, please contact Julia Manning j.manning.17@ucl.ac.uk at least 6 months after taking part in the study.

13. Data Protection Privacy Notice

Notice:

The data controller for this project will be University College London (UCL). The UCL Data Protection Office provides oversight of UCL activities involving the processing of personal data and can be contacted at data-protection@ucl.ac.uk. UCL's Data Protection Officer can also be contacted at data-protection@ucl.ac.uk.

Further information on how UCL uses participant information can be found here:

www.ucl.ac.uk/legal-services/privacy/participants-health-and-care-research-privacy-notice

Your personal data will be used for the purposes outlined in this notice. The categories of personal data used will be as follows for those who indicate in the second study that they wish to take part in further research:

Name
Email Address

The legal basis that would be used to process your *personal data* will be performance of a task in the public interest.

Your personal data will be processed until the end of this research project (01/01/2022). If we are able to anonymize or pseudonymize the personal data you provide we will undertake this and will endeavour to minimise the processing of personal data wherever possible.

You have certain rights under data protection legislation in relation to the personal information that we hold about you. These rights apply only in particular circumstances and are subject to certain exemptions such as public interest (for example the prevention of crime). They include:

- The right to access your personal information;
- The right to rectification of your personal information;
- The right to erasure of your personal data before the 31/07/20;
- The right to restrict or object to the processing of your personal data;
- The right to object to the use of your data for direct marketing purposes;
- The right to data portability;
- Where the justification for processing is based on your consent, the right to withdraw such consent at any time; and
- The right to complain to the Information Commissioner's Office (ICO) about the use of your personal data.

If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at data-protection@ucl.ac.uk.

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If you remain unsatisfied, you may wish to contact the ICO. Contact details, and further details of data subject rights, are available on the ICO website at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/

14. Who is organising and funding the research?
This research is organised by University College London.

16. Contact for further information
Please contact Professor Ann Blandford a.blandford@ucl.ac.uk or on Phone: +44 (0) 203 108 7049 for any further information

Thank you for reading this information sheet and for considering taking part in this research study.

NB: Participants were orally briefed about the changes to on-line setting due to Covid

Appendix C Study Two Workshop Feedback Form

Managing Stress Workshop

April 2020

Feedback and Participation in Study 3 (Practical) Form

Please type in your answers and email this form back to Julia at: j.manning.17@ucl.ac.uk

Study 3 Practical – Participant Form

1. Name

2. Technology Choice

3. Reason for choice

4. When do you think you would use it?

5. Where do you think you would use it?

6. Home Postcode (required for access to some technologies)

7. Mobile No. (for communication with you ahead of the practical)

Keep this response form for your records. This technology decision is not final, but it gives you a record of your reasoning, and along with the presentation, gives you the chance to explore the technology more fully before making a final decision.

Feedback

This page will be kept separately from the participation sheet (above) with <u>no identifying detail included in the aggregation of the responses.</u>

About you
Age:
Sex: F / M
Total years in teaching:
Do you have extra caring responsibilities at the moment? Y / N

What are your thoughts on the workshop you have just taken part in?

Current practice
1. How many days have you been in school since March 20th 2020?
2. Do you feel more or less stressed than usual about schoolwork? More / Less / Both / Same

Can you briefly say why?

Culture
3. Has your school Principal communicated about supporting teachers' work-related stress in the past? Y/N
4. Has the Corona virus made it easier for you to talk about work stress? Y/ N / Same

Environment
5. Do you feel more or less physically isolated now you are working mainly from home compared to when in school?   More / Less / Both / Same

Can you briefly say how or why?

6. Are you more or less able to manage your work stress when working from home?
   More / Less / Both / Same

Organisation
7. Prior to March 20th did your school leadership encourage collaboration between staff? Y / N
   - Has this changed since March 20th? Y / N
8. Would you describe your school as:
   - Having a positive learning environment? Y / N / Don't know
   - Fostering positive relations with the community   Y / N / Don't know
   - Including teachers in decisions related to school policy?   Y / N / Don't know

Thank you so much for taking part in this research

Appendix D Study One Interview guide

Study One Interview Guide

Research Questions Reminder

RQ: How do context and design influence the use of digital companions for self-management of work stress by secondary school Heads of Year?

RQ 1 What is influencing school middle-leaders current stress management?

RQ 1a How do secondary school middle-leaders manage their stress?

RQ 1b What are the contextual influences on their management?

RQ 1c How and why do they use digital health tools?

Introduction (5 minutes)

This work is not looking at causes of stress, which for teachers are well documented, but the potential for effective digital health interventions (DHIs) to support teachers and reduce symptoms in the school environment.

Emphasise

- **Confidentiality**: The name of the participants will only be known by the researchers and not be revealed to anyone The participants will be identified by an ID and all potentially identifying information will be removed. Individual teachers and those from different schools are being interviewed and findings aggregated, so no answers can be tracked back to a particular school.
- **Participation:** don't share information you don't want to, all conversations must remain confidential. There are no right or wrong answers, it is about their views – but please be as honest as you can.
- **I will probably need to interrupt you! – apologies in advance!**
- **Recording:** the session will be audio-recorded, transcribed and analysed by researchers using NVIVO software, software for qualitative analysis
- **Any questions…**…. If there is time at the end we can return to something you might want to talk more about

Question Guide

A. Which years do you teach/ how long have you been a teacher / why did you choose to teach (your subject)

B. How do you look after your own wellbeing? What does that mean to you?

C. How often do you feel stressed at work, and is it a brief feeling or something more long-lasting and pervasive?

D. Lots of research has been done of the causes of stress, and if you think back to an instance recently that you felt was stressful, can you describe how you dealt with it – either in school or when you got home?

E. Is that how you normally manage stress / stressful situations? Does that approach help – and why?

F. Work on stress symptoms has divided them into four groups, can I ask you about whether you have experienced any of them? This isn't a diagnosis, it's just to get a sense of the most common symptoms amongst teachers – yes/no

Emotional changes
1. Irritability or agitation
2. general unhappiness
3. loss of sense of humour
4. poor self-esteem
5. feeling demotivated
6. becoming withdrawn
7. feeling isolated
Thought changes
1. Impaired judgement
2. finding it hard to concentrate
3. Indecision
4. racing thoughts or mind blanks (in the moment)
Behavioural changes
1. floor pacing
2. nervous habits
3. increased sickness absence
Physical changes
1. Aches and pains
2. Fatigue
3. Sweating
4. Headaches
5. shallow breathing
6. accident prone
7. stomach upsets
8. fast heart rate
9. disregard for personal appearance

G. Do you think your school acknowledges staff wellbeing and stress? What do they do?

H. How autonomous does your line-manager allow you to be and do you feel supported by the SLT?

I. Has the school ever taught any stress management techniques?

- Diaphragm breathing / PMR

- Meditation / mindfulness

- Cognitive restructuring

- Active coping / behavioural activation

- Seeking social supports

- Problem solving

J. Have you shared any thoughts on stress or exchanged ideas with work colleagues? Sharing stuff/resources in a timely way.

K. Why / why not (Barriers and openings)

L. You are probably aware of apps, wearables, online programmes for health and wellbeing

M. Do you yourself use or have ever used any digital health /wellbeing devices e.g. fitbit, wellbeing app etc (separate out wellbeing from chronic condition e.g. diabetes, asthma)

   o What do you like about the DHI?

   o Do you use it in school?

   o Did you have to make any adjustments to be able to use it in school?

- How do you feel about students/staff knowing you use this tech

- Do you think other staff members would be interested in using the same tech?

- Is there anything that makes it especially suited to a school environment?/culture/

- context

- If so, what factors could prevent this?

N. Have you used a DHI to reduce stress

- If yes, what

- If not – any reason why not

- What do you think would be helpful / effective?

- Why wouldn't you use …

O. How would they feel about the school promoting a particular DHI

P. Has there been a moment in your teaching career when you thought yes - this is all worth it!

Appendix E Study Three Interview 1 (Summer)

Study Three Interview Guide 1 (entry)

Introduction notes to cover

- **Thanks:** for their time. Remind them of the Education Support Partnership helpline contact details on the information sheet if they feel they want to talk further or receive support after this interview.
- **Topic Reminder:** This interview marks the start of the 'practical' study where teachers are using their DCT(s) in their workplace – wherever that may be – and its potential to support teachers manage their stress.
- **Confidentiality**: The name of the participants will only be known by the researchers and not be revealed to anyone. The participants will be identified by an ID and all potentially identifying information will be removed. Individual teachers and those from different schools are being interviewed and findings aggregated, so no answers can be tracked back to a particular school.
- **Participation:** Do not share information you don't want to, there are no right or wrong answers, it is about their views – but please be as honest as they can.
- **Recording:** the session will be zoom-audio-recorded, transcribed and analysed by researchers using NVIVO software, one of the most used widely software for qualitative analysis.

Interview Script Framework

1. Please could you describe a typical working day as it is now?

2. Please could you describe a typical working day when you are in school?

Individual - Background

From Feedback

- Technology Choice:

- Reason for choice:

Based on the tech you have chosen, the stress management strategies that it supports fall into the category of…

3. Is this a stress-management strategy that you currently use?

4. Have you used any digital tools to support your stress management before now?

5. How do you think you will use the DCT?

6. What are your hopes or expectations from using it? Both in terms of benefits and drawbacks?

7. Do you think time or effort will be an issue?

8. Three frequently mentioned symptoms in my first study were dehydration, isolation, insomnia – do any of these resonate with you?

Physical – environmental context

From Feedback

9. Where do you think you would use the DCT?

10. Do you feel more or less physically isolated now you are working mainly from home compared to when in school?   More / Less / Both / Same

11. Can you briefly say how or why?

From Ball (Educational contexts – Situated, material)

- situated contexts (such as locale, school histories, intakes and settings)

- material contexts (for example, staffing, budget, buildings, technology and infrastructure)

From HCI Perspectives

- Workspace

- Conditions

- Layout

12. How do you think the type of school that you are in impacts the way that you experience stress? (Given they are WFH, compare workspace, conditions, layout between home and school)

13. Are there particular aspects of stress that you think the DCT will help you manage? (see feedback comments)

Social – relationships context

From Feedback

14. Has your school Principal communicated about supporting teachers' work-related stress in the past? Y/N

15. Has the Corona virus made it easier for you to talk about work stress? Y/ N / Same

16. Are you more or less able to manage your work stress when working from home?

More / Less / Both / Same

17. In your feedback you said (about discussing stress) that ….

18. Do you think your school colleagues will influence your use of the DCT? HOW

19. Do you think you will mind them knowing that the DCT is to help you manage stress?

Organisational – Culture and Control contexts

From Feedback

20. Prior to March 20th did your school leadership encourage collaboration between staff? Y / N

Has this changed since March 20th? Y / N

21. Would you describe your school as:

- Having a positive learning environment? Y / N / Don't know

- Fostering positive relations with the community   Y / N / Don't know

- Including teachers in decisions related to school policy?   Y / N / Don't know

Obviously at the moment you are working from home, so the next question should be considered from two perspectives

22. Firstly, when working from home, in the course of your working day, is there anything you can anticipate that will stop you using the DCT – regulations, disruptions, workload, routine? If so, what are they?

23. And secondly, when working on the school premises, is there anything you can anticipate that will stop you using the DCT – regulations, disruptions, workload, routine? If so, what are they?

Next steps

Study Duration
June 1st – w/c July 13th
Half-way survey
The survey will take place during the week of June22nd-26th
A reminder will be sent the week before
Keeping in touch
Please feel free to contact me with questions at any time.
I am not requesting that you keep a diary of your technology use, but any notes or comments you want to make as you go along would be fine – or simply send them in a text to me xxxx and I can collate them.
Thank you
Finally – thank you once again for being prepared to give up your time and take part in this study. I very much hope that you will find the experience valuable and interesting.

Appendix F Study Three Interview 2 (Summer)

Study Three Interview Guide 2 (exit-summer)

Introduction notes (as Appendix E)

Interview Script Framework

<u>Covid19</u>

1. How many days have you been in school since half term?

2. What do you think has been the impact of Covid19 on your experience of work stress?

3. How have the changes to your routine changed your use of technology for a) work b) yourself?

<u>Tailored questions for DC choice</u>

You Chose (DC Name) which enables (DCT concepts)
To help with your (SMS) (as appropriate) stress management strategies (relaxation, exercise, seeking social support etc)

4. Were there any issues with learning, functionality, amending or remembering how to use the DC?

5. Do you think that overall as a result of having the DC/data there has been a change in: (A/B)

Action	In School	Covid wfh	Details
	Effectiveness – awareness enough?		Why (motivation), did novelty wear off,
exercise			
Relaxation			
Social connections			
Sleep			
Drinking (water/ tea!)			

Other action as a result of the data			

6. Did you feel that the data related to your stress levels – that it gave you a valid correlation?

7. What encouraged you to use the DC (facilitators) (C)

8. What discouraged you to use the DC? (drawbacks/ challenges/ barriers) C)

Tailored questions based on previous interview

(N.B. Questions follow that relate to expectations from Entry Interview)

9. Comparisons with …

10. What aspect most useful – reminders/ alarms/ steps/ calories etc

11. You mentioned chatting to colleagues online and via an app – which one do you use?

12. Was your heart rate interesting to monitor?

13. Was time or effort would an issue?

14. Has there been any change to your quality or quantity of sleep?

Withings Watch (example)

(if not previously covered)
Stress

15. The watch provided data on which to reflect – it also enabled meditation, social support, setting alerts and reminders. What did you find the most helpful to looking after yourself?

16. Did you think the watch was particularly useful to you as a teacher/ Head of Year in managing stress, and if so, why?

17. Has using the Watch made you think that managing your stress is more important than you did before?

<u>User</u>

18. What would be your goals if you carried on using the watch?

19. There was roughly a 50:50 split on those who had mentioned their DCT stress management to colleagues; Would you recommend a fellow teacher buying one?

20. What more could be done to help participants engage with occupational digital mental health?

<u>HCI & Contexts</u>

This section is to investigate the influences of your job role, location and colleagues on your stress management as supported by the watch.
The table below will be populated as viewed on shared screen by the participant and interviewer.
The participant will be asked to consider the influence of the context on stress management of the use, usability and usefulness of the technology as a support for their stress management strategies

	Contextual factors: facilitators and barriers in these contexts		
Influence on <u>Stress</u> <u>management with Tech</u>	Situated - physical environment *Workspace, conditions, building layout.*	Individual - culture *Inter-staff relationships - mutual trust/support/collaboration with colleagues; ok to raise issues.*	Organisational – Culture approach *Trust and value teachers/ Support PDP & Student behaviour/ prevent interruptions/ good comms and clear expectations / responsibilities*
1. Use – When, where, how, why; data-driven, intent, motivation	Opportunity	Perception	Legitimacy
1. Usability – efficiency, ease, satisfaction, enjoyment, context	Practicality	Attitude	Local Privacy - Ability to withdraw
1. Usefulness – helpfulness, demands, relevance, facets, self-management, perception, comparison	Value in location	Value amongst colleages	Value by leadership

<u>Final Q</u>

21. What would the ideal digital companion be like to support your stress management in your role as a Head of Year?

Appendix G Study Three Interview 3 (Autumn)

Study Three Interview Guide 3 (extended - autumn)

Introduction notes (as Appendix E)

Interview Script Framework

<u>Exemplar for Withings Watch</u>
The stress-management strategy that you identified was the following:
1. Educational – such increasing awareness of the stress response
2. **Physiological – such as relaxation or exercise**
3. Cognitive – such as problem solving or time management or
4. Social – such as seeking social support or social skill development

The technology you chose to try out utilises the technique of
A. **Fostering reflection by making health and contextual information available**
B. Suggesting treatment adjustments or activities, and guided self-management
C. Peer-to-peer social support
D. Utilizing entertainment

<u>General questions</u>

1. You have just had the first full half-term with pupils back in school since the start of the pandemic – what have been the similarities and differences compared to pre-pandemic?
2. Following on from above (to prompt more detail if need be)
   a. Physical environment
   b. Culture – individual / relational
   c. Culture - Organisation
3. What have been your particular experiences of stress during this half term?
4. Now you are back in the school workplace, what has your experience been of using your watch/app to help with your stress management? (Differences between now and summer term).
5. If we consider a stressful moment in school – whatever that happens to be – do you think the technology you chose helped you <u>in the moment</u> (at the time of the stressful incident)?
   a. If yes, what is it about the technology that helps?
   b. If no, what is it about the technology that doesn't help?
6. If we consider a stressful moment in school – whatever that happens to be – do you think the technology you chose helps <u>you withstand the pressure</u> (or in building resilience - more able to withstand or adapt to stress)?
   a. If yes, what is it about the technology that helps?
   b. If no, what is it about the technology that doesn't help?
7. Thinking in more detail about the barriers and facilitators to the tech helping you, we're going to think about these again from the physical, social and cultural perspectives that we thought about in July.

	Facilitator / barrier contextual factors		
Influence on <u>Stress</u> <u>management with Tech</u>	Situated - physical environment *Workspace, conditions, building layout e.g. isolated buildings, internal windows.*	Individual - culture *Inter-staff relationships - mutual trust/support/collaboration with colleagues; ok to raise issues.*	Organisational – Culture approach *Trust and value teachers/ Support PDP & Student behaviour/ prevent interruptions/ good comms and clear expectations / responsibilities*
1. Use – When, where, how, why; data-driven, intent, motivation	Opportunity – what is needed?	Perception – better for being informed by data?	Legitimacy - Stigma
1. Usability – efficiency, ease, satisfaction, enjoyment, context	Practicality – how easy?	Attitude - Trust	Local Privacy - Ability to withdraw provided
1. Usefulness – helpfulness, demands, relevance, facets, self-management, perception, comparison	Value in location – specifically helpful/unhelpful?	Value amongst colleagues	Value by leadership – could tech demonstrate that teacher wellbeing requires permission to self-care (some schools had Place-to-be provision counselling for teachers)

8. In previous interviews, teachers indicated that they liked seeing the data the technology collected or portrayed for a variety of reasons. Would you agree or disagree with the following statements on having the data:
   a. The data confirmed your stress-management strategy Y/N
   b. The data affirmed the importance of your self-care Y/N
   c. The data allowed you to frame and plan your day Y/N
   d. The data allowed you more opportunity to reflect on your wellbeing Y/N
   e. The data was accessible in school Y/N
   f. The ability to act on the data was dictated by the circumstances you were in Y/N
   g. The data influenced the amount of activity or exercise you did Y/N
   h. The data prompted better time management Y/N
   i. The data affirmed your hard work and validity of having a break Y/N
   j. The data in-the-moment indicated that you were more stressed that you realised Y/N
   k. The data helped you to feel connected to your peers Y/N
   l. The data helped you to feel less isolated - no feels isolated from close colleagues Y/N
   m. The data was helpful for improving your sleep
   n. The data was helpful for drinking or eating more regularly Y/N
   o. The data helped you understand and manage your colleagues stress Y/N

9. Now having used the technology during the summer and autumn terms, how would you improve it?

10. If there was one thing <u>you would like</u> to change in school that would help you to self-manage stress what would it be?

11. Do you think the same change would be <u>helpful to your colleagues</u>, or is there another change that would make a difference for the majority of your colleagues in managing their stress?

Tailored questions (which may have been covered in responses above)

1. You spoke in July about finding your voice and how this had reduced your sense of stress – has this continued do you think?

2. Do you think the watch has helped you more with managing your own stress or dealing with your stressed colleagues?

3. Are you still looking at your sleep patterns?

4. Have you carried on trying to be more active and drinking more? (was she more active in the summer as planned?)

5. You mentioned your heart rate rising due to other people's behaviour or management expectations of you doing things in a certain way – does that still happen or have you found a way to deal with that?!

6. You liked having all the notifications on your watch – did you continue to appreciate these (and not having to have you phone with you?)

7. Have you felt more or less isolated from colleagues? Or less able to avoid interruptions from kids?

8. Has the SLT management been more supportive this term?

9. Have you tried going to a different toilet this term?!

<u>Keeping in touch</u>

Please feel free to contact me with questions at any time. Reminder data is kept in anonymous form until end of 2022 then destroyed.
Thank you

Finally – thank you once again for being prepared to give up your time and take part in this study. I very much appreciate all the time you have given to this study.

Appendix H Study Three Open and Closed Question Survey Responses Summer Term

Survey questions in week 4 of longitudinal study on Monday, Wednesday and Friday
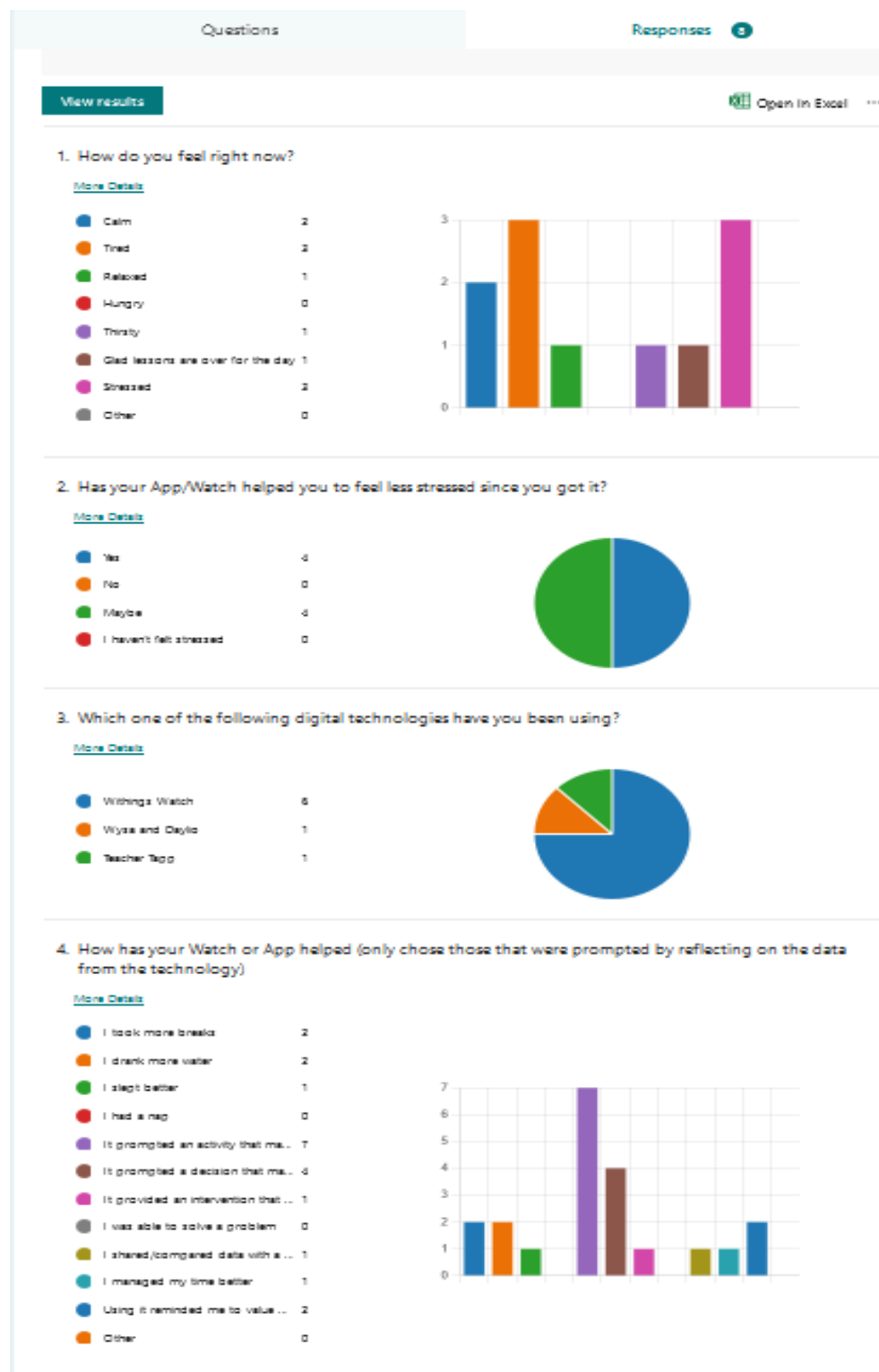
5. Has knowing data e.g. your heart rate, activity levels or quality of sleep, made any of your stress management strategies easier, and if so, how?

More Details

6
Responses

Latest Responses

"Not really"

"It reminds me to get out and take a break, otherwise I would stay at my co..."

6. Are you wearing your watch all the time? Yes, no, during the day only, not in the shower/bath

More Details

|	
🔵 Yes	1
🟠 No	1
🟢 During the day only	1
🔴 Not in water	3
🟣 Not at night	0

7. Has your ability to manage stress with your watch features during work been made harder by:
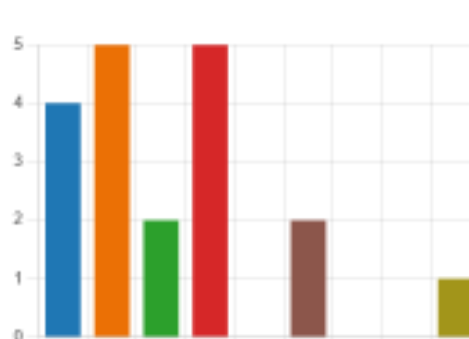
More Details

🔵 Your work surroundings	0
🟠 Your work colleagues	0
🟢 Your workload or timetable	2
🔴 Disruptions or interruptions to y...	3
🟣 Not wanting to reveal you were ...	0
🟤 School layout (if in school)	1
🩷 Having to adapt to mixed abilit...	0
⚫ None of the above	2
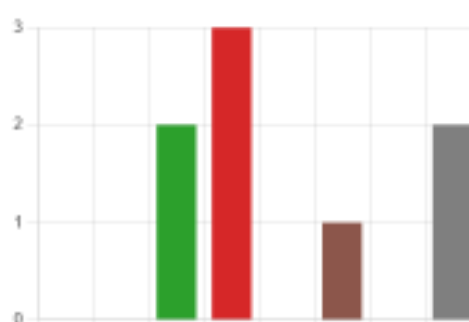
8. Which of these are true about your experience of your Withings Watch and data?

More Details

🔵 efficient	4
🟠 easy to use	5
🟢 satisfying or helpful	2
🔴 enjoyable	5
🟣 can only be used in certain plac...	0
🟤 is only helpful with certain stress...	2
🩷 too time consuming	0
⚫ isn't persuasive enough	0
🟡 Other	1

9. Has Wysa helped with stress management and where are you usually when you use Wysa?
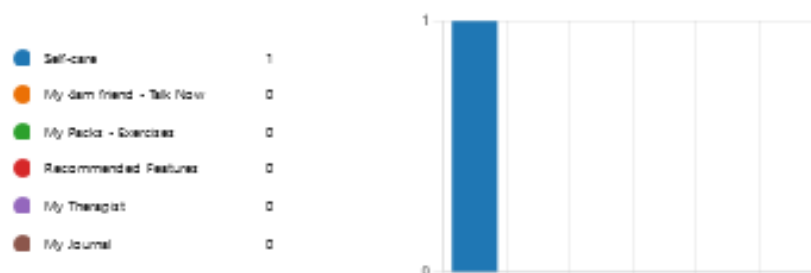
More Details

1
Responses

Latest Responses

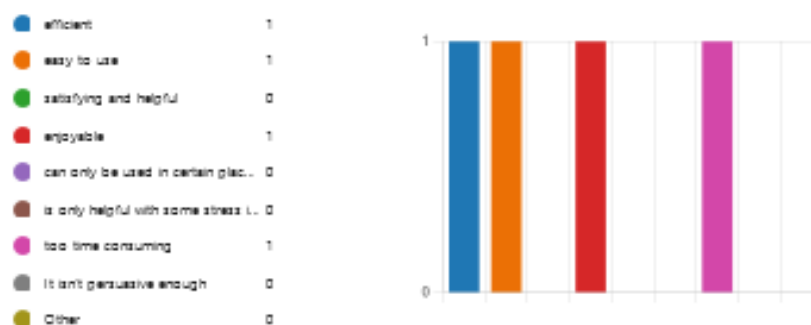10. What feature(s) of Wysa has been most useful recently?

More Details

Self-care	1
My dam friend - Talk Now	0
My Packs - Exercises	0
Recommended Features	0
My Therapist	0
My Journal	0

11. Is Wysa helpful to managing your experiences of stress as a teacher?

More Details

Yes	1
No	0
Maybe / Sometimes	0
Other	0

12. Which of these are true about your experience of Wysa? (pick all relevant)

More Details

efficient	1
easy to use	1
satisfying and helpful	0
enjoyable	1
can only be used in certain plac...	0
is only helpful with some stress i...	0
too time consuming	1
It isn't persuasive enough	0
Other	0

13. When and where do you input data into Daylio?

More Details

During the day in school time	0
During the day out of school ti...	1
In the evening	1
Before I go to bed	1
In the morning before school st...	0
Other	0
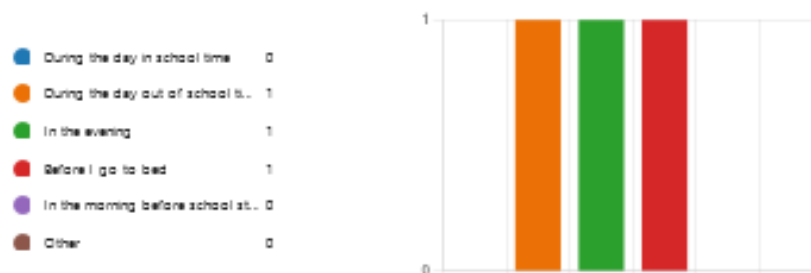
14. What aspect of Daylio has been most useful and why?

More Details

1

Responses

Latest Responses

15. Has information from Daylio been detailed enough to help you to manage occupational stress?
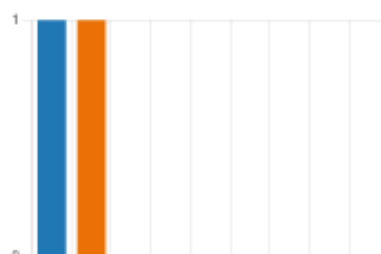
More Details

● Yes 0
● No 0
● Other 1

16. Which of these are true about your experience of Daylio (pick all relevant)

More Details

● efficient 1
● easy to use 1
● satisfying and helpful 0
● enjoyable 0
● can only be used in certain plac.. 0
● is only helpful with some stress i.. 0
● is too time consuming 0
● It isn't persuasive enough 0
● Other 0

17. What was the last feature on TT that you read or acted upon, why, and where were you at the time?

More Details

1

Responses

Latest Responses

"GCSE and A level assessment; I read it at home roughly about 8pm"

18. Has reading the TT website helped you to manage workplace demands?

More Details

● Yes 0
● No 0
● Some aspects 1

19. Has information on the TT website been relevant to managing your stress?

More Details

● Yes 0
● Sometimes 1
● I feel more informed but it hasn.. 0
● No 0

20. Which of these are true about your experience of Teacher Tapp (pick all relevant)

More Details

- 🔵 efficient and relevant — 1
- 🟠 easy to use — 1
- 🟢 satisfying and helpful — 1
- 🔴 enjoyable — 1
- 🟣 can only be used in certain plac... — 0
- 🟤 it is only helpful with some stres... — 0
- 🩷 too time consuming — 0
- ⚫ it isn't persuasive enough — 0
- 🟡 Other — 0

21. Have you experienced any of these emotional changes since Lockdown?

More Details

- 🔵 Irritability or agitation — 3
- 🟠 General unhappiness — 2
- 🟢 loss of sense of humour — 0
- 🔴 poor self-esteem — 3
- 🟣 feeling demotivated — 5
- 🟤 becoming withdrawn — 2
- 🩷 feeling isolated — 2
- ⚫ None — 1
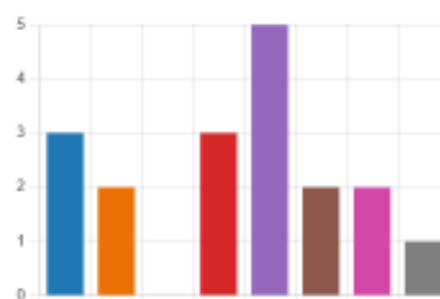
22. Have you experienced any of these thought changes since Lockdown?

More Details

- 🔵 Impaired judgement — 1
- 🟠 Finding it hard to concentrate — 3
- 🟢 Indecision — 3
- 🔴 Racing thoughts or mind blanks — 2
- 🟣 None — 3

23. Have you found yourself doing any of the following during Lockdown?

More Details

- 🔵 Floor pacing — 1
- 🟠 Nervous habits — 1
- 🟢 Increased sickness absence — 1
- 🔴 None — 5

24. Have you noticed any physical changes during Lockdown such as

More Details

🔵	Aches and pains	5
🟠	Fatigue	3
🟢	Sweating	0
🔴	Headaches	4
🟣	Shallow Breathing	0
🟤	Accident prone	0
🟣	Stomach upsets	1
⚫	Fast heart rate	1
🟡	Disregard for personal appeara...	0
🔵	None	2

Questions	Responses 6

6	05:01	Active
Responses	Average time to complete	Status

View results   Open in Excel —

1. Have you used any of these technologies in the past to support your health or wellbeing?

More Details

● Alarm	3
● Reminder system (e.g. mobile ...	2
● App for physical health	1
● App for mental or emotional h...	1
● Website for physical health	2
● Website for mental or emotio...	0
● Internet Search for any healt...	1
● Wearable band e.g. Fitbit	4
● Pedometer	2
● None	0
● Other	0

2. If you have used any technology for health before, what did you like about it?

More Details

6	Latest Responses
Responses	"It gave me information about how to get physically fitter and more ...
	"It was able to tell me my step count on a daily basis. Promotes health...
	"n/a"

3. If you had NOT used any technology for health before, or STOPPED using it, were any of the following reasons true? (Choose any relevant)

More Details

● It didn't help	2
● I wasn't convinced it could help	1
● I never felt I needed it	0
● It was attractive or pleasing o...	1
● I'm not that keen on technology	0
● It looked complicated or difficu...	0
● I didn't want to be monitored	0
● I didn't know anyone who bell...	0
● I didn't trust the privacy or sec...	0
● I didn't want to be seen to be ...	0
● I didn't think there was anythi...	1
● Other	2

4. Have you used any of the following platforms to find or give support in your role as a teacher?

More Details

● Whatsapp	1	
● Twitter	1	
● Reddit	0	
● Facebook	3	
● Instagram	2	
● Podcasts	2	
● blogs	1	
● Pinterest	2	
● Slack	0	
● None	1	
● Other	0	
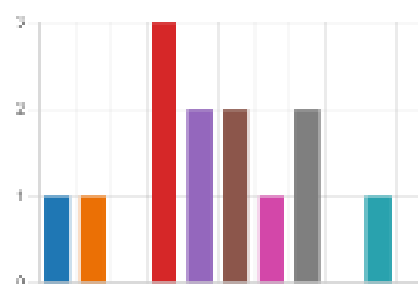
5. What date(s) and time(s) between July 15th and 20th are you free for the end of study Zoom interview please?

More Details

6
Responses

Latest Responses
"17th July"
"July 16 or 17 at 4pm"
"July 16th or July 20th in the morning or early afternoon"

Questions	Responses **7**

Friday Questions

7	**04:27**	**Active**
Responses	Average time to complete	Status

View results   [x] Open in Excel ...

1. Please write your first name here so results can be referred to in the final interview!

More Details

7
Responses

Latest Responses

"*Adeola*"

"*Yemi*"

"*Jade*"

2. Where are you working today

More Details

- From home   6
- In school   1

3. If you are in school, is social distancing adding to workplace stress today?

More Details

- Yes   0
- No   1
- Am not in school   6

4. Has your App/Watch helped you to feel less stressed since Monday?

More Details

|		
●	Yes	3
●	No	0
●	Maybe	3
●	I haven't felt stressed	1

5. How has your Watch or App helped THIS WEEK (only chose those that were prompted by reflecting on the data from the technology)
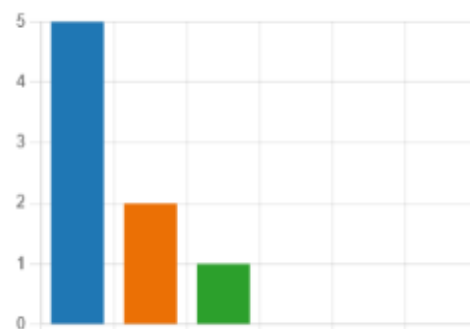
More Details

●	I took more breaks	1
●	I drank more water	4
●	I slept better	3
●	I had a nap	0
●	It prompted an activity that mad...	4
●	It prompted a decision that mad...	0
●	It provided an intervention that ...	1
●	I was able to solve a problem	0
●	I shared/compared data with a c...	0
●	I managed my time better	2
●	Using it reminded me to value m...	1
●	Other	0
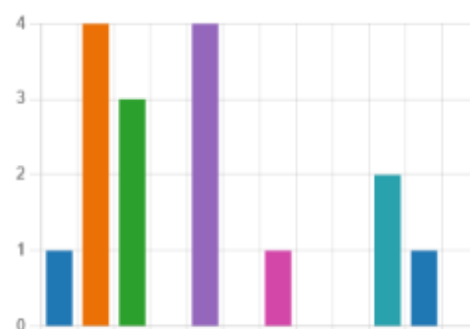
6. Were you able to drink as much as you needed today?

More Details

●	Yes	5
●	No	2
●	I didn't have the time to get to t...	1
●	I forgot!	0
●	I didn't have drinks with me today	0
●	Other	0

7. Were you able to chat to work colleagues easily today?

More Details

🔵	Yes - online. via an app	4
🟠	Yes - In person	1
🟢	No - there wasn't enough time	0
🔴	No - I was on my own all day	1
🟣	Other	1

8. Where exactly were you when you last looked at the data your watch/app provided?

More Details

7
Responses

Latest Responses
"In bed"
"Home"
"On the sofa after getting in from work!"

9. Were you able to get away somewhere from students or caring duties during school hours this week to relax/be uninterrupted for a moment?

More Details

🔵	Yes	6
🟠	No	1
🟢	Other	0

10. Have you compared your data with that of a colleague since the study began?

More Details

🔵	Yes	1
🟠	No	6

11. Have you felt that your efforts to adapt your teaching during lockdown been valued by school leadership?

More Details

🔵	No	0
🟠	Maybe	1
🟢	Yes	6

12. On the scale below how important did you rate managing your own stress and wellbeing?

More Details

Legend: ■ Not Important ■ Slightly Important ■ Moderately Important ■ Important ■ Very Important

Before Lockdown

After you got your Watch/App

100%   0%   100%

13. Have you mentioned to school colleagues using your watch/ app to help with stress management since you got it?

More Details

● No   4
● Yes   3

14. Do you consider that you have the following in your workplace (tick all relevant)?

More Details

● supportive professional relations... 7
● a strong sense of belonging to th... 4
● good support from school admini... 4
● a belief that the students are res... 4
● opportunities to laugh or relax wi... 4

15. How has your principal or SLT recognised the extra stress that you have been under during Lockdown

More Details

7
Responses

Latest Responses

"I've contacted via email and we had a chat in person"

"More regular line management meetings"

"Mentioned it and briefing and said thank you - encouraged us to make sure we ..."

16. Has using the watch/app made it easier to talk to School Leadership about work stress?

More Details

● Yes   0
● No   3
● I haven't had the chance   3
● Other   1

17. How good is your Principal good at keeping you infomed and communicating information and expectations?
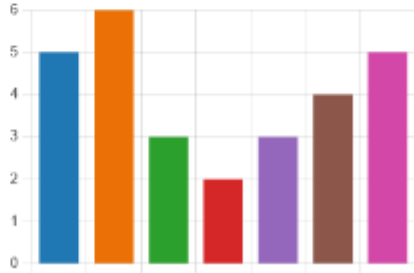
More Details

7
Responses

★★★★★
4.29 Average Rating

18. Does your Principal and SLT enable the following (tick all relevant)

More Details

- a caring, open and inclusive cult... 5
- clear professional identity for tea... 6
- your job satisfaction 3
- your psychological health and e... 2
- positive social interactions amon... 3
- your understanding of policy cha... 4
- a strong sense of school commu... 5

Appendix I Example of Coding from Study One

Study One - Code Book 2

Organising theme A: Educational practice constrains teachers' wellbeing and self-management of stress

Theme Two T2:   Organisational culture influences self-management of stress

| Theme Two T2: Organisational culture influences self-management of stress					
Subtheme 2:1	**Stigma of not coping deters help-seeking**				
Participant no	P10	P9	P8	P13	P12
Quote	*No, (I haven't recommended Mindshift to colleagues) I think we're quite secretive by nature. I think it's such a stigma as teachers I think we've all got a character trait that we like to do well and I think if you admit you're stressed it's like admitting you're failing.*	I think just by nature of our profession, and appraisal driven kind of targets I think people are fearful of admitting that they can't cope with things…	And, all the time people are in fear of their jobs, because they're worried if they don't carry on in the way that they… You know, keep fulfilling those deadlines, and making sure they're doing X, Y, Z, as they're expected to do, then they're going to be financially penalised, they're going to get themselves into a situation	The idea is that because I'm someone who wants to do really well, if you took something off me because I'm stressed, the impact might be that it makes me feel like I'm failing	*I say it's for research purposes, but actually it's for me as well that I access these things. I use Pacifica. I don't know if you've heard of that?*

Code	Symptoms not on list – Fear – of not being good enough	Digital Tools – encourage others to use – no, secretive nature a facet of stigma and fear of admitting can't cope	Symptoms not on list – Fear – of demotion	School Stress Management – strategy – stigma still exists	Digital Tools – Aware of stigma – hides behind research

Theme Two T2:   Organisational culture influences self-management of stress

Subtheme 2:2	**Teachers' wellbeing secondary to student wellbeing**				
Participant no	P4	P7	P10	P9	P12
Quote	I did say to (the head) I wanted (mindfulness) to be on the CPD this year. Because there are a lot of companies that use mindfulness for CPD. For their staff. And he said that, yes, we would put it on the CPD... But he did make it very clear to me, but remember, that is not the bread and butter of this school.	*Because you've really got to look after yourself because nobody else is going to look after you here. They're not because they can't… nobodies got time to look after their staff.* I think that's what it is. Yes.	I think it's just there's too many other things and priorities and also a sense that the students always come first	*So you've got stressed teachers trying to unstress children which doesn't make much sense.*	Depending on who (on the SLT) you talk to, they get the importance of it or not, depending on their responsibilities. Quite understandably, if they're accountable for attainment, they might not be as ready to see this immediately as feeding into that. Although, that's changing for the better, I think.
Code	School Stress Management -	School Stress Management -	School Stress Management -	Stress context - increased	School Stress Management

	culture - teacher wellbeing recognised but not the priority	culture - teacher wellbeing recognised - nobody's job	culture - teacher wellbeing recognised but not the priority	expectations of staff facilitating mental health in school	- culture - inviting MH charities into school

Appendix J Example Mapping of Themes for Study One

Slide 1
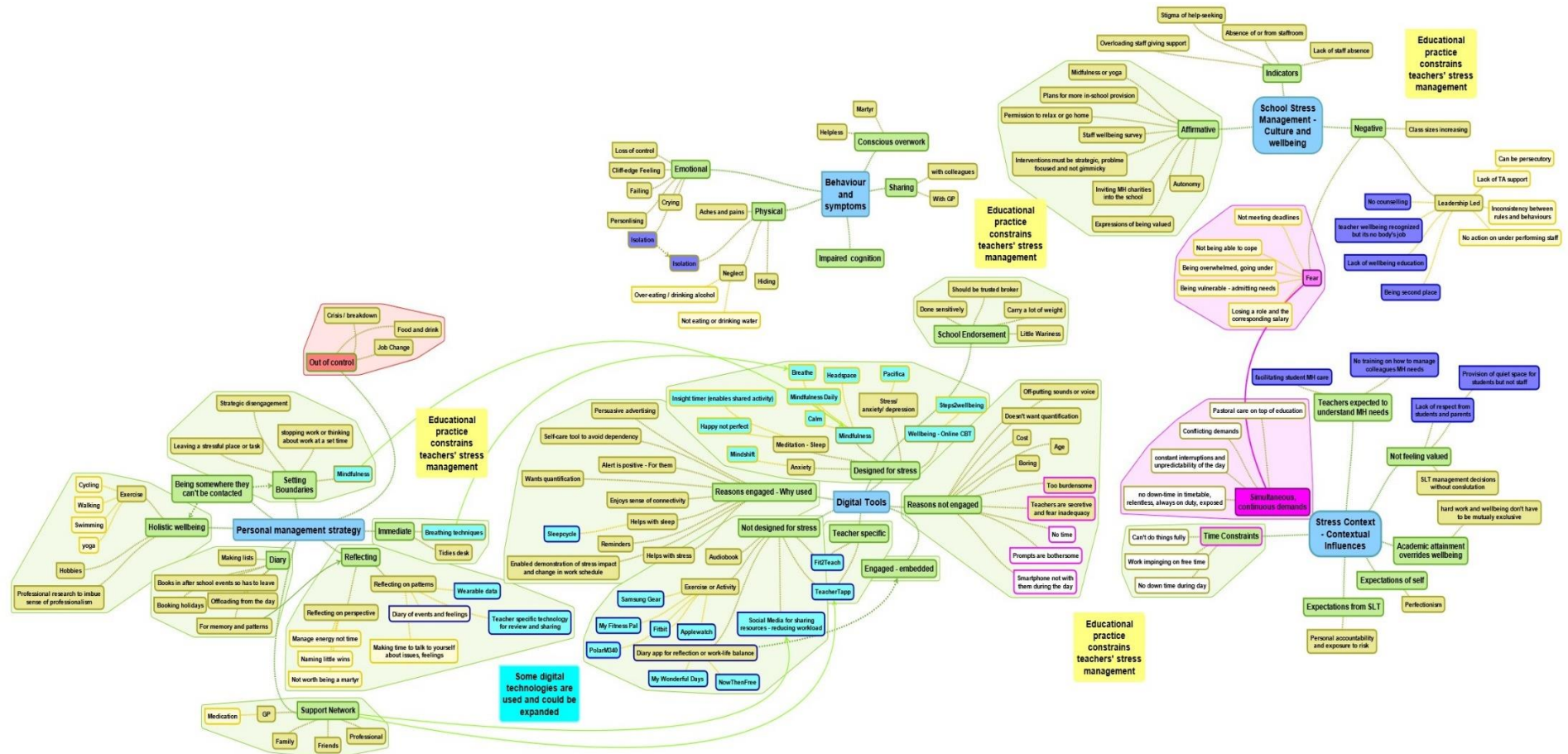
Workshop

Investigating the use of digital health technology for workplace stress management – the influence of the school context

Julia Manning
UCL Interaction Centre

(i) the UCL Data Protection Officer stating that this research project is compliant with the General Data Protection Regulation. My Data Protection Registration Number is: 26364106/2018/10/06
(ii) my ethics application has been approved with project ID number: UCLIC_1920_004_Staff_BlandfordManning

Slide 2

Occupational Stress is normal

- teaching unmotivated students
- maintaining discipline
- time pressures and workload
- coping with change
- being evaluated by others
- dealings with colleagues
- self-esteem and status
- administration and management
- role conflict and ambiguity
- poor working conditions

Camacho DA, Vera E, Scardamalia K, Phalen PL. What are urban teachers thinking and feeling? Psychol Sch 2018;55(9):1133–50 DOI:10.1002/pits.22176

Slide 3

What is new?

Thinking about
– Your ability to manage stress
– Your ability to use digital tools to support stress management
Given the school context in which you work

Slide 4

Aims -
As a senior teacher in a busy Academy school:

- Space for you to think about how you manage your stress (SMS)
- Place for you to think about Digital Tools that you use - including to support stress management
- Time for you to be introduced to other Digital Tools and make a choice of what you could use for the next study

Slide 5

Session One – Exercise One

- So think about how do you de-compress or wind-down?
- What strategies do you use to defuse the feelings of stress, either in the moment or when the final bell goes or on the way home or when you get home? Or perhaps when you get up in the morning to set yourself up for the coming day?
- They could be ways in which you relax, socialise, problem solve or become more aware of yourself.
- What are your wellbeing habits?

Go to Menti.com and use code XXXXXX and add in words or short phrases that describe what you do

Slide 6

Stress Management Strategies

Educational e.g. knowledge and awareness of stress	Physiological e.g. relaxation, exercise	Situational e.g. altering environment	Cognitive e.g. problem solving, time management	Social e.g. seeking social support or social skill development
Reading Teaching websites or literature	Walking Yoga Breathing Mindfulness	[Change job or school!]	Keeping a diary/ lists CBT Talking to yourself	Social media professional or friendship groups Training

Slide 7

Session One – Exercise Two

- Some of you will have downloaded specific stress-buster apps – they will be obvious.
- Others will have apps either on their mobile or on their tablet or desk-top of programmes that help them relax – maybe a game or a meditation.
- Some people have a wearable – to help remind them to take a certain amount of exercise, or monitor their heart rate, or remind them to move or do a breathing exercise.
- Your default might be the X-Box or PS4.
- If you can't think of anything digital you use, don't worry. For some you may simply use a diary app or set your watch 5 mins fast to help with time management. Or you take your watch off at the weekend, or not using your phone.

Go to Menti.com and use code xxxxxx and add in words or short phrases that describe what have or digital tech you use

7

Slide 8

Digital Companion Techniques

Fostering reflection via information – Health or Context R	Suggesting treatment adjustments or activities, and guided self-management T	Wellbeing Support Involving healthcare team I	Peer-to-peer social support S	Utilizing entertainment E
Diary App Step Tracking App or Wearable	Mindfulness App Guided Breathing App	iCBT Online	Fit2Teach Wearable network	PS4 Gamified learning

8

Slide 9

Constraints / Barriers to SMS Identified in first study

Physical
Exposure – no privacy
Isolation – from colleagues
Dehydration, Insomnia

Cultural
Stigma of not coping
Second place to student welfare

Organisational
Relentless
Time
Isolation – Lone actor

9

Slide 10

Selection Criteria

- Available on iOS and Android
- Expert Review Evaluation Frameworks for apps – user, clinical and privacy assurances
  - Mindtools
  - Psyberguide
  - Orcha
- NHS App Library
- Clinical trials
- Encryption (where transmission) of data connection and storage (Wearable, online or app)

Slide 11

chiefmartec.com Marketing Technology Landscape ("Martech 5000")

Why privacy matters:
Digital Marketing Economy

Slide 12

INTERVENTION TAXONOMY

Stress management strategies Digital Companion Techniques	Educational e.g. knowledge and awareness	Physiological e.g. relaxation, exercise	Cognitive e.g. problem solving, time management	Social e.g. seeking social support or social skill development
Fostering reflection via information - Health or Context	Stress Management at Work Fit2Teach TeacherTapp	Withings Steel SR	Daylio Fit2Teach PRO	Withings Steel SR TeacherTapp
Suggesting treatment and guided self-management	Equoo	Headspace Calm	SilverCloud Wysa Big White Wall	
Peer-to-peer social support	Fit2Teach PRO	Withings Steel SR	Fit2Teach PRO Big White Wall	Fit2Teach
Utilizing Entertainment	Equoo	Nintendo / PS4 etc	SilverCloud	Equoo
Involving Healthcare Team Professional Support			Wysa SilverCloud	

Slide 13

10 stress busters

Stress information online

NHS.UK
https://www.nhs.uk/conditions/stress-anxiety-depression/understanding-stress/
https://www.nhs.uk/video/Pages/Stressexpert.aspx

EDUCATION-REFLECTION

13

Slide 14

Fit2Teach

- Start measuring your teacher-wellbeing and work-life balance by answering our in-app daily questions about your routines and work habits
- Discover your unique daily and weekly fit2teach wellbeing-scores
- Track your scores on your personal weekly and monthly calendars
- Monitor your performance to identify patterns and trends potentially damaging to your wellbeing
- Make and measure small changes to improve your work-life balance and reduce your workload
- Receive weekly messages of encouragement and advice
- Complete motivating challenges
- Earn rewards
- Celebrate your progress and success

EDUCATION-REFLECTION

14

Slide 15

Fit2Teach (PRO)

NICE Tier 2
https://www.fit2teachapp.com/

Evaluation - no
Privacy policy
- Identity/Media files access required
- Name/email
- Transmission to F2T – not encrypted; storage – password protected; transmission from F2T – encrypted; user stats aggregated

Interview 2017

Education – Reflection
Educational – Social Support (PRO)
Cognitive – Reflection (PRO)
Cognitive – Social Support (PRO)

15

Slide 16

Teacher Tapp

STEP ONE – ASK

Ever wondered whether what goes on in your school is 'normal'? We work with teachers, researchers and other organisations to craft three multiple choice questions for the panel and load them onto our system.

STEP TWO – ANSWER

At 3:30pm, phones across the country buzz and you get a chance to answer our three questions. Most teachers are super-quick, answering in the first hour!

TEACHER TAPP
ASK · ANSWER · LEARN

Education – Reflection
Social Support - Reflection

16   ★ 01:07

Slide 17

STEP THREE – LEARN

Once you've answered the three questions, you get to find out how other teachers answered yesterday's questions

Share the findings on social media or by email

TEACHER TAPP
ASK · ANSWER · LEARN

17   ★ 01:37

Slide 18

STEP FIVE – LEARN (EVEN MORE)

We harvest the data to create insights about schools and the profession, which we summarise in a weekly blog post

TEACHER TAPP
ASK · ANSWER · LEARN

Teacher Tapp Website
Privacy Policy
Transmission & Storage encrypted
Anonymous storage – GDPR compliant
Researcher data supplied aggregated
The Teacher Gap (Book by Prof Becky Allen, IoE, and Chief Analyst, Teacher Tapp)

18   ★ 00:26

Slide 19 — Equoo

Equoo

Learn a set of key psychological skills in each level - Apply your new skills in choose your own adventure games to unlock insights about your personality and progress to the next level - Learn where you lie on the Big Five measures of personality and what this means for you.

Emotional Awareness
Emotional awareness is recognizing when certain feelings are present in ourselves or the other people and acknowledging them.

Self-Management
This segment of EQ includes the ability to manage emotions. It is the ability to regulate our own emotions and influence other people's feelings as well.

Empathy
Empathy is ability to recognize and understand other people's feelings and use that understanding to communicate to others more effectively.

Motivation
This represents our ability to connect our emotions to motivate ourselves to work towards reaching our goals.

Social Skills
Social competence represent our skills to communicate with other people. High EQ social skills include the ability to understand our own and other people's verbal communication, body language and gestures.

NICE Tier 2 (informative)
https://equoogame.com/
NHS App Library

Evaluation/ research
Psyberguide (2019) A / (no security rating)
Orcha (2018) 85%

No data transmission – all data kept on phone.

Educational – Activities
Educational – Entertainment
Social - Entertainment

19

Slide 20 — Withings Wearable – Steel HR

NICE Tier 2

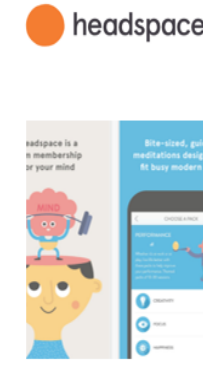Medical grade/ CE – FDA approved / encrypted transmission and storage

Evaluation/ research
Comparison of 4 trackers 2016 (Pulse model – top for accuracy & activity)

Sleep Studies

Withings Wearable – Steel HR

- Prompt
- Activity
- Heart rate
- Total Sleep Time

Physiological – Reflection
Physiological – Social Support
Social - Reflection

20

Slide 21 — Headspace

Headspace

Learn how to meditate and live mindfully – download the app **Headspace**. There are loads of sessions on everything from stress and sleep to focus and anxiety. Lots of SOS exercises for those sudden meltdowns.
https://www.headspace.com

- NICE Tier 2

Evaluation/ research
- Mindtools.io (2017) 4.4/5
https://mindtools.io/programs/headspace/
- Psyberguide (2016) A/ Acceptable
https://psyberguide.org/apps/headspace/
- Orcha (2019) 79%
https://appfinder.orcha.co.uk/Review/208690/
- No encryption

The effectiveness of Headspace is supported by multiple RCTs (Bennike et al., 2017; Economides et al., 2018; Howells et al., 2016; Noone and Hogan, 2018; Rosen et al., 2018; Yang et al., 2018), and uncontrolled studies (Laurie and Blandford, 2016; Taylor et al., 2016; Wen et al., 2017; Wylde et al., 2017)

Physiological – Treatment

21

Slide 22 — Calm

Find Your Calm
Sleep more. Stress less. Live better.
GET STARTED

Meditate
s the life-changing skill of meditation

Sleep
Get more restful sleep and wake up feeling refreshed

Music
Exclusive music to l focus, relax, sl

Body
o lessons on mindful ovement and gentle stretching

Masterclass
Audio programs taught by world-renowned mindfulness experts

Scenes
Nature scenes and to enjoy while rel sleeping, workin studying

- NICE Tier 2

Evaluation/ research
- Mindtools.io (2016)
https://mindtools.io/programs/calm/
- Psyberguide (2019) A Acceptable
https://psyberguide.org/apps/calm/
- Orcha (2019) 72%
https://appfinder.orcha.co.uk/review/267055/
- Partial encryption

"the ideal dosage of mindfulness practice varies by person, and that we must challenge the widely-held assumption that daily practice is desirable" Clark & Draper 2019

Physiological – Treatment

22

Slide 23 — Daylio

Daylio

- NICE Tier 2
- https://daylio.webflow.io
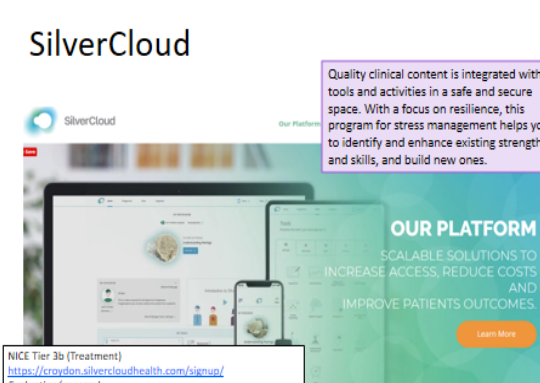
Evaluation/ research
- Mindtools.io A-B
- Psyberguide A-C
- Orcha 72% A (2018)

Cognitive - Reflection

23

Slide 24 — SilverCloud

SilverCloud

Quality clinical content is integrated with tools and activities in a safe and secure space. With a focus on resilience, this program for stress management helps you to identify and enhance existing strengths and skills, and build new ones.

OUR PLATFORM
SCALABLE SOLUTIONS TO INCREASE ACCESS, REDUCE COSTS AND IMPROVE PATIENTS OUTCOMES.

NICE Tier 3b (Treatment)
https://croydon.silvercloudhealth.com/signup
Evaluation/ research
Orcha (2018) 84%
Research Papers
Data storage and transmission encrypted; data sharing on consent only

Cognitive – Treatment
Cognitive – Professional Support
Cognitive – Entertainment

24

WYSA

- NICE Tier 3b guides treatment

Evaluation/ research
- Mindtools.io (2017) 3/5
  https://mindtools.io/programs/wysa/
- Psyberguide (2017) Acceptable
  https://psyberguide.org/apps/wysa/
- Orcha (2019) 93%
  https://appfinder.orcha.co.uk/review/209172/

Research Paper 1
Research Paper 2

Data stored and transmitted encrypted; no personal identifiers shared; anonymized aggregated data shared with consent

Cognitive – Treatment
Cognitive – Professional Support

25

Big White Wall

What we offer

People come to Big White Wall for help with a wide range of mental health and wellbeing issues – from anxiety, depression, stress and trauma, to relationship problems and lifestyle challenges.

Organisations can commission our Support Network services, or Support Network plus Live Therapy

Support Network	Live Therapy
An anonymous and stigma-free environment. Members follow their own path towards better mental wellbeing.	One-to-one online therapy with registered and accredited counsellors and Cognitive Behavioural Therapists.
• Peer support through our online community	• Sessions available seven days a week, 7am to 9pm
• Resources for self-management	• Sessions take place via text, audio and secure video
• Information and advice	• Sessions can be booked quickly, with no waiting lists
• Guided support programmes on a range of common issues	• Members choose their therapist
• Monitored 24/7 by trained clinicians	• Live Therapy clients have access to the Support Network

NICE Tier 3a (Self-manage, behaviour change)
Big White Wall
Evaluation/ research
Data storage encrypted; transmission with consent only

Cognitive – Treatment
Cognitive – Social Support

26

INTERVENTION TAXONOMY

Stress management strategies / Digital Companion Techniques	Educational e.g. knowledge and awareness	Physiological e.g. relaxation, exercise	Cognitive e.g. problem solving, time management	Social e.g. seeking social support or social skill development
Fostering reflection via information - Health or Context	Stress Management at Work / Fit2Teach / TeacherTapp	Withings Steel SR	Daylio / Fit2Teach PRO	Withings Steel SR / TeacherTapp
Suggesting treatment and guided self-management	Equoo	Headspace / Calm	SilverCloud / Wysa / Big White Wall	
Peer-to-peer social support	Fit2Teach PRO	Withings Steel SR	Fit2Teach PRO / Big White Wall	Fit2Teach
Utilizing Entertainment	Equoo	Nintendo / PS4 etc	SilverCloud	Equoo
Involving Healthcare Team Professional Support			Wysa / SilverCloud	

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Appendix L Example Case Study from the Summer Term

One of the eight case studies created from the data collated on each participant is reproduced here as an exemplar. All case studies are available in a separate document as supplementary materials.

Participant T1 Case Study

T1 is in her second decade of teaching science and has been Head of Year for the same school year for some years. Having worked elsewhere before becoming a teacher, she described herself as part of the older generation of teachers at the school. T1 had extra caring responsibilities due to lockdown, which began after schools closed to most pupils on March 20th 2020, and was teaching from the same room in her home in which one of her children was being home-schooled. T1 did not go back in school until the last day of the summer term. The workshop took place in late April at the start of the summer term and the first interview took place straight after the summer half term in June. The surveys were completed at the end of June and at the final interview at the end of the summer term in July. T1 used her DCs for seven weeks during this study.

Findings

Teaching context

T1 described the length of her days as quite varied now she was entirely teaching from home. There were days when she started teaching a live lesson at 8.30 am, others where she would do some administration before this. Her duties included teaching, checking on attendance and following up absent students, Head of Year reporting and planning. During lockdown, T1 reported that the teaching load had been reduced, so all the Heads of Year had been asked to undertake more planning for the next term. Her afternoons were often taken up with meetings and administration, which for her had included composing the school newsletter. However, student welfare and family support had become a larger component of her working life.

Calling parents about student welfare could run into the evening, but she did try and set boundaries. This did not mean the same cut-off time each day, but it meant that she might allow herself space in the day to attend to her own and her family's needs, and then make calls in the evening. These calls would either be to enquire about a student absence or more generally about student wellbeing and progress. It would sometimes also result in a home call.

I'm going to go and visit a parent this evening. I'm going to have to make a cut-off somewhere…Some evenings I'm not doing anything but some evenings I'm ringing parents, just to find out how their children are doing and what's going on.

T1 conveyed a sense of achievement with the attendance rates that the school had attained, which had averaged about 85 per cent. She felt that home-schooling had helped change perceptions about the amount and multiplicity of work that teachers normally undertake. Before the pandemic, it was not unusual to have parents expressing dissatisfaction with either the assortment or the quantity of work that their children were being given to do. Since the onset of the pandemic, with most schooling being undertaken in the home, perceptions had changed. Parents were now voicing their appreciation of both the academic work delivered to children as well as the social and behavioural management normally undertaken by teachers.

What I think it's also done is help parents to appreciate what we do as a school as teachers as well. And that's been a big thing, because often we get complaints from parents that we're not giving them enough work, we're not teaching them, we're not doing this, we're doing that. But over the last couple of months, it's been, 'when are you taking my child back to school', and 'I can't cope with him!'

On one day, T1 revealed that family support had included waking a student up with a phone call, as they had been absent from online lessons the day before. She had been emailed by the mother asking for help, and T1 had followed up with a long phone conversation with the mother and then the child. As a result of this, T1 had told the child that she would do two things for him: she would call him the next morning before school began, and secondly, she would drop off some drumsticks at his house. Her idea was that he could use them to help manage his frustration in a more positive way, bashing it out instead of vocalising his discontent in inappropriate ways in the home.

I actually had a long chat with the boy yesterday. I said, this is what I'm going to do…One, I'm going to make sure you're up in the morning, and two…I'm going to drop him some drumsticks just to help him. When he's feeling agitated and frustrated with life, he can bang drums as opposed to banging something else or using his mouth in the wrong way.

Whilst interacting with the home more was time consuming, compared to a usual day in school, T1 testified that the day in school was incomparable. In school it was non-stop with no time factored in to allow for any uninterrupted moments to catch one's breath.

Busy. Really busy. Full on, no time to breathe.

Working from home, she could eat and drink, even have a lunch break, and working life was less stressful. T1 emphasised repeatedly that the time to think and reflect when working from home had made a huge difference to her working life. She had time to review, plan and make changes. The stress was also less because, as T1 described it, not being in the classroom meant that she was not having to make the students complete tasks. When in the classroom, enforcing completion of assessments and assignments was expected. Now, with the pandemic and home-teaching, there was a pragmatic view that there was only so much the teachers could do from home to encourage work to be finished. When in school she was known for being totally focused and organised to the point of being a perfectionist. Yet she would be so overwhelmed and exhausted she sometimes felt that she was losing her mind. The only way she could create space to think would be to get up early or stay up late.

I [would] often have to go home, get up at four in the morning, or late at night when there's nothing happening, to have a little bit of clarity of mind.

Process of DC adoption and use

T1 had wanted to try several of the apps featured in the workshop. She already had a Fitbit which she used for monitoring her running, sleeping and heart rate, so was interested in finding out about other ways of managing her stress. She commented that the workshop had demonstrated other strategies to her and shown her other technologies that she would like to try.

It has also given me ideas of what other methods I could use and also recommend to my peers.

T1 had chosen three apps initially, Wysa, Daylio and Fit2teach. The latter had been included as at the time, contact with the developer was still being attempted. However, with the lack of response, this app had to be excluded as it had no recent update or evidence of ongoing support. With both the other apps, T1 stated that she wanted to know more about her stress triggers. She reasoned that if she had a better understanding of the causes of her stress, she would be better able to nip them in the bud and reflect on alternative ways of dealing with her feelings or a situation. She would also have foresight, being able to anticipate a potential problem and think ahead of how to deal with it well to avoid negative feelings or experiences.

So I think…prevention is better than cure, if we can understand where the triggers are and look at it from different angles and learn how to cope at that moment in time, then [you could think] what could I do differently so I don't feel like this?

Before T1 began to use the apps, she ventured that she would have to ensure using them became a new, regular habit. She knew she was busy, so entering data would have to be remembered and time intentionally found for input.

I need to see it like brushing my teeth. So that was the thing…that I felt a little bit anxious about. But I said [to myself], you can do this. You've got to just really train yourself to do this, if that makes sense.

T1 declared herself to be a big advocate for making lists, to the extent of writing down little chores, like making the bed, and things she had already done so she could have the satisfaction of crossing them off. She liked routine, and creating new routines was something she was happy to do. T1 speculated that creating new habits in the summer term would help her when she was back in school full time.

I think it's a good…it's about getting yourself into routine and starting to know yourself a little bit…I think if you start something off here (at home) it becomes more of a habit than if you start it off at school.

T1 had set up Daylio to send her notifications, which she received several times a day. She found it very easy to use and liked the fact that the moment she turned to the app on her phone, it presented her with emoji faces for her to choose her current mood. She had been able to personalise it to her activities. Not having to remember to use it was appreciated, as was getting an end-of-week report.

I think probably it comes up about three or four times a day on my phone, which is fine. And I hear the brrrrng. And everybody's what's that? It will just come on and so I just do it quickly. That's very straightforward and it gives a report at the end of the week.

T1 had observed that it did not take very long for her to be able to see patterns and associations. Most days she reported that she was fine, but she would be able to tell when she had not been feeling physically great because of the 'meh' emoji response that she had entered. She also described appreciating the reminders that the app sent to her about exercise. Whatever exercise she had previously done, the app would send her a reminder to do more of the same. And having set the notification to sound loudly, she did not miss the alert. T1 also testified that these reminders had encouraged her to think more about her posture and inactivity, and the need to do some more stretching during the day. She observed that she would obviously have been aware of her backache without the app, but seeing the app and being able to see the record of her activities helped her to be more intentional and prompted her to act. Inputting the activity was akin to ticking an item off a

list and gave her a sense of achievement. All this had encouraged her to take up yoga, which she now tried to do in the morning.

I was getting a bit of a bum ache, and backache and all these aches…I guess it's helped me to think, okay, I need to ensure that I'm doing a bit of yoga in the morning…And then if I've done it, I can say that's an achievement, if that makes sense.

T1 shared that she not only used Daylio during the day, but in the evening and before she went to bed.

Wysa had also been easy to begin, but T1 found it took more time to use. She also described how one could start using it and start responding to the questions, then be directed to something to read and then to something to watch on YouTube. As a result, she had been put off using it more, as she considered it time-consuming and felt she did not have the time it required. She reported needing a clear head to use it, and that one had to be very self-disciplined with the time allocated to using it. That said, she also emphasised that she did value the advice it gave, both in terms of solutions to problems and insight into other people's responses. She really enjoyed how it helped her reflect on her reactions and her feelings.

You can't just do a quick fix with Wysa…I was doing Wysa, and it must have been about 45 minutes later, I've got to go to bed…What I love about Wysa, it talks about remedies, and it gives you ideas, and it educates you on why people feel like that.

T1 described some thinking ahead to when she would be back on the school premises, in that she had bought herself a pouch to wear so that if she was wearing a dress with no pocket, she could have her phone with her and still receive the Daylio alerts. She would probably change the alert to vibrate rather than the loud sound she currently used.

I thought I need to have a pouch or something, so if I'm wearing a dress or it's something that hasn't got pockets, then I can put it in my pouch and keep it on me.

T1 predicted that having to access her phone to use the apps would not be a problem, as she checked it during the normal school day for messages from her children. She had taken school email notifications off her phone as she found them too intrusive, but she did answer calls that came through MS Teams from the school.

Influence of Contexts on DC Adoption

Physical Influences

T1 reflected on both the physical teaching-at-home setting and being on the school premises as influences on app use. The main influences of the Daylio app on T1 when working from home were the reminders to undertake more of the exercise she had done before, and to prompt a moment's reflection on how she was feeling and whether she needed to get up and move. Her home setting reduced her physical movement but there were no physical barriers to taking time to use the apps. Awareness of her sedentariness had inspired her to take up yoga, as she was more conscious of her posture. She attributed a change in her thinking to both Daylio and Wysa apps, becoming more aware of herself and her own needs, including looking after her physical body. She testified that in the past, she had not been good at doing anything for herself; she was even harsh on herself, and using the apps had raised her awareness of not only her own needs, but the validity of those needs and how important it was to look after herself. T1 stated this even extended to telling a friend she couldn't go out as she need to do her yoga first to prioritise her own wellbeing, which she implied as being important.

The biggest thing about using the apps, is helping me to be self-conscious of me. Even like thinking how I'm running, how I'm doing things, how I'm sitting, how I'm walking…think I have more value for 'me'. In fact, I've probably treated 'me' a lot more harshly (in the past); it was never about me. It was about everybody else.

When back in school, T1 ventured that she would use Daylio but not Wysa on the school premises. She would have access to Daylio through her phone, carried if necessary in a pouch so it was with her all the time. T1 reported that using Wysa required not only time, but a quiet space. Although she described having an office in school, it was a place that people came in and out of all the time. For some, this was a deliberate visit because the office had a spare chair which was made available to any staff or student who needed to have a moment to offload. Moreover, at school, she was expected to carry a walkie-talkie with her all the time with the expectation being that she was always contactable. The reality she described, both for herself and other staff, was that in order to have a moment of undisturbed peace ahead of a lesson, they would sometimes turn off the walkie-talkie and conceal themselves in a toilet or classroom.

There are times when I locked the door and I hide in a corner so they can't see me.

T1 thought she would still use Wysa, but perhaps mostly in the holidays.

Social Culture Influences

At the start of the study T1 had said that she hoped her experiences of using the DCs would be of benefit to her colleagues. She considered herself to have already learned to cope with

a lot of school stress, but she also appreciated there was probably much more that she could be doing. She commented that the workshop was thought-provoking and had caused her to reflect both on self-care and how she could help her peers in school.

What I'm hoping to do with all of this, [is to know how I] can help other people at the same time. When I see them stressed, I'll say, well why don't you try this? This helped me as well.

T1 had already had a discussion with one of her colleagues about her apps. She described how helpful it had been for herself to talk about their usefulness and that having them had encouraged a change in her mindset. Sharing with another teacher what behaviour they enabled, rather than the details of how they worked, helped her to appreciate what they helped her to achieve. T1 also felt this related to being a woman and tending to dwell more on negatives than positives. The Daylio app, she observed, prompted opportunity throughout the day to think differently and change one's perspective. As the activities were personalisable, one could build up a suite of activities and actions that were individually meaningful.

Often as women we believe the negativity and not the positivity. And it's about looking at changing your thought process…These apps prompt you to think differently and change your perspective and not go, 'yes, I need to do that'…but actually reflect as you go through the day… if you've been positive in something, you can put it in as a positive [action] and tick that box.

Although T1 had said at the start of the study that she would like to know more about her stress triggers, she reported that in using the apps she had learned more about her colleagues' stress than her own. She had obviously been aware of their stress, but she was now more conscious of the ways other people expressed their stress. T1 described how the Wysa app had trained and taught her about emotions and habits that helped with her understanding and empathy, in relation to both colleagues and students. Now knowing about some of the helpful videos signposted by Wysa meant she could share these videos with others whom she thought might be able to benefit from them. In terms of managing her own stress, T1 later confessed that she had in fact known what her triggers were, but she was now in a place where she could acknowledge them and do something about them.

I'm going to be honest because I know what triggers my stress. But I've learnt more about how people stress. I think I've learnt more about other people. It's helped me to understand different ways to manage my stress… What I'm trying to do is acknowledge that you need to do something about it and not just put it in a box and put it to the side.

T1 reported that she wouldn't hesitate to recommend both apps to her colleagues as both had been helpful to her. She appreciated the rapidity of Daylio and the accumulation of data that allowed her to look back and see trends in her behaviour. This allowed her to make associations between days where she didn't feel good and what had happened on that day.

I would actually recommend both of them because there's so much you can take from both of them.

Organisational Culture Influences

T1 stated that when working from home, using the apps was not an issue. However, when back in school, the way the day was organised would preclude using Wysa. This was because of the need for time and quiet when using Wysa; it required uninterrupted space for thought and reflection. There was barely time in her schedule to eat or go to the toilet, let alone any time to retreat in school that would enable the use of Wysa. Daylio was different because it was instant and easy to use, requiring just a quick click and no typing.

Daylio is easier to use at school because it's a quick fix.

T1 speculated that the school leadership would not oppose using Daylio because it would not detract from any tasks at hand and could be used without anyone's knowledge. Staff using phones for email was common, so having another staff member looking at their phone, even for a moment, would not pose a problem. This was not something she had previously done, even though it was permitted, because she did not want the continual interruptions that would result.

We can keep our phones on us at school because staff generally have their emails on their phones. However, I don't [have emails coming through] for sanity purposes.

T1 also commented that the school had been good at thinking about staff wellbeing needs during lockdown. This to T1 felt more sincere than it had been before the pandemic, a time when she described leadership talking about staff wellbeing yet feeling this was outweighed by the demands made of staff. There were staff who had wellbeing in their remit and there was a mantra of 'manageable and meaningful', but T1 did not consider this particularly consequential. Since the COVID-19 outbreak, T1 had noticed that the principal's first question when she saw her was always about her and her family, which she interpreted as genuine care for her wellbeing.

Conclusions

T1 had used both Daylio and Wysa during the second half of the summer term and had found both of them easy to adopt. She appreciated the immediacy and ability to personalise

Daylio, being able to add in moods and actions that were more meaningful to her. She also liked the reminders and felt that the process of using the app had prompted her to be more intentional about self-care. Wysa prompted T1's deeper reflection about both herself and her colleagues, and the way they experienced and expressed their stress.

T1 had enjoyed working from home and simply having more space to breathe. She had found the apps had helped her to think about prioritising her own needs and she had put new things in place to look after herself better. She now felt that managing her stress was important, whereas previously it had been less so and that a change in habits had contributed to her feeling less stressed.

T1 had already shared some of the learning from the apps with her colleagues and said she would happily recommend them to other staff. She had found the knowledge gained from Wysa had given her insight, which then enabled her to be more empathetic.

T1 felt that concerns about teachers' wellbeing had been more meaningful since the onset of COVID-19 and that the culture had become more caring. She did not perceive there to be any barriers to teachers using DCs to support their stress management.

End of Case Study