Supplementary file 3

Coding, theory development, retroduction and integration of substantive theory

Coding

After the main set of full documents had been identified we started coding. As a first step, KM read a broad selection of studies for familiarisation with the data. Initial CMOCs were drafted. All documents were then uploaded into NVivo 12 (QSR international) for a more detailed and systematic analysis. The subsequent coding process was both deductive and inductive. A first set of codes (called 'nodes' in NVivo) was deductively created in advance, informed by the initial programme theory and the first set of CMOCs. New nodes were created inductively as new categories with regards to outcomes and potential contexts or mechanisms came up. In one paper,[1] for instance, the authors concluded that generational issues such as age and maturity might impact take up of workplace MBPs. We created a node called 'role of age, maturity' and subsequently assigned all related data to that node. Nodes were continually refined during analysis. For example, based on our initial programme theory, we had created a node called 'approach, acceptance vs. withdrawal.' During analysis we found that by renaming that node 'being vs. doing' we were able to account for much more of the data. We created a child node called 'being vs. doing,' and a brief memo, to document the change. Other child nodes were created as sub-categories emerged.

Coding proceeded from what we perceived to be the richest documents to less informative documents. In general, qualitative and mixed-methods studies that provided a lot of data with regards to implementation and participants' experiences were considered to contain the most relevant data and therefore coded first. After all qualitative and mixed-methods studies had been coded, data was extracted from quantitative studies, starting with randomised and controlled studies. We then checked all observational studies and studies with pre-test/post-test design to see whether additional relevant data could be identified. Three pretest-posttest studies were included because they contained interview data that supported theory building and refinement. The remaining studies did not provide any data that we considered to be relevant for theory development. Outcome nodes had reached saturation, that is, no new insights could be gained from extracting more outcome data. We therefore stopped coding. The characteristics of all studies to be included in our analysis and synthesis were extracted into an Excel spreadsheet (Supplementary file 4). Coding was mainly performed by KM. A random sample of 10% of the coding was checked independently by GW for consistency.

Theory development

Theory development was an iterative process. First, we went through each coded piece of data (called 'reference' in NVivo) to highlight any information on a participant's or other stakeholder's reasoning or reaction to the resources provided by an MBP. We also highlighted information with regards to the context in which the reasoning or reaction took place. We further marked any explanations of outcomes provided by the authors of a study. In other words, we highlighted all passages that we thought had explanatory power. Each highlighted passage was annotated in NVivo. In these annotations, we summarized causal processes that we found to be at work (e.g. 'employees are busy > MBP adds stress') or quotes that captured participants' values, beliefs, etc. (e.g. 'time is a scarce commodity informally valued among employees'). In a next step, we exported all annotations from NVivo into an Excel spreadsheet and broke each annotation down into what might be

functioning as context, mechanism, or outcome. We then started to build CMOCs by putting the pieces – context, mechanism, outcome – together across annotations and studies. During that process we moved iteratively back and forth between annotations, references, and whole documents to ensure that our interpretations stayed true to the original context of the data. The process was completed when all annotations had been accounted for.

Theory development followed realist methodology.[2, 3] It involved situating (establishing which mechanisms were activated in which context), juxtaposing (where evidence about what happened in one document enabled insights into outcome patterns of another document), consolidation (building multi-faceted explanations of outcomes), and reconciling (identifying differences which explain apparently contradictory sets of findings). To give an example: One study[4] concluded that being able to practice during work hours (mechanism) led to programme engagement (outcome 1) and facilitated relaxation (outcome 2). In contrast, other studies[5, 6] reported that training sessions that took place during work hours (context) created task conflicts in individuals (mechanism) and resulted in enhanced levels of stress/distress (outcome 1) and/or in drop-out from the programme (outcome 2). The missing piece was found in yet another study[7] where employees reported that, in order for them to engage with the programme (outcome), they needed to 'feel permitted' to do so (mechanism) and that they only felt permitted if they were given time off to attend training sessions (context). This was supported by quantitative findings from an RCT[8] where flexible handling of work time significantly facilitated programme engagement. Through weaving threads across various studies, we were able to build CMOCs that explained under what circumstance and why employees engage with workplace MBPs and how that might facilitate subsequent benefits.

Once we had a set of theories, we returned to NVivo to test and refine our theories and to make sure that we had not overlooked any data. We created a node for every CMOC and assigned references to CMOC nodes. This means that we moved each reference from the initial nodes to CMOC nodes. Some references could not be moved. They could neither be assigned to any of the existing CMOCs nor did they contain enough information for us to be able to build a new CMOC. For instance, one reference in the node 'role of age, maturity' suggested that more mature participants might be more ready to handle change initiatives in organisations.[1] However, that hypothesis was supported by only one additional reference[9] and contradicted by another [10]. Based on the given data, we were thus not able to formulate a theory on the role of age and maturity in workplace MBPs. The same was true for references related to 'motivation to participate in MBP.' We could not detect any pattern in these references and were unable to assign them to existing CMOCs. Likewise, many outcome references could not be linked to any CMOC, particularly if the outcomes manifested further down the outcomes chain (e.g. 'improved sleep,' 'medical symptoms', 'anxiety', 'depression', 'burnout'). When we reached a point where remaining data did not allow us to build new CMOCs or refine existing ones we stopped our analysis and synthesis. All final CMOCs and associated references were exported from NVivo into Microsoft Word (Supplementary file 5).

Retroduction and integration of substantive theory

A key element in the process of theory development was retroduction. Retroduction is often used in realist approaches and refers to identifying causal mechanisms that might be underlying the emerging patterns yet cannot be directly observed or are not explicit in the existing evidence.[11] Retroduction, in realism, rests on the belief that an understanding of causation cannot be achieved by using only observable evidence. The reason for that is that mechanisms are seen to operate at a different level of reality than the outcomes they generate.[12] In order to identify these unobservable mechanisms, we need to think through or imagine what context dependent causal forces might be at work in producing observed outcome patterns. This thinking through or imagining involves inductive, deductive, and abductive logic of inference. Adductive theorising is 'hunch-driven.' It imagines the existence of certain mechanisms or interprets something in a new conceptual framework and thereby leads to new ideas for generating theories and testing possible mechanisms.[13] In our case, for instance, 'concern' was a mechanism that was not often verbalized yet helped explain many of the observed reactions and behaviours in workplace MBPs. In addition, 'concern' could be conceptualized within the framework of two 'formal' or 'substantive' theories, Conservation of Resources (COR) Theory and, related to that, the Theory of Psychological Safety.

Substantive theory, in realism, refers to existing theories within certain disciplines that help identify mechanisms or features of context and explain how overall sets of findings fit together.[14] One pattern that had emerged during coding was a large amount of participant quotes related to 'feeling permitted' and 'feeling safe' or the lack thereof in practicing mindfulness at work. In order to gain a better understanding of that pattern, we looked for organisational research on psychological safety. In one systematic review on psychological safety, we found a link to COR Theory that seemed to us to explain much of what we found to be going on in workplace MBPs.[15] Both, COR Theory[16-18] and the Theory of Psychological Safety[19, 20] were subsequently used as explanatory lens through which we interpreted the patterns that had become visible in the data. COR Theory had been mentioned in one of our included studies as an explanation for the reported beneficial outcomes.[21] Other authors had previously cited the COR model with regards to mindfulness.[22, 23] In all these examples, mindfulness was seen as a resource to help individuals buffer against organizational stress and enhance job engagement and job satisfaction. More recently, a study by Hülsheger *et al.*[24] on state mindfulness in working populations showed how previous day recovery experiences benefitted mindfulness and subsequent recovery experience (gain spiral), whereas workload hampered the experience of mindfulness as well as subsequent recovery experience (loss spiral). Hülsheger *et al.* explained the relationship between mindfulness and recovery experience by the availability of energetic resources that are necessary to bring awareness to present moment experience. They proposed to look at additional work-related factors that might impede mindfulness, including situational constraints, role conflict, or customer-related stressors.

Our choice of substantive theories was guided by what turned out to be the 'best fit' for our data. We had considered other substantive theories in our theory development. In one study, for instance, a participant reported that she had been grateful to hear that other people were struggling even more than she was.[25] This quote might have been used in support of Festinger's[26] Social Comparison Theory. According to that theory people try to establish well-being, among others, by contrasting themselves with people who are worse-off.[27]

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However, we found no further references to support Social Comparison Theory and therefore did not pursue it as substantive theory. Other substantive theories that we considered, because they had been mentioned in individual studies, were Argyris and Schoen's Theory of Single and Double Loop Learning,[28] the Framework for Organizational Readiness,[29] the Job Demands-Resources Model,[30] Lazarus and Folkman's Stress-Appraisal Theory,[31] Attachment Theory,[32] Bandura's Self-Efficacy Theory,[33, 34] and the Theory of Planned Behaviour.[35] While each of these theories explained certain outcome patterns in individual studies, none of them helped us make sense of some of the more prominent and important parts of what we found to be going on in workplace MBPS. Psychological Safety and COR Theory, on the other hand, provided a framework that allowed us to analyse and synthesise data from a large number of studies covering various settings and programme modalities.

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