A Dynamic Perspective on Perceived Behavioural Control in Group Model Building Interventions

Master Thesis for Master Specialisation Business Analysis and Modelling

Radboud University Nijmegen

16-07-2024

Author:

Eva van de Laar

1st supervisor:

prof. dr. Etienne Rouwette

2nd supervisor:

dr. Eric Jacobs

List of abbreviations

TPB = Theory of Planned Behaviour

GMB = Group Model Building

PBC = Perceived Behavioural Control

PC = Perceived Control

PSE = Perceived Self-Efficacy

Table of contents

1. Introduction

During the last decades, the effects of the facilitated modelling approach called Group Model Building (GMB) have been studied on three levels: the individual level that entails learning and commitment, the group level that entails consensus, aligning mental models and improved communication, and finally the organisational level that entails system process changes and system outcomes changes (Andersen et al., 1997; Rouwette et al., 2002; Scott et al., 2016). A psychological theory that scholars have used to study the effectiveness of GMB interventions in the context of the latter category, the organisational level, is the Theory of Planned Behaviour (TPB) as developed by Ajzen (1991). This theory gives valuable insight into how three different factors, which are attitude, subjective norm and perceived behavioural control, determine the behavioural intention for action which in turn determines behaviour (Ajzen, 1991). Rouwette (2003) is one of the authors who applied the TPB to GMB, by stating that the factors of the TPB can be related to outcomes of a GMB intervention. For example, behaviour in the TPB is similar to the implementation of actions after a GMB intervention.

Among the different factors of the TPB, Perceived Behavioural Control (PBC) is the hardest factor to relate directly to a central outcome or goal of modelling (Rouwette et al., 2011). However, Rouwette et al. (2011) state that modelling entails several activities that can be expected to influence one's perception of control. Contrary to this hypothesis, various studies (Rouwette, 2003; Rouwette et al., 2011; Vennix et al., 1996) found no effect of a GMB intervention on PBC. These results are problematic since it is known that a lack of perceived control over a complex problem can form a substantial barrier to change (Rouwette et al., 2011).

The goal of this research is to expand the current knowledge on the effectiveness of GMB by looking into how in a GMB intervention the *Perceived Behavioural Control* of participants regarding the central problem changes over time. This will be researched in two different studies. By taking a dynamic perspective, this research gives insight into how different mechanisms, affected during different phases of the GMB intervention, affect the PBC of participants. Knowing what mechanisms in a GMB intervention influence the PBC of participants and in what way, gives practitioners useful leverage points that can be used to increase the PBC of participants after a GMB intervention. Since PBC is one of the predictors of conducting a particular behaviour according to the TPB and affirmed by many scholars (Ajzen & Driver, 1992; Armitage & Conner, 2001; Pavlou & Fygenson, 2006), improving the PBC of participants can help the client of a GMB intervention to improve the problematic situation that is the focus of the GMB intervention.

To reach this goal, this research will answer the question: 'How does a Group Model Building intervention shape the Perceived Behavioural Control of participants regarding improving the problematic situation that is central to the intervention, over time?' To answer this, the dynamic effect of a GMB intervention on the participant's PBC over action in the problem at hand is studied, by measuring participants PBC over time in two separate GMB studies, each consisting of multiple sessions. With this, the following question will be answered:

- **RQ1.** What are the differences in the perceived behavioural control of participants regarding improving the problematic situation that is central to the GMB intervention, across different moments in time?

Next, the underlying mechanisms causing the effect or lack of effect on the PBC of participants will be studied, which current studies (Rouwette, 2003; Rouwette et al., 2011) have not yet explored. Answering this question will help to find leverage points to improve the PBC of participants by a GMB intervention. To do this, we will focus on two distinct mechanisms within a GMB intervention that differ in their effects across the time of the intervention, resulting in the questions:

- **RQ2.** What role does perceived complexity have in shaping the perceived behavioural control of participants regarding improving the problematic situation that is central to the GMB intervention over time?
- **RQ3.** What role does knowledge of concrete action points have in shaping the perceived behavioural control of participants regarding improving the problematic situation that is central to the GMB intervention over time?

The theoretical contribution of this research is twofold. First, this research will broaden our perspective on research into GMB by applying insights from the field of psychology. Second, this research will expand existing knowledge of the effectiveness of GMB interventions, by studying the effect of GMB on the PBC of participants. In a practical sense, this research will help to find leverage points of PBC that can be used to increase the PBC of participants regarding the central problem in a GMB intervention, which will help organisations improve the problematic situation by concrete system changes.

2. Theoretical Framework

In this chapter, we will review and build further upon previous research to develop our conceptual model. In section 2.1 we will explain the origin of PBC and its relevance. In section 2.2 we will discuss the multidimensionality of the construct of PBC. In section 2.3, first GMB as an intervention technique will be explained, then previous research studying PBC in a GMB intervention will be reviewed and finally, our dynamic perspective based on the exploring or analysing nature of GMB sessions will be outlined. In section 2.4 driving factors that can affect PBC will be discussed and reviewed, so that in section 2.5 we can link the exploring or analysing nature of GMB sessions with these driving factors to hypothesise the effect on the PBC of participants in a GMB intervention that we expect to find.

2.1. Origin of Perceived Behavioural Control

The Theory of Planned Behaviour (Ajzen, 1985) is a psychological framework, that has been widely used for decades to study human behaviour. The prior framework, the Theory of Reasoned Action (TRA, Fishbein & Ajzen, 1975), only included attitude towards behaviour and subjective norm as drivers of behavioural intention. However, Ajzen (1991) argued that the TRA did not account sufficiently for behaviours under *incomplete* volitional control. To overcome this limitation, they added a third factor as a driver of behavioural intention: one's Perceived Behavioral Control (PBC) regarding the behaviour. Ajzen defined it as "the perceived ease or difficulty of performing the behaviour and it is assumed to reflect past experience as well as anticipated impediments and obstacles" (Ajzen, 1991, p. 188).

The impact of adding this concept is quite large. Various studies have found that adding PBC to the model improved the degree to which the model predicted intentions of behaviour (Ajzen & Driver, 1992; Armitage & Conner, 2001; Han et al., 2010; Madden et al., 1992; Paul et al., 2016; Pavlou & Fygenson, 2006). Furthermore, various studies have confirmed Ajzen's hypothesis that PBC is directly and significantly related to the prediction of behaviour, skipping intentions of behaviour as a mediating variable (Ajzen & Driver, 1992; Armitage & Conner, 2001; Pavlou & Fygenson, 2006). Godin & Kok (1996) found this true for some studies of health-related behaviours they reviewed, but not for all, implicating behaviours differ in their extent of volitional control. However, generally speaking, this direct effect of PBC on behaviour makes PBC an important target variable that practitioners dealing with a problematic situation might want to increase since this can increase the implementation of actions to help solve the problematic situation. The current research focuses on even one step earlier in the process, which is how the factor of PBC is shaped. Since a GMB intervention is developed to be useful

in dealing with complex problems (Vennix, 1996), it is particularly interesting to study whether and if so PBC can be increased during a GMB intervention and how this process is shaped.

2.2. Multidimensionality of Perceived Behavioural Control

In 1991, with the Theory of Planned Behaviour still in its infancy, Ajzen argued that the concept of PBC can be seen as similar to Bandura's (1977) concept of perceived self-efficacy (PSE). Both measure *perceptions* or *beliefs* concerning performing a particular behaviour (Ajzen, 1991; Bandura, 1977). However, during the past decades, much discussion has taken place about the difference between PBC and PSE, with various authors stating that the construct of PBC exists of two separate constructs: one control and one self-efficacy construct.

Terry & O'Learly (1995) hypothesised and also proved through a better fit with the data, that self-efficacy (SE) and perceived behavioural control (PBC) should be treated as two separate constructs. They founded their arguments on the theory of locus of control, stating that self-efficacy concerns internal constraints on behaviour and PBC concerns external constraints on behaviour (Terry & O'Leary, 1995). Ajzen (2002) however strongly advocated against this, stating that one's self-efficacy can both be determined by internal factors, such as knowledge, and by external factors, such as money, making the theory of locus of control an inappropriate argument to differentiate between PSE and PC.

Sparks et al. (1997) made a similar distinction between perceived difficulty and perceived control but also rejected the theoretical argument of internal and external factors. Furthermore, Manstead and van Eekelen (1998) made a similar distinction too, between self-efficacy and perceived control. Although all authors that we just reviewed name the distinction differently, the underlying meaning of the constructs is similar, roughly distinguished as perceived control and self-efficacy measures.

The relevance of this distinction is illustrated in the fact that both constructs are proven to have different effects. All authors (Manstead & van Eekelen, 1998; Sparks et al., 1997; Terry & O'Leary, 1995), proved self-efficacy as a better predictor for intentions of behaviour than perceived control, with Manstead and van Eekelen (1998) also finding that self-efficacy was a better predictor for behaviour compared to PBC. These results stress that self-efficacy and perceived control are different constructs since they have different effects. Cheung and Chan (2000) reviewed 67 studies that applied the TPB and operationalised PBC as perceived difficulty of performing a behaviour, perceived control of performing a behaviour, mixed or both. They again showed that perceived difficulty had a stronger effect in predicting intention than

perceived control and even suggested leaving the control aspect behind completely, renaming PBC as perceived difficulty (Cheung & Chan, 2000).

Ajzen (2002) acknowledges the findings described above. However, instead of treating self-efficacy and perceived control as independent constructs, he advocates for using a hierarchical model where PBC is the overarching construct and self-efficacy and perceived control are its two subcomponents that are each measured by different indicators. Pavlou and Fygenson (2006) confirm this argument for a hierarchical model by proving PBC as a higher-order factor that is formed by first-order dimensions of self-efficacy and controllability. Our research will align with the conclusive viewpoint of Ajzen (2020): although conceptually there is no difference between self-efficacy and perceived behavioural control since both measure beliefs concerning one's capability to perform a particular behaviour, operationally they are measured differently. We define:

- Perceived self-efficacy (PSE), defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3)
- Perceived control (PC), defined as the "beliefs about the extent to which performing the behavior is up to the actor" (Ajzen, 2002, p. 672)

The word 'perceived' is added to the name of self-efficacy to emphasise the subjective nature of the construct, as is the case with control.

2.3. Group Model Building

Now we will discuss Group Model Building as an intervention technique and its studied relations to PBC. GMB is a participative modelling technique that combines facilitation with system dynamics "to share and align mental models in order to foster concerted action" (Vennix, 1996, p. 25). In multiple sessions (often two to three), a group of 5-10 participants develop a model around the problematic situation that is at focus, with the help of a facilitator who guides the discussions and helps translate ideas into the preferred format for the model. The facilitator structures the sessions by the use of scripts, which are gathered and stored in Scriptapedia (https://en.wikibooks.org/wiki/Scriptapedia) and consist of various individual and group tasks (Andersen & Richardson, 1997; Vennix, 1996) that lie at different places on the continuum of exploring to analysing. In this research, we focus on GMB interventions that only develop a qualitative model, a Causal Loop Diagram (CLD), and not also a quantitative model.

Studies conducted so far have not found a significant change between pre-test and post-test measures of PBC in a GMB intervention (Rouwette, 2003; Rouwette et al., 2011). However, the current study differs in two relevant points from these two previous studies, which may cause this research to have different results, highlighting the importance of developing a strong conceptual model on our own. First, they used only two items to measure PBC (Rouwette, 2003; Rouwette et al., 2011), while we used five items that each measure one of the two different dimensions of PBC, which are PSE and PC. Second, the two previous studies (Rouwette, 2003; Rouwette et al., 2011) measured the PBC of participants over policies that participants themselves had listed before the start of the GMB intervention, instead of measuring the PBC of participants over the targeted behaviour of the GMB intervention as we do in the current study.

Furthermore, this research not only focuses on a change in PBC but also on *when* and *why* this change occurs, by taking a dynamic perspective on PBC. We hypothesise that changes in PBC exist based on the exploring or analysing nature of the sessions. Under the *exploring phase*, we count the start of building the model that grows in size and complexity during the progression of the session. In the *analysing phase*, the model is finalised and its structure, including the main feedback loops driving the behaviour of the system, is analysed. Furthermore, policies are developed based on leverage points in the model. We hypothesise that both phases will affect different driving factors or affect the same driving factors differently, leading via these factors to a different effect on PBC. We will now review relevant driving factors that can affect PBC.

2.4. Driving Factors of Perceived Behavioural Control

We will first review sources of self-efficacy identified by Bandura (1977). Then we will discuss factors influencing volitional control according to Ajzen (1985, 2020), which is the literature coming closest to factors influencing PC, although volitional control is a broader construct than PC.

Bandura (1997) identified several sources of efficacy expectation. The first is (1) *enactive mastery experiences*, meaning that past performances can convey information about capability that influences one perceived efficacy, by weighing the relative contribution of both ability and nonability factors. The second source is (2) *vicarious experience*, in which one does not use his or her own experience with the situation to alter one's self-efficacy, but the experiences of others that are in a similar situation (called a 'modelled attainment'). The model's performances are judged by a cognitive process of comparison that partly depends on the degree of

similarity the observer perceives to exist between him- or herself and the model, either in terms of past performances or personal characteristics. Self-efficacy beliefs can also be changed by learning effective skills and coping strategies from the model. The third source is (3) *verbal persuasion* of one's capabilities. The influence of verbal persuasion on one's self-efficacy depends on the degree to which the observer judges the persuader to be credible and knowledgeable of the activity in focus and whether the appraisal reflects a lack of skills or an ineffective use of preexisting skills. An appraisal of ineffective use of skills can increase one's self-efficacy more easily than an appraisal of a lack of skills. The fourth and last source is (4) *physiological and affective states*, which are used as sources of information in judging one's self-efficacy for a particular behaviour. Physiological arousal can at a moderate level help develop skills, while at a high level hinder one's functioning. Also, a negative mood triggers the recalling of memories related to failures, while the opposite is true for a positive mood.

Ajzen (1985, 2020) refers to several factors that influence the volitional control over performing a particular behaviour, dividing these into two categories: internal and external factors. However, this division can be confusing since we do not distinguish between internal and external factors but between PSE and PC. Therefore we have developed categories ourselves of the factors listed by Ajzen (1985, 2020), based on their content. The first is (1) *individual differences*, under which we include one's general ability to exercise control over own actions and the power of will one possesses (Ajzen, 1985). The second category is the (2) *available resources* one has access to. These include information, knowledge, money and time (Ajzen, 1985, 2020). A third category is (3) *skills and abilities*, which one needs to be able to perform the behaviour (Ajzen, 1985). Furthermore, (4) *opportunities and obstacles* are an important category, which includes the environmental circumstances and obstacles that can prevent one from performing a particular behaviour (Ajzen, 1985). The last category is (5) *cooperation by other people* (Ajzen, 2020), where behaviour that depends on cooperation by others lowers one perception of being in control of the behaviour (Ajzen, 1985).

2.5. Conceptual Model

We will now outline our hypothesis concerning the dynamic nature of PBC, by linking how the exploring or analysing nature of a session will affect different driving factors or affect similar driving factors differently, leading to a different effect on two core mechanisms and thereby on the two dimensions of PBC.

During the first *exploring phase* of a GMB intervention, participants may feel overwhelmed by the growing size and complexity of the model. According to Rouwette (2016), a

possible hypothesis for the lack of change found in the PBC of participants in GMB interventions is that the *perceived complexity of the problem* central to the intervention increases due to the intervention itself. We define complexity as aggregate complexity, which is defined as "how individual elements work in concert to create systems with complex behavior" (Manson, 2001, p. 405). It is reasonable to assume that during exploring activities of extending the model participants may feel overwhelmed, relating to the source of self-efficacy identified by Bandura (1997) as the physiological and affective state, where a negative mood can negatively affect one's PSE. Furthermore, it is reasonable to assume that perceiving more complexity will also lower one's PC since getting insight into a high amount of interrelated factors can give the feeling that improving the situation is not up to the actor. Thus, we hypothesise:

- during the exploring phase of the GMB intervention, the *perceived complexity of the problem* experienced by participants will increase, which will decrease PSE and PC

During the *phase of analysing* of a GMB intervention, the model developed so far might start to make more sense to participants, due to learning how making a model works and due to the identification of the main loops that drive the system. This may also cause participants to feel less aroused and have a more positive mood state. Furthermore, a process of vicarious experiences can be in place, since observing and hearing other participants make sense of the model and the models' complexity can give the observer, by using social comparisons, also a higher feeling of self-efficacy. Taking all this in conclusion, we hypothesise:

- during the analysing phase of the GMB intervention, the *perceived complexity of the problem* experienced by participants will decrease, which will increase PSE and PC

A second explanation given by Rouwette (2016) for the lack of change found in the PBC of participants in GMB interventions is a lack of *knowledge of concrete leverage points*. During the *exploring phase* of the GMB intervention, no emphasis is yet placed on leverage points. This means that participants do not yet know which resources, skills, abilities, obstacles and opportunities are necessary for solving the problem, which are all relevant factors affecting volitional control according to Ajzen (1985, 2020). Therefore we hypothesise:

- during the exploring phase of the GMB intervention, *knowledge of concrete action points* will decrease or simply not yet exist, which will cause a low level of PSE and PC

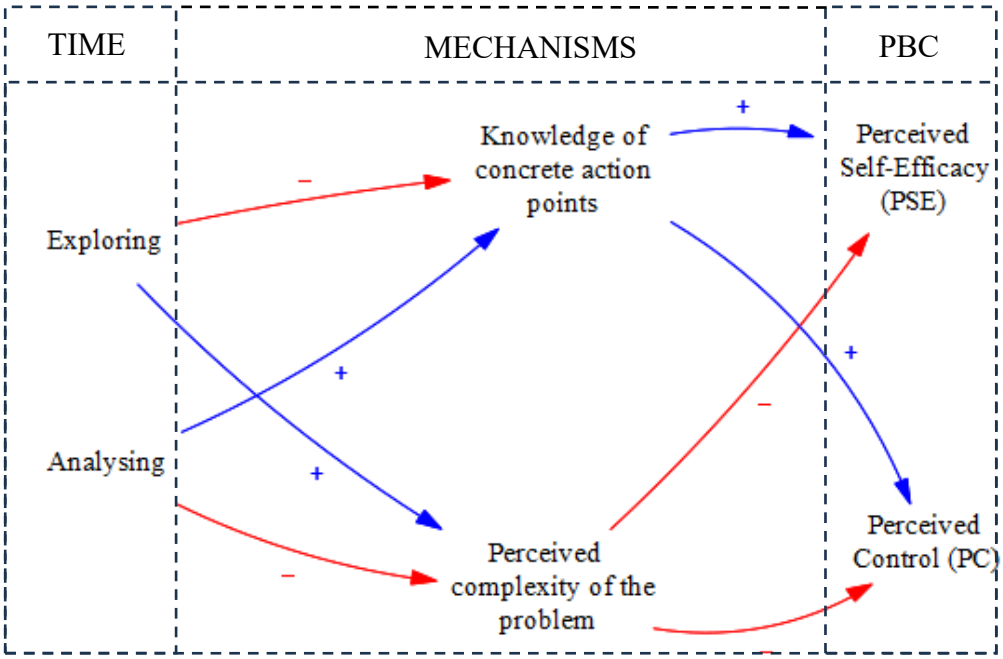
However, during the *analysing phase* usually there is an elicitation of action points to improve the problematic situation, often in the third session with the 'places to intervene' script

(Hovman et al., 2015). Relating to the source of self-efficacy identified by Bandura (1997) as vicarious experiences, it is expected that self-efficacy beliefs can be raised by having others, who serve as models for the observer, verbalise their thought processes on how to solve the problem (Bandura, 1997). Furthermore, the graphical representation developed by a CLD can also give insight into effective strategies to tackle a problematical situation and the resources, skills and abilities necessary for these strategies, thereby increasing one's PSE. It is also reasonable to assume that giving the actor insight into action points, will give participants insight into factors one has control over, increasing one's PC regarding the behaviour. Therefore, we hypothesise that:

- during the analysing phase of the GMB intervention, k*nowledge of concrete action points* will increase, which will increase PSE and PC

Figure 1

The Conceptual Model



Note. Adapted from de Gooyert (2003), *Modelling for Stakeholder Engagement I. Lecture 2: Anatomy of group processes* [PowerPoint slides]. Brightspace Radboud Universiteit. https://brightspace.ru.nl/

The hypotheses so far result in the conceptual model depicted in Figure 1, showing an influence of time on the two dimensions of PBC (PSE and PC), via two mechanisms, which are knowledge of concrete action points and perceived complexity of the problem. Following this reasoning, we expect a decrease in PSE and PC in the *exploring phase* and an increase in PSE and PC in the *analysing phase*. This model is similar to the model by de Gooyert (2023), who

hypothesises that time spent converging and time spent diverging both affect knowledge of high-leverage points and perceived complexity, which in turn affects self-efficacy.

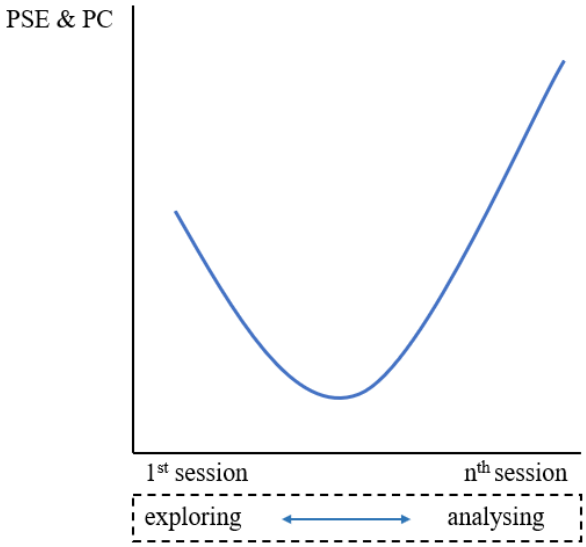
We further hypothesise that the overall PSE and PC of participants regarding the targeted behaviour is higher after the GMB intervention compared to before. Not only the model and the identified action points will contribute to a higher PSE and PC, but also the group element present during the whole intervention. Exchanging ideas, opinions and strategies with fellow participants with whom you often have a certain characteristic in common to be invited in the first place, can serve as a source of verbal persuasion (Bandura, 1997). A GMB intervention also relates to the factor driving volitional control identified by Ajzen (2020) as cooperation by other people, since by combining their efforts, participants might find solutions and courses of action not yet considered. Based on these arguments, we hypothesize that:

- PSE and PC will be higher after the GMB intervention compared to before the GMB intervention

All hypotheses described above can be summarised in Figure 2 below, where the expected PBC of participants regarding the central problem in the GMB intervention over time is sketched. This expected path of PSE and PC is similar to de Gooyert's (2023) expectation concerning self-efficacy following the model described above, with first a dip in self-efficacy and then an increase towards a higher level of self-efficacy compared to the start of the intervention.

Figure 2

Our Hypothesis of the Dynamic Behaviour of PSE & PC



Note. Adapted from de Gooyert (2003), *Modelling for Stakeholder Engagement I. Lecture 2: Anatomy of group processes* [PowerPoint slides]. Brightspace Radboud Universiteit. https://brightspace.ru.nl/

3. Methodology

3.1. Research Design

This research consists of a pre-experimental, repeated-measures design on two GMB interventions (Rogers & Revesz, 2019), with a deductive approach to develop a conceptual model and questionnaire based on existing literature (chapter 2), but an inductive approach to compare insights from interviews to insights from the questionnaire. A full experiment is not possible, since the requirements of random selection and the use of a control group can not be fulfilled. Although a pre-experimental design may limit the ability to objectively measure the effect of the GMB intervention on PBC and thereby harm the internal and external validity of this research (Rogers & Revesz, 2019), we believe that the applied setting in which the pre-experiment will be conducted will enhance the feeling of commitment and responsibility participants feel towards the outcomes of the intervention (Scott et al., 2016), which is beneficial for the internal validity of the research.

3.2. Sample Selection

Study 1 – Implementation of the MR-Linac

Study 1 is a GMB intervention that is conducted as part of a PhD research of Marike Ulehake, conducted by the Radboud Universitair Medisch Centrum (RUMC) into the use of modelling to inform the optimal use of innovative medical technology (ZonMW Projecten, n.d.). The central problem in this project is the implementation of the MR-Linac, a new technology combining radiation therapy with MRI images (ZonMW Projecten, n.d.). In the GMB intervention factors influencing the optimal use of the MR-Linac were modelled in a CLD, to develop a practical tool that can help with making choices concerning treatment groups. The GMB intervention consisted of two sessions (the 1st and the 30th of May, 2024) of 2 hours each. Participants were all working in the radiology department in varying functions.

Study 2 – Well-Being of Young Professionals

Study 2 is a GMB intervention that is conducted as part of the PhD research of Mareikje Pfenning within the Hanzehogeschool Groningen. The client company of the GMB intervention was a secondment agency within the building sector. The project aimed to model factors relating to the well-being of young professionals in a CLD, to be able to enhance their well-being. The GMB intervention consisted of three sessions (17th of April, 8th and 22nd of May, 2024) of approximately 3 hours each. Participants all worked for the client company in different departments and locations and were young professionals themselves, having started their working careers between 8 and 2 years ago.

3.3. Quantitative Data Collection

Procedure

To answer RQ1 and thus explore the relationship between TIME and PBC as presented in the conceptual model, participants in Study 1 and Study 2 were asked to fill in a questionnaire at the beginning of session one and at the end of each session. In other words, in Study 1 there were three measurement times and in Study 2 there were four measurement times, as depicted in Table A1 in Appendix A. This table also presents an overview of which participants were present during which measurement times, since not all participants could attend all of the sessions and some had to leave halfway through a session.

Operationalisation

The questionnaire is developed by combining measures of both dimensions of PBC: perceived self-efficacy (PSE) and perceived control (PC). According to the TPB, PBC should be measured by summing control beliefs times the power of control for each participant (Ajzen, 1991). However, this requires first gathering a list of relevant factors with a pilot questionnaire (Ajzen, 2006), which is not possible in this research since in a GMB intervention these factors are the result of the model-building process itself. Therefore, our questionnaire is based on the reflective (direct) measures of PBC, based on the questionnaire of Ajzen (2006) and items developed by other scholars, as summarised by Ajzen (2002). In Table B1 in Appendix B the items are presented. PSE is measured by two items and PC is measured by three items, all measured on a 5-point Likert scale with positive answers presented left and negative answers right. To check for response bias towards positive or negative phrased questions, one extra question, which is the negative formulation of item PSE2-Confidence, named item PSE2-NegativeConfidence, was asked in Study 1. This was not possible in Study 2 because this informed consent had already been sent out mentioning 5 questions. Furthermore, one open question is included to look deeper into why someone experiences a certain degree of control, to find out what the core factors in one's mind are and to track these during the progress of the GMB intervention. The behaviour over which the participant's PBC is measured is selected in line with the goals of the studies, for Study 1 "optimally implementing the MR-Linac" and for Study 2 "improving my well-being". The resulting questionnaires can be found in Appendices B2 for Study 1 and B3 for Study 2.

3.4. Quantitative Analysis

To analyse the results of the questionnaire, the same steps were followed for both studies. Before analysing the data all items, except PSE2-Negative Confidence, were reversed since with the original scale a lower score resembled a higher PSE and PC and the interpretation of such results could be confusing.

All analyses are conducted using SPSS Statistics Version 29. Normally a factor analysis and reliability analysis (Field, 2018) would be conducted to study the multidimensional nature of PBC. However, the number of participants in this research was too low to run and report these tests[1]. Nevertheless, we still work with the assumption of the two sub-hierarchical dimensions of PBC, which are PSE and PC, since we rely on the foundation of our questionnaire items in previous studies.

Furthermore, descriptive data was gathered and analysed. Then a repeated-measures ANOVA, which is appropriate to measure the variance between two or more measures in time of the same group (Field, 2018), was conducted on the average PBC score per measurement time using the procedure described in Field (2018), also separately for both studies. It was decided not to integrate the data from Study 1 and Study 2, since both studies measure PBC over a whole different problem and targeted behaviour, making such an integration low in internal validity.

The answers to the open question were analysed by comparing the answers across time for the same participant to identify any relation between one's level of control (PC1) and one's answers to the open question (PC1 – open question) and to track differences in the open answers over time.

3.5. Qualitative Data Collection

In Study 1, the first session was audio-recorded and transcribed. There was no recording available of the second session due to a failure that turned out to have occurred in this recording. In Study 2, all sessions were recorded. The first session of Study 2 was fully transcribed, after which it was judged that the added value of having full transcriptions in answering the research questions was low. Therefore, the decision was made only to transcribe parts of the second and third sessions, the hopes and fears part in session 2 and the elicitation of action points part in

[1]Running these tests despite the too small amount of data resulted in no sensible results for the factor analysis, sufficient reliability for the whole scale including all items in Study 1 but technically not possible strong negative Cronbach's alfa in Study 2 (for the results of the reliability analysis, see Appendix C1.2 and C2.2.).

session 3, since these parts were judged most likely to contain relevant information related to one's perception of control. Transcriptions were mainly used for describing participants' comments related to participants' perception of control made during the sessions, in sections 4.1 and 5.1.

Semi-structured interviews, conducted after the GMB intervention, were used as a data collection method in both Study 1 and Study 2, for two purposes. The first purpose was to (1) explore the hypothesised relations in the conceptual model. To do this, the interviews were used to (1.1) support the quantitative results of the questionnaire in answering RQ1, related to the relationship between time and PBC. This was done by explaining the concept of PC to the participant, and asking how they currently experience their PC, whether they had experienced a change in their PC during the GMB intervention and if so, what changed and when it changed. Similar questions were asked for the concept of PSE. Furthermore, in some interviews where it was deemed interesting, results of the questionnaire were used to confront participants with their scores on PC and PSE and they were asked if they could relate to those scores. Another relation in the conceptual model which the interviews explored was (1.2) the hypothesised role of the mechanisms, which are the knowledge of concrete action points and perceived complexity, in mediating the relation between TIME and PBC. These findings helped to answer RQ2 and RQ3. Participants were asked whether they experienced a change during the GMB intervention in one of the mechanisms, what caused this change, what type of change it was and when it changed.

The second purpose was to (2) explore other factors at play not yet included in this research. This included (2.1) exploring other mechanisms at play, by asking participants what caused their change or lack of change in both PC and PSE. However, it also included (2.2) adding more detail to the current conceptual model by asking the mechanisms behind the mechanisms by asking what caused a change in knowledge of action points or perceived complexity, as there may be reasons other than time to change these mechanisms. Lastly, it included (2.3) asking participants what they had learned during the GMB intervention and what stood out to them, similar to Rouwette's (2003) post-intervention interviews with participants, to gain insight into what is on top of the participants' minds.

In conclusion, the semi-structured interview guide, presented in Appendix D, combined both the questioning of some key relations in the conceptual model as a validity test, as well as giving participants room to express other mechanisms they deemed relevant in an explorative manner.

In Study 1, five participants gave permission to be contacted for the interview. However, only two interviews were held (one via Microsoft Teams and one in the radiology department of the RadboudUMC), since the other participants were only present during half of session 1 (two participants) or did not react to the invitation via email (one participant). In Study 2, four participants gave permission to be contacted for the interview. Three interviews were scheduled and held via Microsoft Teams, the fourth participant did not react to the invitation via email.

3.6. Qualitative Analysis

In total for both studies, four interviews were recorded and transcribed via Microsoft Teams and one interview was done physically, recorded via a laptop and transcribed via Word Online. All transcriptions were then edited by hand to fully match the transcriptions with the recordings, except for some 'yes' comments by the interviewer and expressions such as sighs, hums and silences.

To analyse the transcriptions of the interview, the Grounded Theory approach of Corbin and Strauss (1990) using open, axial and selective codes, is combined with System Dynamics. To code transcriptions, Atlas.ti was used. First, in open coding, codes were identified based on what identified the text fragment best. However, since the interview guide strongly focused on questioning the core concepts and relations presented in the conceptual model, many codes resembled these core concepts, making it partly a deductive coding approach. Study 2 was coded first since these interviews were finished first.

The second step of axial coding happened during the coding process, as codes were edited and grouped into categories. Then, all interview transcripts were reviewed again with the developed codebook, leading to the removal and splitting of several codes and ensuring codes were consistently applied in all transcripts within each study. For Study 1, the two interviews were coded using the developed codebook from Study 2, but with the addition of three new codes. The codebooks can be found in Appendices E1 for Study 1 and E2 for Study 2.

The final step of selective or pattern coding was done by developing a CLD for each interview, focusing on the mechanisms at play during a GMB intervention shaping participants' experiences. Models were substantiated with an overview in Excel of text fragments from interview transcripts supporting the relation(s). Then, the individual models were combined into one integrated model per study, focusing on shared experiences, by adhering to the following rules:

- Relations and mechanisms where contradictions between interviewees existed were not included, however, there turned out to be none of these
- A factor, relation or mechanism explicitly named not by all of the interviewees but only one (in Study 1) or one or two (in Study 2), was only included if it implicitly was supported by the other interviewees, judged on their statements of related topics

Argumentations for all relations in the integrated model, including the implicit assumptions made, can be found in Table G2 for Study 1 and Table G4 for Study 2, both in Appendix G. The use of models to analyse textual data based on the Grounded Theory approach has been described by various authors, such as Eker & Zimmermann (2016) and Kim & Andersen (2012). Kim & Andersen (2012) also point to the reduced influence of the modeller's subjectivity on the model, due to inferring relations directly and step by step from the data itself. By comparing the resulting model to our conceptual model, the interviews can serve as a form of disconfirmatory interviews (Andersen et al., 2012) that are described as good practice for qualitative coding practices in studies developing a model, to strengthen the quality and validity of models (Turner et al., 2013).

After all this, a matrix (Appendix F) was filled in for both studies summarising the answers to key concepts asked during the interviews. This matrix described if participants experienced a change in PSE and PC, which was used in supporting the questionnaire results in validating the hypothesised relation between time and PBC.

3.7. Research Ethics

This research is conducted in accordance with the research ethics principles outlined by Denscombe (2012). First of all, no physical harm is done to participants and the researcher has strived to create a psychologically and socially safe environment during the sessions and interviews. Second, all participants have signed an informed consent for participating in the GMB intervention and the questionnaires and if applicable, participants signed a separate informed consent for participating in the interview. The informed consents explained the goal of the research, what would be asked from participants, their right to quit any time they want and how data would be stored and processed. Questionnaires were anonymous, by using a code instead of a name to link questionnaires to each other. Recordings made of sessions and interviews will be deleted after finishing the master thesis. Only pseudonymised quotations from interviews were used in the final GMB report and thesis. Lastly, the researcher has strived to record the procedures and methods as precisely as possible in this thesis.

4. Results Study 1

4.1. Description of the Intervention

In Table A1 in Appendix A, an overview of the participants present during the two sessions can be found. In session one, two men and three women were present but two participants (one man and one woman) had to leave halfway during the session. In session two, three women were present, of which two had also attended the whole session 1.

Exploring

The agenda for the two sessions is presented in Appendix A. During the first session, participants wrote down core values of implementing the MR-Linac on post-its, which then were shared in the group and clustered on the wall. After this, participants wrote down causes, consequences and/or other factors relevant to implementing the MR-Linac. This resulted in 48 post-its that were shared and simultaneously clustered on the table. Then a start was made with extending the conceptual model that that existed of five variables. Session one ended with a model consisting of 20 variables.

Analysing

In the first half of session two, five core feedback loops were presented and the model was refined and extended, based on discussions about questions Marike had prepared and variables that were left over from session one. The model ended with 26 variables. In the second part, participants were asked to write down on each post-it: a variable in the model they wanted to impact, a solution of how to do this and scores on the impact and feasibility of this solution. In total 14 post-its were discussed and placed on an impact-feasibility matrix, mostly clustering around a moderate level of feasibility, ranging from low to high impact. Despite 10 different variables being targeted, there was much alignment among the actions that were named to target the variables. A core theme that could be identified was communication, both towards referrers and patients, by spreading information about the Radboud UMC having an MR-Linac, as well as information about new indications. Another core team was structuring and sharing the hospital's own evidence of the added value of the MR-Linac.

4.2. Quantitative Results

Repeated Measures ANOVA

A repeated measures ANOVA was conducted with only N = 2 since this test uses listwise deletion, which is far too low to conduct a reliable test (for descriptives, see Table C1.3. in Appendix C). As the dependent variable, the average PBC score of all participants for each time

measurement was used. Mauchly's test only indicated a w = .000, indicating to correct degrees of freedom using Greenhouse-Geisser estimates of sphericity ε =.500. The effect of time on PBC was not significant, $F(1,1) = 1.11$, $p = .483$.

Response bias

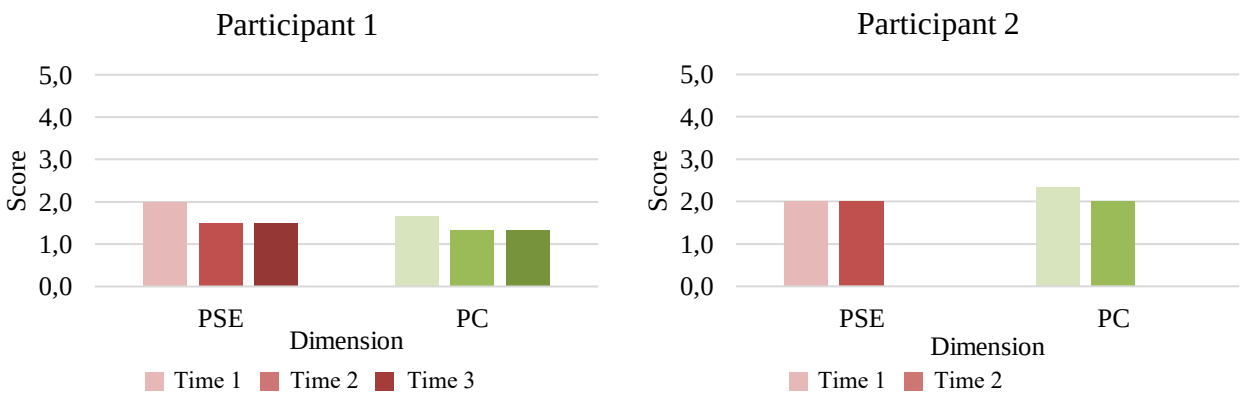
At all measurement times, the mean for PSE2-NegativeConfidence was considerably higher than the mean of PSE2-Confidence (Figure C1.1.3. in Appendix C1). There was no significant relation between PSE2-NegativeConfidence and PSE2-Confidence in any measurement ($r = .468$, $p = .427$ at time 1; $r = .982$, p = .121 at time 2; $r = .945$, $p = .212$). One possible explanation might be that participants assess their PSE higher in negative phrasing, due to the human tendency to dislike thinking negatively about their abilities. Another explanation is the nuance in the question, with the use of 'certain' in item PSE2-Confidence causing more negative answers since one might not feel very capable but even more so does not feel certain about it. Overall it could be concluded that using either positive or negative phrasing influenced the responses of participants. Therefore, this item was removed from the questionnaire, leaving only the five positively phrased items.

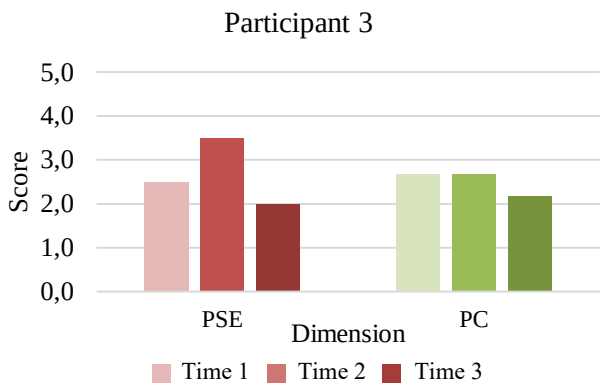
Relationship TIME and PBC

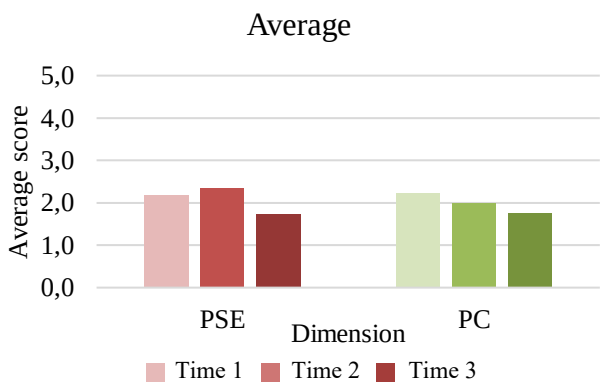
Three participants (participants 1, 2 and 3) were present during two or more measurement times. In Figure 3 below it can be seen that after the *exploring phase* (after session one), participant 1 perceived a decrease in PSE and PC, participant 2 perceived no change in PSE but a decrease in PC, while participant 3 perceived an increase in PSE and no change in PC. After the *analysing* phase (after session two), participant 1 perceived no changes in either PSE or PC, while participant 3 experienced a decrease in PSE and PC. The average of these three participants across time shows a small decrease in both PSE and PC.

Figure 3

Scores on Items for Participants 1, 2 and 3 from Study 1







Other remarkable findings

Questionnaire results yielded three other remarkable findings. First, participants 4 and 5 scored considerably higher on the average of all items together than other participants (Figure C1.1.2. in Appendix C1). Second, in Study 1 there was a link between the average score of all items and the framing of the causes they wrote down in the open question responsible for their experienced level of control. For example, participants 4 and 5 described having 'a good overview of indications' and it being a 'focus area', while other participants named aspects limiting their control, such as being dependent on patient inflows by 'referrals' of other specialists. Third, average scores on item PC2, measuring one's perception that optimally implementing the MR-Linac is completely up to them, are lower compared to other items (Figure C1.1.3. in Appendix C1).

4.3. Interview Results

Relationship TIME and PBC

Participant 2 did not specifically mention a change in PC but more an awareness. Participant 3 mentioned a change of PC and when confronted with their questionnaire scores that showed a lower PC after than before the intervention, answered this might be because the model grew and that insights gained were ambiguous: on the one hand insight into factors you can not control, on the other hand, factors you can control. Both participants 2 and 3 did not report a change in PSE.

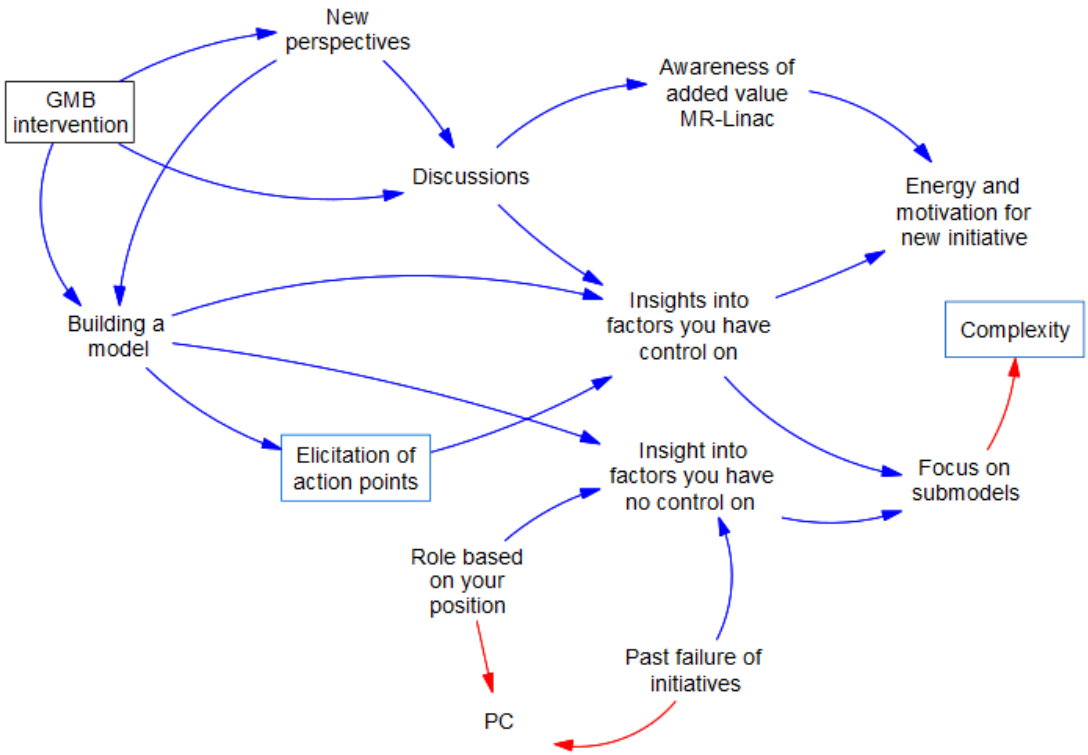
Mechanisms at Play During a GMB Intervention

In Figure 4 below, the integrated model based on the interview results of Study 1 is shown, depicting the mechanisms at work during the GMB intervention. We will now first discuss the mechanisms of our conceptual model (blue squares), resembling knowledge of action points and complexity. Then we will discuss newly found variables, first energy and motivation

as new output and job position and past failures as new mechanisms. Variables are noted in *italics* in the text.

Figure 4

Model Based on Interviews Study 1



Knowledge of Concrete Action Points. Participant 2 expressed a limited knowledge of action points before the intervention and no change in this during the intervention, but this probably is caused by the absence of participant 2 in session two. Participant 3 said they were stuck in trying to exercise certain action points before and now have *elicited more concrete and new points* to work with.

Complexity. Participant 2 experienced before the GMB intervention parts of optimally implementing the MR-Linac complex. Participant 2 also said that the model helped to structure thoughts and that zooming in made things complex but zooming out in the model helped to identify themes and overarching topics. Participant 3 experienced the topic as very complex before the GMB intervention and expressed that making such an extensive model on the one hand makes the topic more complex, but that on the other hand the *submodels*, the parts in the model they focus on, reduced *complexity.*

Energy and Motivation. A core theme felt clearly in both interviews was *energy and motivation* for new initiatives that foster the implementation, caused by

(1) a renewed *awareness of the added value of the MR-Linac*, explicitly mentioned by participant 2 and more implicitly present in the interview of participant 3. According to participant 2, this awareness was mostly caused by the *discussions* where *new perspectives* were heard, something which participant 3 also experienced, since people from different positions were present
(2) new *insights into factors they can influence*, contributed both by the *discussions* and the *model*

Mechanisms Influencing PC. Two factors both participants mentioned as influencing their *PC*, were

(1) one's *position and/or job in the department*, which sets the extent to which you have the power to make certain changes
(2) *past failures of initiatives*, which were conducted either solely (participant 2) or collectively (participant 3)

Both factors contributed to their *knowledge of which factors they can't change*, which was supported in the GMB intervention through the *model building process*. This insight helped them to *keep focus in the model and to structure it into parts*, making it less *complex* to comprehend and, for participant 3, to find leverage points for change.

5. Results Study 2

5.1. Description of the Intervention

In Table A1 in Appendix A, an overview of the participants present during the three sessions can be found. In session one, four men and two women were present, in session two, three men and three women were present and in session three, four men and three women were present.

Exploring

The agenda for the three sessions is presented in Appendix A. During the first session, participants wrote down, clustered and shared hopes and fears regarding their well-being. Relatively many hopes and fears were related to events outside one's control, such as the housing crisis, inflation, health, etc. After this, participants wrote down, clustered and shared causes and consequences of their well-being, resulting in 34 post-its. In evaluating the identified clusters, participant X mentioned it was striking that it all were external factors that made them happy, which they, as participant X added, had not much influence on. After this task, a shared definition of well-being was developed by the group, from where the model building process started by relating identified factors to this definition. The session ended with 15 variables in the model and three feedback loops.

In the second session, participants started by sketching their (1) past, current and expected, (2) hoped for and (3) feared for line of well-being over time, which were afterwards shared in the group. In evaluating these graphs, participant X mentioned that as a common thread, it could be noted that everyone has small drops in their well-being, but that everyone also undertakes actions to improve their well-being after such a dip. Next, the group continued building the model with the variables that were left over from the first session.

Analysing

During the second session, discussions moved towards discussing what was understood by variables and whether leftover variables from session 1 still needed to be included or could be deleted. Here we see the change from an exploring towards an analysing nature. At the end of the second session, the model included 24 variables and nine feedback loops.

In the first half of the third session, feedback loops were presented and the final variables still left over were discussed, but the group did not want to extend the model. In the second half, action points were elicited via the same procedure as in Study 1, although not everyone understood the task in the same manner, focusing on the variables and not writing down a

concrete action. Most post-its were clustered in the high-impact, high-feasibility quadrant. Approximately two-thirds of the policies were actions the company could undertake to improve well-being, which is to be expected since the company would be given an advice report after the intervention and participants were encouraged to think about actions which the company could undertake. The other third consisted of actions they could undertake themselves. However, participants did mention that in doing these actions, one is limited by external factors. For example, one could decide to work less and have more free time, but due to the financial circumstances nowadays this is not possible. Similarly, one participant said that one could try to stress less about non-important stuff but that there are also circumstances beyond one's control, such as sickness in one's environment, which make it hard not to stress.

5.2. Quantitative Results

Repeated Measures ANOVA

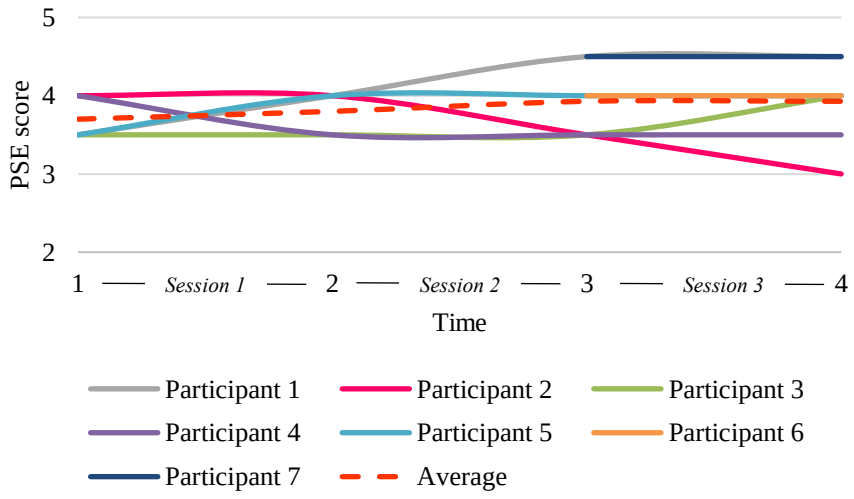
A repeated measures ANOVA test was conducted with N = 4 with the average PBC score of all participants for each time measurement as the dependent variable (for descriptives, see Table C2.3. in Appendix C). The assumption of sphericity based on Mauchly's test, has been met with χ^2 (3) = 3.19, p = .715. The effect of time on the PBC of participants was not significant, $F(3, 9) = .21$, $p = .889$.

Relationship time and PBC

In Figure 5 below, the changes in PSE of participants over time in Study 2 are visualized on a scale of 2 to 5. From this, it becomes clear that variations in PSE over time are minor. Overall, thus compared from one's first time measurement to one's last, three participants showed an increase, two participants a decrease and two participants no change at all in their PSE score across time. In Figure 6 below the same graph is depicted for PC, where overall four participants show an increase, two participants show a decrease and one participant shows no change at all in their PC score. On average, both PSE and PC show a small increase. However, we do see more fluctuations in scores of participants in PC (Figure 6) compared to PSE (Figure 5).

Figure 5

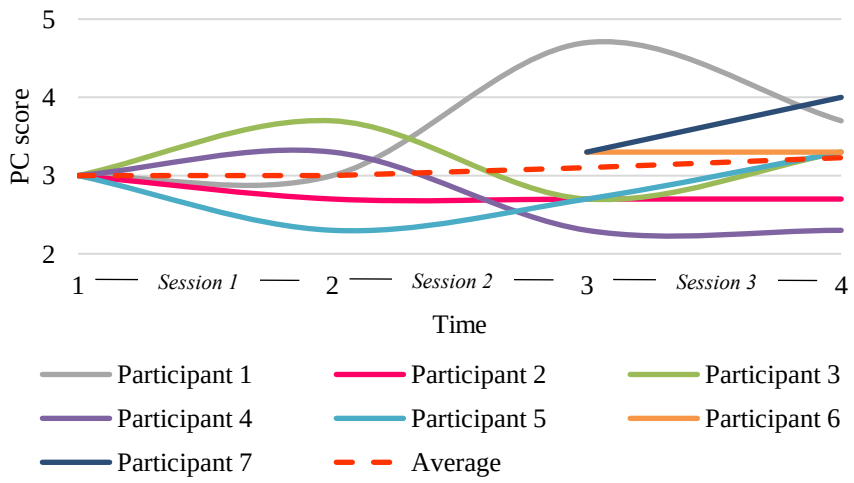
PSE of Participants Over Time in Study 2



Note. For participant 2, measurement time 3 has been replaced by the average between time 2 and time 4, to still be able to show its decrease in the figure.

Figure 6

PC of Participants Over Time in Study 2



Note. For participant 2, measurement time 3 has been replaced by the average between time 2 and time 4, to still be able to show its decrease in the figure.

Other Remarkable Findings

Questionnaire results yielded two other remarkable findings. First, there are two clear outliers when looking at the average scores per item over time (Figure C2.1.2. in Appendix C2). PSE2 scored considerably higher and item PC3 scored considerably lower, compared to the other items. Second, answers to open questions remained mostly the same over time, except for participant 5, for which a decline in PC was accompanied by mentioning the role of external parties and an increase was accompanied by mentioning 'doing yourself'.

5.3. Interview Results

Relationship TIME and PBC

Participant 2 perceived more control, by having gained insights into what you can do yourself to influence your well-being, such as scheduling your work agenda differently. Being confronted with his scores on item PC1, showing a small increase after session one but a decrease again after session three, participant 2 mentioned that such scores depend on which situation you are in at the moment, that his/her PC1 scores remained around average and that he/she still feels this way. Participant 6 perceived a little more control after the GMB intervention compared to before and expressed having become more aware of how activities they already did, such as walking or doing sports, in fact actively contribute to one's well-being and related factors and that it is one's own decision to do these things. Participant 7 did not feel any change in control, but a change in awareness regarding things participant 7 is doing now, why he/she does these and how these influence his/her well-being, expressing the plan to make changes to what he/she does. Answers to asking about one's PSE very much resembled answers to asking about one's PC.

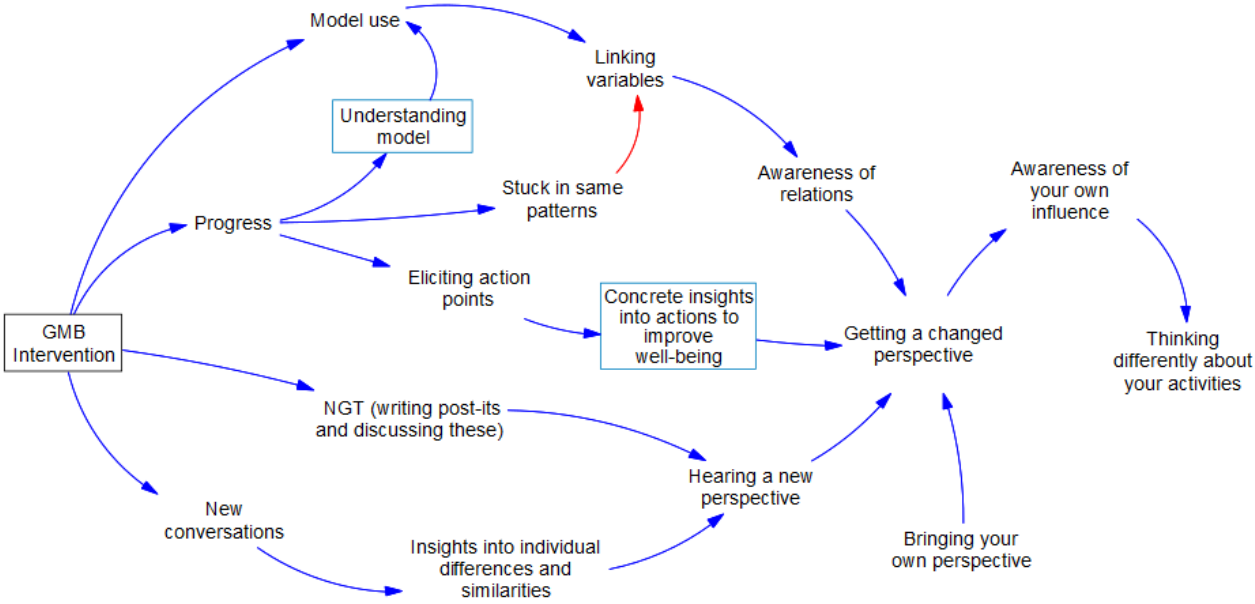
Mechanisms at Play During a GMB Intervention

In Figure 7 below, the integrated model based on the interview results of Study 2 is shown, depicting the mechanisms at work during the GMB intervention. We will now first discuss the mechanisms of our conceptual model (blue squares) and then a newly found output, a changed perspective, and its four mechanisms causing it.

Knowledge of Concrete Action Points. In general, when asking towards the *elicitation of concrete action points*, participants did not so much learn any new points, but gained more *concreteness* of points one was already familiar with and experienced a change in *one's awareness or perspective* on these points.

Figure 7

Model Based on Interviews Study 2



Complexity. None of the interviewees reported finding the topic of improving well-being as complex before the GMB intervention. When asking further what effect the model building process had on their perception of complexity, no one found it very complex. Participant 2 expressed that the group makes things more complex due to the increased variety of factors named, but that you can scale it down for yourself, by judging what is relevant to your situation. Participants 6 and 7 admitted in the beginning the model was vague but as time *progressed*, they gained more *understanding of the model*.

Getting a Changed Perspective. All participants expressed gaining a changed perspective by the GMB intervention, which causes an awareness of one's influence and thereby a rethinking of one's current activities and practices. This changed perspective is caused by four mechanisms:

(1) an *awareness of relations* between factors, that is gained through the use of a model and linking variables in this model

(2) concrete insights into actions to improve well-being, as just explained

(3) *hearing a new perspective*, which is facilitated by (3.1) the *writing and speaking out loud of factors and actions* as used in the Nominal Group Technique (NGT), and by (3.2) hearing *differences and similarities* between fellow young professionals

(4) one's own *previous mental model or perspective*

6. Conclusion

In answering RQ1, we can conclude that changes in the PBC of participants regarding the central problem of the GMB interventions were not unambiguous. Study 1 showed a small decrease in PSE and PC, while Study 2 showed a small increase in PSE and PC. A comparison of the questionnaire results to the interview results, points in the majority of the cases to a clear mismatch. For example, in Study 2 participants 2 and 6 mentioned an increase in PBC but their scores showed respectively a decrease and no change at all, while participant 7 mentioned no change in PBC but its scores did show an increase in PBC. However, all interviewees of both studies did agree that they had gained new insights, in the form of (1) a new perspective, (2) a new or renewed awareness or (3) new knowledge or more concrete knowledge of action points. Some interviewees perceived this as indeed feeling more control, while others did not describe this as feeling more control. Overall, we can conclude that the ambiguous results do not provide sufficient evidence to support our hypothesis stating that PBC is higher after the intervention compared to before.

Focusing on fluctuations in PSE and PC across time, we see small differences in time for PSE and PC in Study 1 and PSE in Study 2, and little larger differences in PC in Study 2. The hypothesized flow of changes we hypothesised, expressed in the parabola graph in Figure 2, can on average not be found and is thus not supported. However, the results do support the idea that PSE and PC change over time. The two interviewees being confronted with part of their questionnaire results, rationalised their scores by saying it depends on the situation and that the person itself also feels ambiguous about the topic, respectively. Also, in Study 2 already in session one comments were made by participants concerning their perception of control on identified factors, supporting the idea that during the whole duration of a GMB intervention, cognitive processes occur that shape one's PBC, even though we may not yet have a clear insight how.

In answering RQ2, we can conclude that our hypothesis, stating that complexity will work as a mechanism for increasing PSE and PC in the *exploring phase* and decreasing them in the *analysing phase*, is not supported. Almost no one experienced the modelling project as making the topic more complex, except for some vagueness in the first session, which improved as they continued working on the model across the sessions. A recurring pattern in the interviews was that although the models showed many factors, people brought their own focus to it, based on what they judged as relevant or by cutting the model into parts where previous experience with what didn't work helped to bring focus. Furthermore, no one in the interviews linked

their experienced complexity or lack of complexity to their perception of control. So, as also can be seen in the models derived from both studies, the perceived complexity does not seem to play a role in shaping the PBC of participants over time.

In answering RQ3, we can conclude that the first part of our hypothesis stating that knowledge of action points will decrease or not yet exist in the *exploring phase*, thereby working as a mechanism lowering PSE and PC, is not supported. Interviewees did mention they already knew some action points beforehand and did not express a decrease in this during the first part of the intervention. However, the second part stating that knowledge of concrete action points will increase during the *analysing phase*, thereby increasing PSE and PC, is supported. Many interviewees experienced actions becoming more concrete in the final session. Although not explicitly linked to their PSE of PC, insights derived from deriving concrete action points have been mentioned in asking for their change of PC, pointing to a possible relation existing here.

However, a third mechanism can be identified that has been named most often during the interviews in both studies as contributing to insights that have changed participants' PC, namely discussions. A recurring pattern in the interviews was that not so much the model contributed to insights gained, although it was experienced as useful, but more the discussions and conversations used in building that model. In both models (Figure 4 and Figure 7) discussions play a central role. In Study 1, both interviewees expressed experiencing the discussions with colleagues about the MR-Linac as giving new energy and motivation to get working with it again, after talking with similarly motivated colleagues about the implementation of the MR-Linac. In Study 2, being confronted with a new perspective by hearing others express their factors and ideas and noting differences and similarities, led to a change of their perspective. Therefore, we might conclude that an important element influencing the PBC of participants is group discussions.

7. Discussion

7.1. Interpretation of Conclusions

PSE and PC

In the questionnaire, the many individual differences combined with the low number of participants, make it difficult to identify a clear change in the two subdimensions of PBC. Since PBC is a psychological construct, that is defined as a *perception* and or *belief* of one's capabilities and control, such differences between individuals are to be expected. Also, the subjectivity of the construct makes it hard to measure with a questionnaire. However, in the interviews the subdimensions also turned out to be hard to question. Despite explaining the difference between PC and PSE to interviewees, many answered PSE questions similar to PC, as participants expressed a causal relation between being capable or having the necessary resources and perceiving control over the behaviour. Therefore, this research affirms the statement of Ajzen (2020) that the two dimensions are very similar and only have value in operationalisation in, how we perceive it, capturing the full meaning of PBC.

Four Stages of Learning

The results of the current research show great similarities with the four stages of learning, which is most likely first mentioned by Broadwell (1969) and later used by several authors, such as Howell (1982). According to this theory, one moves through the following four stages of learning: from *unconscious incompetence* to *conscious incompetence*, then to *conscious competence* and finally to the ultimate state of *unconscious competence* (Howell, 1982). From the interviews and sessions in Study 2, it became clear that many participants were not actively thinking about their well-being beforehand, being *unconsciously incompetent*. However, through the GMB intervention, they were confronted with their incompetence by mentioning factors in their well-being that needed improvement, thus being *consciously incompetent*. This, together with insights derived from the discussions, model and action points, created *conscious competence*, since participants were not only more aware of their well-being but also learned new ways of improving it or were triggered to rethink their current ways of doing things and make changes in it. To conclude, even though there was no clear increase in PBC in study 2, it might be that participants feel more aware of their capabilities and control, but do not experience awareness as being more in control.

GMB Intervention as Driver of PBC

Looking back to the identified sources and drivers of PBC in section 2.4, almost all factors named can be found in both GMB interventions conducted. In building the model,

participants use *enactive mastery experiences* (Bandura, 1997) to judge whether a factor and/or action should be added. Hearing others share experiences gave participants, especially in study 2, new ideas and perspectives on their activities, which is a source of *vicarious experience* (Bandura, 1997). In study 1, the idea of *verbal persuasion* (Bandura, 1997) was highlighted, since both interviewees felt motivated by the group to get back to work on trying to get the most out of the MR-Linac technology. In study 2, the role of *individual differences* (Ajzen, 1985) was highlighted, since some participants expressed during the sessions very different approaches towards their well-being and how they saw their role in this. *Available resources*, *skills and abilities* (Ajzen, 1985, 2020) were made clear by discussions and building the model in both studies. *Cooperation by other people* (Ajzen, 1985, 2020) became very visible in Study 2, since the system was too interconnected to improve the implementation of the MR-Linac alone. These examples, together with the results of the interviews that highlight new insights gained, stress the potential of a GMB intervention as a mechanism to stimulate the PBC of participants regarding a particular behaviour.

Differences Between the two GMB Interventions

Many differences exist between Study 1 and Study 2, as shown in Table 1 below. Most strikingly, both studies implemented the GMB approach differently. In Study 1, GMB was used as an approach to get honest and true conversations going about what people perceive as well-being and how they think they can improve their well-being, while in Study 2 GMB was used as an approach to develop a practical tool (the model itself), find leverage points to intervene. These differences are related to the differences in topics in both studies: a more subjective approach for 'improving well-being', compared to a more factual approach for 'optimally implementing the MR-Linac'. PSE and PC scores were also lower in Study 1 compared to Study 2, pointing to differences in the extent of volitional control of behaviours. Other key differences between the studies, illustrating the different implementation possibilities of a GMB intervention, are shown in Table 1.

Table 1

Overview of Key Differences Between Study 1 and Study 2

Topic	Study 1 – MR-Linac	Study 2- Well-being young professionals
Client	Project for research	Project both for research and client organisation, which is given an advice report afterwards
Gatekeeper	No gatekeeper, researchers invited participants	Gatekeeper (HR) who invited participants
Sector	Health sector (hospital)	Administrative services (office)
Model building	Starting from a conceptual model	No conceptual model, starting from a shared definition of the problem variable
	Focus on mapping the system (objective)	Focus on mapping how participants experience well-being (subjective)
Interactions	Agreement between participants in the building process	Agreement is not 100% possible since well-being is experienced differently among participants, also depending on their function
	Relatively little explanation given by participants for proposed factors or relations	Much explanation, examples and experiences shared for proposed factors or relations

7.2. Contribution

This research contributes to existing research in several ways. Firstly, this research offers an in-depth insight into whether PBC is changed during a GMB intervention, hinting at the fact that although PBC is difficult to measure, participants do experience insights that are related to PBC. Secondly, this research contributes to the discussion concerning the operationalisation of PBC and the role of PSE and PC in PBC as a construct. This research showed the application of a questionnaire developed by combining several items previously used to measure PBC and by combining both PSE and PC items. Thirdly, this research offers insights into how participants experienced the GMB intervention and what according to them contributed to gaining insights, if there were any. The two models developed can give researchers and practitioners new insights into relevant leverage points to focus on during a GMB intervention. Lastly, this research provides an in-depth description of two quite different GMB interventions

performed, giving practitioners inspiration for and insight into the application of the GMB approach in different sectors, with varying purposes and with varying sessions.

7.3. Limitations

The main methodological limitations of this research are linked to limitations derived from studying a phenomenon in practice. First, the low number of respondents to questionnaires and interviews is expected since a GMB intervention always involves a relatively small number of participants, but it makes it difficult to make conclusions from quantitative data. Especially in Study 1, the number of participants was very low, possibly because unlike in Study 2, there was no gatekeeper motivating people from inside the organisation for the project. Another explanation is given in an interview with participant 3 in Study 1, stating that the invitations sent to participants were too static and focused on needing participants as test objects for research, instead of explaining the value of the sessions for the department. A second limitation is not having the same participants present during every measurement time due to unavailability, which makes it difficult to compare changes in PBC scores over time. A third more methodological limitation is the direct measurement of PBC regarding the behaviour that is under study (such as "improving my well-being"), instead of beforehand asking which factors would enable one to improve their well-being and then during the intervention sum one's control beliefs times power of control over these factors. However, such an approach in the context of GMB intervention would steer participants already in a certain direction, limiting one's open perspective at the start of the GMB intervention.

7.4. Recommendations

First of all, more research is needed into the operationalisation of PBC. Although combining items from different previous studies into one questionnaire to measure PBC resulted in sufficient to good reliability for most measurement times, it is still puzzling why a negative Cronbach's a was achieved in time 1 and 2 in Study 2. Also, using the questionnaire on a larger database would allow one to run a valid factor analysis and contribute to the discussion concerning the hierarchical construct of PBC as consisting of both PSE and PC. Secondly, future research could further study how PBC is shaped in GMB interventions in different sectors and when including a larger participant group and/or a more consistent participant group over sessions. This would require a high motivation of participants to participate and schedule one's agenda around the sessions. Finally, since interviews resulted in a richer understanding than only the questionnaire results could offer, we would highly encourage future research including GMB interventions to use post-intervention interviews, as an addition to questionnaires.

8. References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control. SPSS Springer Series in Social Psychology*. Springer. https://doi.org/10.1007/978-3-642-69746-3_2

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, *32*(4), 665-683. https://doi.org/10.1111/j.1559-1816.2002.tb00236.x

Ajzen, I. (2006). *Constructing a theory of planned behavior questionnaire*. https://www.researchgate.net/publication/235913732_Constructing_a_Theory_of_Planned_Behavior_Questionnaire

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, *2*(4), 314-324. https://doi.org/10.1002/hbe2.195

Ajzen, I., & Driver, B. L. (1992). Application of the Theory of Planned Behavior to Leisure Choice. *Journal of Leisure Research*, *24*(3), 207-224. https://doi.org/10.1080/00222216.1992.11969889

Andersen, D. F., & Richardson, G. P. (1997). Scripts for group model building. *System Dynamics Review*, *13*(2), 107-129. https://doi.org/10.1002/(SICI)1099-1727(199722)13:2%3C107::AID-SDR120%3E3.0.CO;2-7

Andersen, D. F., Richardson, G. P., & Vennix, J. A. M. (1997). Group model building: adding more science to the craft. *System Dynamics Review*, *13*(2), 187-201. https://doi.org/10.1002/(SICI)1099-1727(199722)13:2%3C187::AID-SDR124%3E3.0.CO;2-O

Andersen, D. L., Luna-Reyes, L. F., Diker, V. G., Black, L., Rich, E., & Andersen, D. F. (2012). The disconfirmatory interview as a strategy for the assessment of system dynamics models. *System Dynamics Review*, *28*(3), 255-275. https://doi.org/10.1002/sdr.1479

Armitage, C. J., & Conner, M. (1999). Distinguishing perceptions of control from self-efficacy: Predicting consumption of a low-fat diet using the theory of planned behavior. *Journal of Applied Social Psychology*, *29*(1), 72-90. https://doi.org/10.1111/j.1559-1816.1999.tb01375.x

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*(4), 471-499. https://doi.org/10.1348/014466601164939

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191-215. https://doi.org/10.1037/0033-295x.84.2.191

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). Academic Press. https://www.academia.edu/32386167/Bandura_self_efficacy

Bandura, A. (1997). *Self-efficacy: the exercise of control*. W. H. Freeman and Company.

Broadwell, M. M. (1969, February 20). Teaching For Learning (XVI.). *The Gospel Guardian.* https://edbatista.typepad.com/files/teaching-for-learning-martin-broadwell-1969-conscious-competence-model.pdf

Cheung, S. F., & Chan, D. K. (2000). *The role of perceived behavioral control in predicting human behavior: A meta-analytic review of studies on the theory of planned behavior* [Unpublished manuscript]. Chinese University of Hong Kong.

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, *13*(1), 3-21. https://doi.org//10.1007/BF00988593

de Gooyert, V. (2023). *Modelling for Stakeholder Engagement I. Lecture 2: Anatomy of group processes* [PowerPoint slides]. Brightspace Radboud Universiteit. https://brightspace.ru.nl/

Denscombe, M. (2012). *Research Proposals: a Practical Guide*. McGraw-Hill Education.

Eker, S., & Zimmermann, N. (2016). Using textual data in system dynamics model conceptualization. *Systems*, *4*(3), 28. https://doi.org/10.3390/systems4030028

Field, A. P. (2018). *Discovering statistics using IBM SPSS statistics* (Fifth ed.). SAGE Publications.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: an introduction to theory and research*. Addison-Wesley.

Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications to health-related behaviors. *American Journal of Health Promotion*, *11*(2), 87-98. https://doi.org/10.4278/0890-1171-11.2.87

Han, H., Hsu, L.-T., & Sheu, C. (2010). Application of the Theory of Planned Behavior to green hotel choice: Testing the effect of environmental friendly activities. *Tourism Management*, *31*(3), 325-334. https://doi.org/10.1016/j.tourman.2009.03.013

Hovman, P. S., Rouwette, E. A. J. A., Andersen, D. F., & Richardson, G. P. (2015). *Scriptapedia/Places to Intervene*. Retrieved June 12, 2024 from https://en.wikibooks.org/wiki/Scriptapedia/Places_To_Intervene

Howell, W. S. (1982). *The empathic communicator*. Wadsworth Publishing Company (as cited in ChangingMinds.org. (n.d.). *Conscious and competence*. http://changingminds.org/explanations/learning/consciousness_competence.htm Accessed June 12, 2024).

Kim, H., & Andersen, D. F. (2012). Building confidence in causal maps generated from purposive text data: mapping transcripts of the Federal Reserve. *System Dynamics Review*, *28*(4), 311-328. https://doi.org//10.1002/sdr.1480

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin*, *18*(1), 3-9. https://doi.org/10.1177/01461672921810

Manson, S. M. (2001). Simplifying complexity: a review of complexity theory. *Geoforum*, *32*(3), 405-414. https://doi.org/10.1016/S0016-7185(00)00035-X

Manstead, A. S. R., & van Eekelen, S. A. M. (1998). Distinguishing between perceived behavioral control and self-efficacy in the domain of academic achievement intentions and behaviors. *Journal of Applied Social Psychology*, *28*(15), 1375-1392. https://doi.org/10.1111/j.1559-1816.1998.tb01682.x

Paul, J., Modi, A., & Patel, J. (2016). Predicting green product consumption using theory of planned behavior and reasoned action. *Journal of Retailing and Consumer Services 29*, 123-134. https://doi.org/10.1016/j.jretconser.2015.11.006

Pavlou, P. A., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS Quarterly*, *30*(1), 115-143. https://doi.org/10.2307/25148720

Rogers, J., & Revesz, A. (2019). Experimental and quasi-experimental designs. In J. McKinley & H. Rose (Eds.), *The Routledge handbook of research methods in applied linguistics* (1st ed., pp. 133-143). Routledge. https://www.researchgate.net/publication/334250281_Experimental_and_quasi-experimental_designs

Rouwette, E. A. J. A. (2003). *Group model building as mutual persuasion* [PhD dissertation, Radboud University Nijmegen]. Wolf Legal Publishers. https://repository.ubn.ru.nl/bitstream/handle/2066/136345/218392.pdf?sequence=1

Rouwette, E. A. J. A. (2016). The impact of group model building on behavior. In M. Kunc, J. Malpass, & L. White (Eds.), *Behavioral Operational Research: Theory, Methodology and Practice* (pp. 213-241). https://repository.ubn.ru.nl/bitstream/handle/2066/178390/178390pos.pdf

Rouwette, E. A. J. A., Korzilius, H., Vennix, J. A. M., & Jacobs, E. (2011). Modeling as persuasion: the impact of group model building on attitudes and behavior. *System Dynamics Review*, *27*(1), 1-21. https://doi.org/10.1002/sdr.441

Rouwette, E. A. J. A., Vennix, J. A. M., & Mullekom, T. v. (2002). Group model building effectiveness: a review of assessment studies. *System Dynamics Review: The Journal of the System Dynamics Society*, *18*(1), 5-45. https://doi.org/10.1002/sdr.229

Scott, R. J., Cavana, R. Y., & Cameron, D. (2016). Recent evidence on the effectiveness of group model building. *European Journal of Operational Research*, *249*(3), 908-918. https://doi.org/10.1016/j.ejor.2015.06.078

Sparks, P., Guthrie, C. A., & Shepherd, R. (1997). The dimensional structure of the perceived behavioral control construct. *Journal of Applied Social Psychology*, *27*(5), 418-438. https://doi.org/10.1111/j.1559-1816.1997.tb00639.x

Terry, D. J., & O'Leary, J. E. (1995). The theory of planned behaviour: The effects of perceived behavioural control and self-efficacy. *British Journal of Social Psychology*, *34*(2), 199-220. https://doi.org/10.1111/j.2044-8309.1995.tb01058.x

Turner, B. L., Kim, H., & Andersen, D. F. (2013). Improving coding procedures for purposive text data: Researchable questions for qualitative system dynamics modeling. *System Dynamics Review*, *29*(4), 253-263. https://doi.org/10.1002/sdr.1506

Vennix, J. A. M. (1996). *Group model building. Facilitating team learning using system dynamics*. Wiley.

Vennix, J. A. M., Akkermans, H. A., & Rouwette, E. A. J. A. (1996). Group model-building to facilitate organizational change: an exploratory study. *System Dynamics Review*, *12*(1), 39-58. https://doi.org/10.1002/(SICI)1099-1727(199621)12:1%3C39::AID-SDR94%3E3.0.CO;2-K

ZonMW Projecten. (n.d.). *Exploratory, participatory and adaptive technology-specific modeling to inform optimal use of innovative medical technology: the case of MR-guided radiotherapy*. https://projecten.zonmw.nl/nl/project/exploratory-participatory-and-adaptive-technology-specific-modeling-inform-optimal-use

Appendices

Appendix A – Details of GMB Intervention in Both Studies

A1 Presence of Participants in Both Studies

Table A1

Participants who Participated in Questionnaires and Interviews

Study 1 – Implementation of the MR-Linac				
Participant	**Measurement time**			
	1	**2**	**3**	
	Questionnaire before session 1	Questionnaire after session 1	Questionnaire after session 2	Post-intervention interview
Participant 1	x	x	x	
Participant 2	x	x		YES
Participant 3	x	x	x	YES
Participant 4	x			
Participant 5	x			
Participant 6			x	

Study 2 – Well-being of young professionals					
Participant	**Measurement time**				
	1	**2**	**3**	**4**	
	Questionnaire before session 1	Questionnaire after session 1	Questionnaire after session 2	Questionnaire after session 3	Post-intervention interview
Participant 1	x	x	x	x	
Participant 2	x	x		x	YES
Participant 3	x	x	x	x	
Participant 4	x	x	x	x	
Participant 5	x	x	x	x	
Participant 6	x	x	x	x	YES
Participant 7			x	x	YES

Note. x represents being present during measurement time and filling in the questionnaire. Due to an error in handing out the questionnaires in session 1 of Study 2, the questionnaires of participant 6 could not be assigned to measurement time one or two. The researcher forgot to specify times 1 and 2 which both were handed out in session 1. For the other participants, this could be traced via a folded corner in questionnaires handed out in session 1, both participant 6 was handed out a questionnaire with a folded corner at both time 1 and 2 since there was one questionnaire left over from time 1. Therefore the two questionnaires of participant 6 could not be used and were excluded (the red x in Table A1).

A2 Agenda Study 1 – Implementation of the MR-Linac

Table A2

Agenda of Sessions in Study 1

Session 1	
Scripts	**Duration**
Nominal Group Technique on core values of implementing the MR-Linac [a]	10 min
Nominal Group Technique (causes and consequences) [b]	20 min
Initiating and Elaborating a Causal Loop Diagram [b]	40 min
Session 2	
Scripts	**Duration**
Model review [b]	20 min
Initiating and elaborating a causal loop diagram [b]	40 min
Combination of places to intervene and initial policy options [b] with mapping policies on an impact/feasibility matrix [a]	60 min

Note. The agenda does not include breaks, since these were taken depending on the timing during sessions and how long tasks took in reality.
[a] Task that is not based on a particular script but on a combination of techniques used in scripts and previous experiences and insights.
[b] Script from https://en.wikibooks.org/wiki/Scriptapedia.

A3 Agenda Study 2 – The Well-being of young professionals

Table A3

Agenda of Sessions in Study 2

Session 1	
Scripts	**Duration**
Hopes and fears [a]	30 min
Nominal Group Technique (causes and consequences) [a]	30 min
Initiating and Elaborating a Causal Loop Diagram [a]	40 min
Session 2	
Scripts	**Duration**
Graphs over time [a]	60 min
Initiating and Elaborating a Causal Loop Diagram [a]	60 min
Session 3	
Scripts	**Duration**
Model review and finishing model [a]	60 min
Combination of places to intervene and initial policy options [a] with mapping policies on an impact/feasibility matrix [b]	60 min

Note. The agenda does not include breaks, since these were taken depending on the timing during sessions and how long tasks took in reality.
[a] Script from https://en.wikibooks.org/wiki/Scriptapedia.
[b] Task that is not based on a particular script but on a combination of techniques used in scripts and previous experiences and insights.

Appendix B – Questionnaires

B1 Items of Questionnaire

Table B1

Items Measured in Questionnaires

	Scale (5-point Likert scale)	**Based on**
Perceived Self-efficacy		
1. **PSE1 –** Difficulty For me, [behaviour X] is…	Very easy (1)– very difficult (5)	(Madden et al., 1992; Manstead & van Eekelen, 1998; Rouwette, 2003; Sparks et al., 1997; Terry & O'Leary, 1995)
2.1 PSE2 – NegativeConfidence I don't feel capable of conducting [behaviour X]	Totally agree (1) – totally disagree (5)	To check for bias in positive or negative-phrased questions, only for Study 1
2.2 PSE2 - Confidence I am confident that I can [behaviour X].	Totally agree (1) – totally disagree (5)	(Ajzen, 2006; Armitage & Conner, 1999; Manstead & van Eekelen, 1998; Sparks et al., 1997)
	Perceived control	
3. PC1 - ExtentControl How much control do you have over [behaviour X]?	Very much control (1)– very low control (5)	(Manstead & van Eekelen, 1998; Sparks et al., 1997; Terry & O'Leary, 1995)
3.2 PC1 – open question Explain in keywords why you experience this level of control.	Open question	
4. **PC2** - SelfInControl Whether or not I [behaviour X], is completely up to me.	Totally agree (1) – totally disagree (5)	(Ajzen, 2006; Armitage & Conner, 1999; Sparks et al., 1997)
5. **PC3** - FactorsPreventing The number of events that prevent me from [behaviour X] is…	Very small (1) – very large (5)	(Madden et al., 1992; Rouwette, 2003)

B2 Questionnaire Study 1

Gelieve elk item hieronder te beoordelen op de bijhorende schaal.

	Heel makkelijk	**Makkelijk**	**Neutraal**	**Moeilijk**	**Heel moeilijk**
Het optimaal inzetten van de MR-Linac technologie is voor mij					
	Helemaal eens	**Eens**	**Neutraal**	**Oneens**	**Helemaal oneens**
Ik voel mij niet in staat om de MR-Linac technologie optimaal te kunnen inzetten.					
Of ik wel of niet de MR-Linac technologie optimaal inzet, is volledig aan mij.					
Ik ben er zeker van dat ik de MR-Linac technologie optimaal kan inzetten.					
	Heel veel controle	**Veel controle**	**Gemiddeld**	**Weinig controle**	**Heel weinig controle**
Hoeveel controle heb je over het optimaal inzetten van de MR-Linac technologie?					
Leg hiernaast in steekwoorden uit waardoor je deze mate van controle ervaart.	_____ _____ _____ _____				
	Heel klein	**Klein**	**Neutraal**	**Groot**	**Heel groot**
Het aantal factoren dat mij belemmert om de MR-Linac technologie optimaal in te zetten, is…					

B3 Questionnaire Study 2

Vragenlijst – perceptie van controle

Deze vragen meten de perceptie van controle die je ervaart over het verbeteren van je welzijn als young professional. De vragen gaan niet over óf je een probleem ervaart omtrent je welzijn, maar gaan over of je je welzijn **kunt** verbeteren, vanuit de aanname dat je dit zou willen. Vul de vragen in zoals je het op dit moment ervaart.

Code: _____
Voorletter(s) vader + geboortejaar + voorletter(s) moeder + geboortejaar
(Voorbeeld: MA1974LC1970)

1. **Het verbeteren van mijn welzijn, is voor mij…**

Heel makkelijk	Makkelijk	Neutraal	Moeilijk	Heel erg moeilijk
○	○	○	○	○

2. Ik ben er zeker van dat ik mijn welzijn kan verbeteren.

Helemaal eens	Eens	Neutraal	Oneens	Helemaal oneens
○	○	○	○	○

3. **Hoeveel controle heb je over het verbeteren van jouw welzijn?**

Heel veel controle	Veel controle	Gemiddeld	Weinig controle	Heel weinig controle
○	○	○	○	○

4. **Leg in steekwoorden uit waardoor je deze mate van controle ervaart.**

_____

_____

_____

_____

5. **Of ik wel of niet mijn welzijn verbeter, is volledig aan mij.**

Helemaal eens	Eens	Neutraal	Oneens	Helemaal oneens
○	○	○	○	○

6. **Het aantal factoren dat mij belemmert om mijn welzijn te verbeteren, is…**

Heel klein	Klein	Neutraal	Groot	Heel groot
○	○	○	○	○

Appendix C –Results Questionnaire

C1 Study 1

C1.1 Descriptive Statistics

Figure C1.1.1.

Scores on PSE and PC Across Time per Participant in Study 1

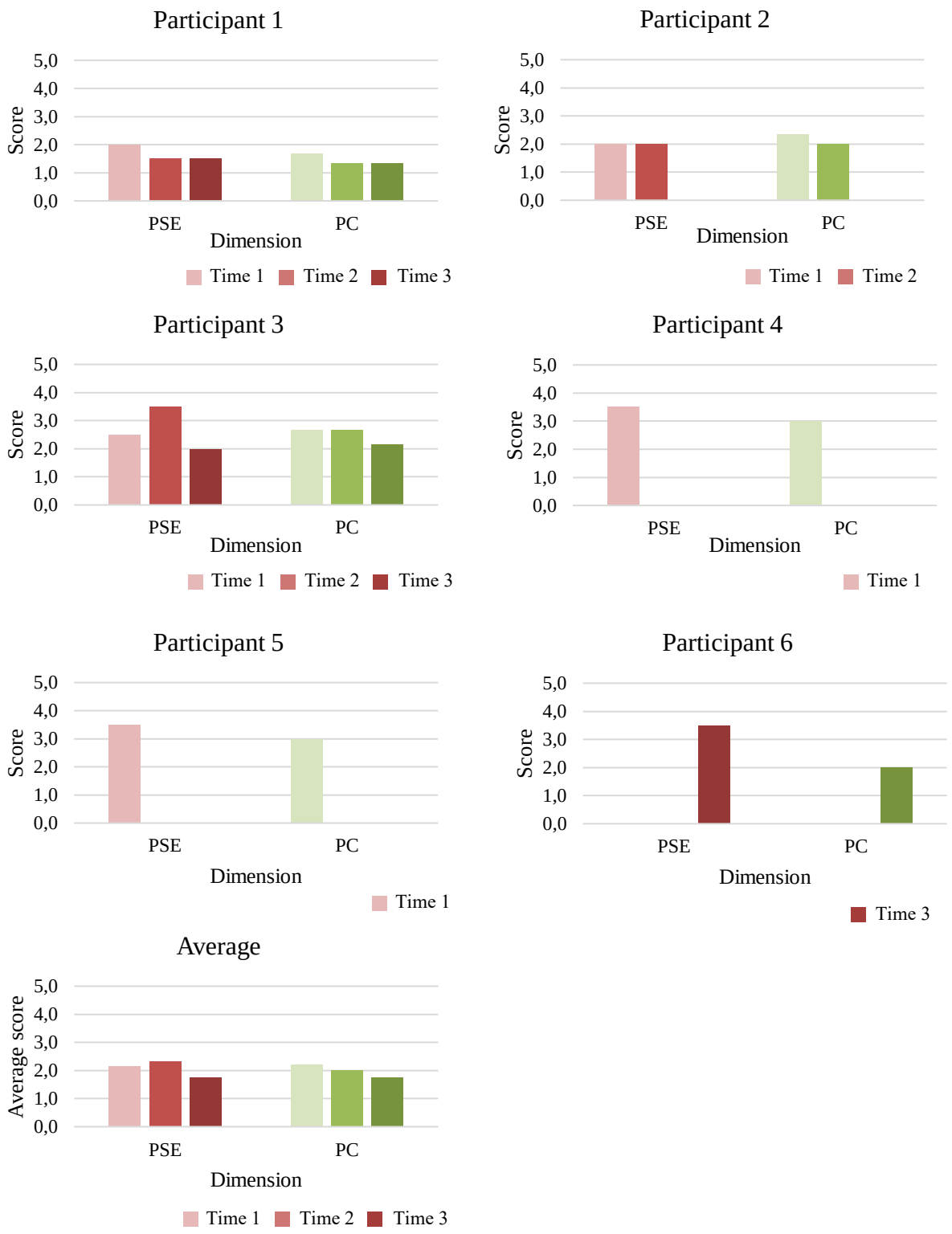


Figure C1.1.2.

PBC of Participants over Time in Study 1

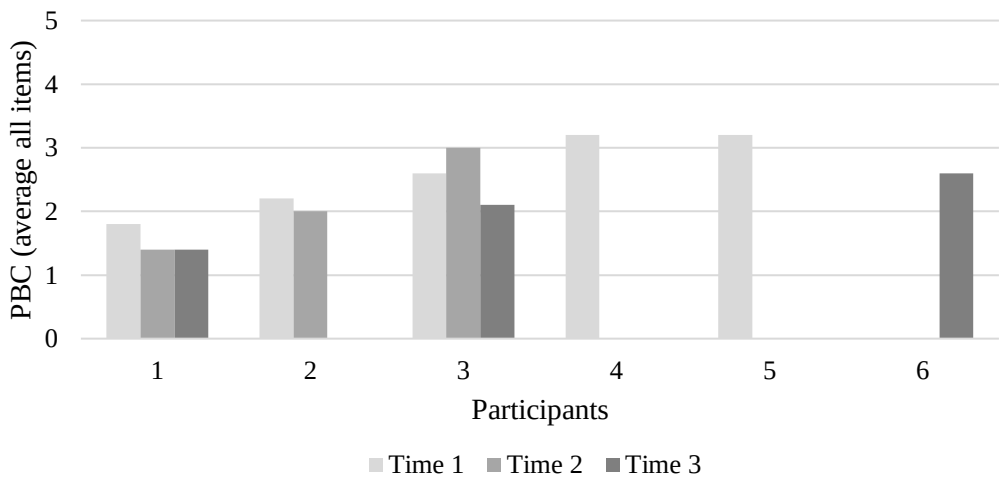


Figure C1.1.3.

Means of Items Across Time in Study 1

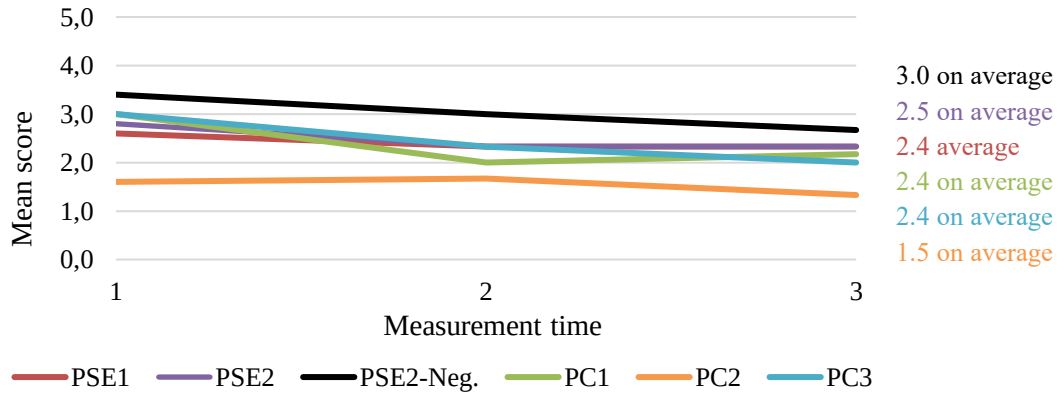


Table C1.1.1.

Correlations of Items in Measurement 1 Study 1

	N	M	SD	1	2	3	4	5
1. PSE1 - Difficulty	5	2.6	.894					
2. PSE2 - Confidence	5	2.8	.837	.54				
3. PSE2 - NegativeConfidence	5	3.4	.894	.56	.47			
4. PC1 - ExtentControl	5	3.0	1.000	.84	.90*	.56		
5. PC2 - SelfInControl	5	1.6	.548	-.41	.33	.41	.00	
6. PC3 - FactorsPreventing	5	3.0	.707	.79	.42	.79	.71	.00

Note. *= $p < .05$

Table C1.1.2.

Correlations of Items in Measurement 2 Study 1

	N	M	SD	1	2	3	4	5
1. PSE1 - Difficulty	3	2.3	.577					
2. PSE2 - Confidence	3	2.3	1.528	.95				
3. PSE2 - NegativeConfidence	3	3.0	1.000	.87	.98			
4. PC1 - ExtentControl	3	2.0	1.000	.87	.98	1.00**		
5. PC2 - SelfInControl	3	1.7	.577	.50	.76	.87	.87	
6. PC3 - FactorsPreventing	3	2.3	.577	1.00**	.95	.87	.87	.50

Note. **= $p < .01$

Table C1.1.3.

Correlations of Items in Measurement 3 Study 1

	N	M	SD	1	2	3	4	5
1. PSE1 - Difficulty	3	2.3	.577					
2. PSE2 - Confidence	3	2.3	1.528	.95				
3. PSE2 - NegativeConfidence	3	2.7	1.155	1.00**	.95			
4. PC1 - ExtentControl	3	2.2	1.258	-.12	.22	-.12		
5. PC2 - SelfInControl	3	1.3	.577	1.00**	.95	1.00**	-.12	
6. PC3 – FactorsPreventing [a]	3	2.0	.000	-	-	-	-	-

Note. [a] = correlation could not be calculated due to a constant variable

C1.2. Reliability

Table C1.2.

Reliability at all Measurement Times for Study 1

Measure-ment time	Cronbach's α	Items
Time 1	.816	Possible iteration 1: Removing item PC2 would improve Cronbach's α to .903 Possible iteration 2: Removing either of the two items would improve Cronbach's α to .905 PSE2: iteration 3 is to remove PC3 to improve Cronbach's α to .909. Remaining items: PC1 and PSE1 PC3 Possible iteration 3: remove PSE1 to improve Cronbach's α to .937. Remaining items: PC1 and PSE2
Time 2	.918	Possible iteration 1: Removing item PSE2 would improve Cronbach's α to .912 Possible iteration 2: Removing item PC2 would improve Cronbach's α to .923 Possible iteration 3: Removing item PC2 would improve Cronbach's α to 1 Remaining items: PSE2 and PC3
Time 3	.661	Item PC3 is beforehand removed due to no variance. Possible iteration 1: Removing item PC1 would improve Cronbach's α to .857 Possible iteration 2: Removing item PSE2 would improve Cronbach's α to 1. Remaining items: PSE1 and PC2

Note. Item PSE2-Reponseset is not included in the reliability analysis.

C1.3. Repeated Measures ANOVA test

Table C1.3.

Descriptive Statistics for PBC Scores in Study 1

Time	M	SD	N
PBC 1	2.2	.566	2
PBC 2	2.2	1.131	2
PBC 3	1.75	.495	2

Note. PBC scores were calculated by averaging the PBC scores (average of all 5 items) of all participants within one time measurement.

C2 Study 2

C2.1 Descriptive Statistics

Figure C2.1.1.

Scores on Items Across Time per Participant in Study 2

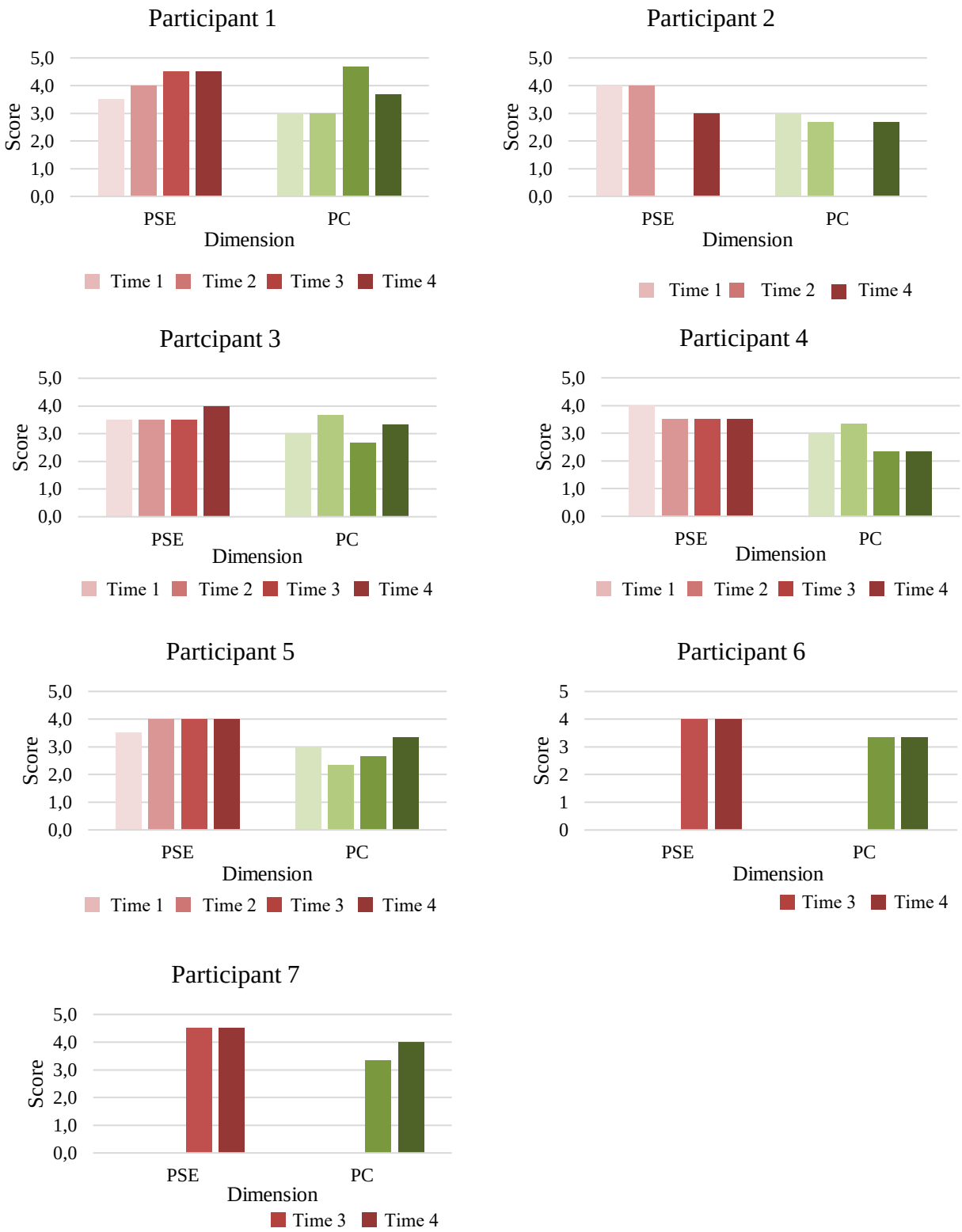


Figure C2.1.2.

Means of Items Over Time in Study 2

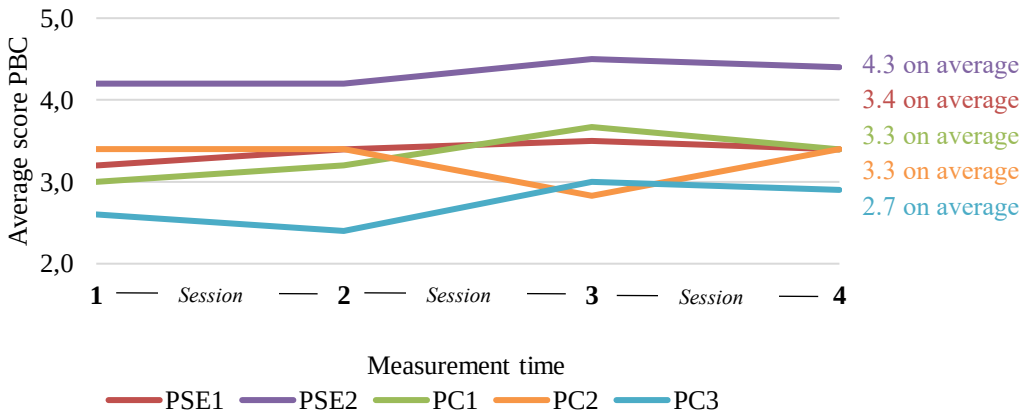


Table C2.1.1.

Correlations of Items in Measurement 1 Study 2

	N	M	SD	1	2	3	4	5
1. PSE1 - Difficulty	5	3.2	.873					
2 PSE2 - Confidence	5	4.2	.447	-.80				
3. PC1 - ExtentControl	5	3.0	.000	-	-			
4. PC2 - SelfInControl	5	3.4	.894	-.47	.38	-		
5. PC3 - FactorsPreventing	5	2.6	.894	.47	-.38	-	-1.00**	

Note. ** $p < .01$; - = correlation could not be calculated due to a constant variable

Table C2.1.2.

Correlations of Items in Measurement 2 Study 2

	N	M	SD	1	2	3	4	5
1. PSE1 - Difficulty	5	3.4	.894					
2 PSE2 - Confidence	5	4.2	.447	-.88				
3. PC1 - ExtentControl	5	3.2	.837	-.13	-1.13			
4. PC2 - SelfInControl	5	3.4	1.342	-.79	.67	.134		
5. PC3 - FactorsPreventing	5	2.4	.548	-.41	.61	-.76	.07	

Table C2.1.3.

Correlations of Items in Measurement 3 Study 2

	N	**M**	**SD**	1	2	3	4	5
1. PSE1 - Difficulty	6	3.5	.873					
2 PSE2 - Confidence	6	4.5	.548	-.22				
3. PC1 - ExtentControl	6	3.7	.816	.59	.45			
4. PC2 - SelfInControl	6	2.8	1.169	.51	.47	.77		
5. PC3 - FactorsPreventing	6	3.0	.894	.27	.41	.27	.77	

Table C2.1.4.

Correlations of Items in Measurement 4 Study 2

	N	**M**	**SD**	1	2	3	4	5
1. PSE1 - Difficulty	7	3.4	.787					
2 PSE2 - Confidence	7	4.4	.535	.28				
3. PC1 - ExtentControl	7	3.4	.535	.28	1.00**			
4. PC2 - SelfInControl	7	3.4	1.134	.69	.75	.75		
5. PC3 - FactorsPreventing	7	2.9	.900	.34	-.20	-.20	-.09	

Note. ** $p < .01$

C2.2. Reliability

Table C2.2.

Reliability at all Measurement Times for Study 2

Measure-ment time	Cronbach's α	Items
Time 1	-9.778	Item PC101 is removed in the reliability analysis due to zero variance. Possible iteration 1: Removing item PC2 would improve Cronbach's α to -.2. Possible iteration 2: Removing item PSE2 would improve Cronbach's to α .636 Remaining items: PSE1 and PC3
Time 2	-2.404	Possible iteration 1: Removing item PSE1 would improve Cronbach's α to .252. Possible iteration 2: Removing item PC1 would improve Cronbach's α to .514 Possible iteration 3: Removing item PC2 would improve Cronbach's α to .750 Remaining items: PSE2 and PC3
Time 3	.802	Possible iteration 1: Removing item PSE2 would improve Cronbach's α to .821 Possible iteration 2: Removing item PSE1 would improve Cronbach's α to .825 Possible iteration 3: Removing item PC1 would improve Cronbach's α to .850 Remaining items: PC2 and PC3
Time 4	.686	Possible iteration 1: Removing item PC3 would improve Cronbach's α to .831 Possible iteration 2: Removing PSE1 would improve Cronbach's α to .843 Possible iteration 3: Removing PC4 would improve Cronbach's α to 1. Remaining items: PSE2 and PC1

C2.3. Repeated Measures ANOVA test

Table C2.3.

Descriptive Statistics for PBC Scores in Study 2

Time	M	SD	N
PBC 1	3.25	.100	4
PBC 2	3.35	.252	4
PBC 3	3.40	.817	4
PBC 4	3.50	.503	4

Note. PBC scores were calculated by averaging the PBC scores (average of all 5 items) of all participants within one time measurement.

Appendix D – Interview Guide

D1 Interview Guide Study 1

Notes from the sessions

[contribution of the participant to sessions]

[describe results questionnaire for participant]

Introduction

What did you learn during the GMB project?

What did you find striking during the GMB project?

Part 1: perception of control

These questions are about your perception of control. By this, we mean the extent to which you feel that optimally implementing the MR-Linac is up to you, in other words, within your control.

1. *PC* - How much control do you experience in optimally implementing the MR-Linac at the moment and why?
2. *Change PC* - Do you feel that your perception of control, whether or not it is up to you to implement the MR-Linac optimally, has changed during the GMB project?
   2.1. If so,
      2.1.1. In what way has this changed?
      2.1.2. What makes you think it has changed?
      2.1.3. during or between which session(s) did this change take place? From what then?
   2.2. If not, why do you think this has not changed?

Part 2: Perceived Self-Efficacy

These questions are about self-efficacy. Self-efficacy is the belief or confidence you have in your ability to use the MR-Linac to its full potential.

3. *PSE* - How much self-effectiveness, i.e. being able to implement the MR-Linac optimally, are you experiencing at the moment?
4. *Change PSE* - Do you feel that your perception of self-efficacy, i.e. to what extent you are able to optimally implement the MR-Linac, has changed during the GMB project?
   4.1. If so,

4.1.1. In what way has this changed?

4.1.2. What makes you think it has changed?

4.1.3. during or between which session(s) did this change take place? From what then?

4.2. If not, why do you think this has not changed?

Part 3: GMB mechanisms

5. *Knowledge of action points before* - How was your knowledge of concrete action points to optimally implement the MR-Linac before the GMB project?
6. *Knowledge of action points change* - Do you think this has changed during the GMB project and if so,
   6.1. In what way has this changed?
   6.2. What do you think changed this?
   6.3. During or between which session(s) did this change take place? From what then?
7. *Complexity before* - How did you experience the complexity of optimally implementing the MR-Linac before the GMB project?
8. *Complexity change* - Do you think this has changed during the GMB project and if so,
   8.1. In what way has this changed?
   8.2. What do you think changed this?
   8.3. During or between which session(s) did this change take place? From what then?

These were all my questions. Do you have anything else you want to say to evaluate this project? This can be anything.

D2 Interview Guide Study 2

Notes from the sessions

[contribution of the participant to sessions]

[describe results questionnaire for participant]

Introduction

What did you learn during the GMB project?

What did you find striking during the GMB project?

Part 1: perception of control

These questions are about your perception of control. By this, we mean the extent to which you feel that improving your well-being is up to you, in other words, within your control.

9. *PC* - How much control do you experience in improving your well-being at the moment and why?
10. *Change PC* - Do you feel that your perception of control, whether or not it is up to you to improve your well-being, has changed during the GMB project?
    10.1. If so,
        10.1.1. In what way has this changed?
        10.1.2. What makes you think it has changed?
        10.1.3. during or between which session(s) did this change take place? From what then?
    10.2. If not, why do you think this has not changed?

<u>Part 2: Perceived Self-Efficacy</u>

These questions are about self-efficacy. Self-efficacy is the belief or confidence you have in your ability to improve your well-being.

11. *PSE* - How much self-effectiveness, i.e. being able to improve your well-being, are you experiencing at the moment?
12. *Change PSE* - Do you feel that your perception of self-efficacy, i.e. to what extent you are able to improve your well-being, has changed during the GMB project?
    12.1. If so,
        12.1.1. In what way has this changed?
        12.1.2. What makes you think it has changed?
        12.1.3. during or between which session(s) did this change take place? From what then?
    12.2. If not, why do you think this has not changed?

<u>Part 3: GMB mechanisms</u>

13. *Knowledge of action points before* - How was your knowledge of concrete action points to improve your well-being before the GMB project?
14. *Knowledge of action points change* - Do you think this has changed during the GMB project and if so,
    14.1. In what way has this changed?
    14.2. What do you think changed this?
    14.3. During or between which session(s) did this change take place? From what then?

15. *Complexity before* - How did you experience the complexity of improving your well-being before the GMB project?
16. *Complexity change* - Do you think this has changed during the GMB project and if so,
    16.1. In what way has this changed?
    16.2. What do you think changed this?
    16.3. During or between which session(s) did this change take place? From what then?

These were all my questions. Do you have anything else you want to say to evaluate this project? This can be anything.

Appendix E – Interview Codings

E1 Codebook Study 1

Table E1

Codebook used in Coding Interviews Study 1

Code Category	Code(s) and Definition(s)
Actions	**Action points before** = one's knowledge of action points to improve or foster the behaviour that is the central topic of the GMB intervention, before the start of the GMB intervention **Action points during project** = one's knowledge of action points to improve or foster the behaviour that is the central topic of the GMG intervention, that is developed during the timespan of the GMB intervention
Communication	**Discussions** = conversations between participants during a GMB intervention discussing ideas, opinions, variables, etc. **New conversations** = conversations with new people one previously had no conversations with before the GMB intervention and/or new topics of conversations that one did not talk about with people before the GMB intervention **Democracy of GMB intervention**= the design of a GMB intervention that ensures equal contribution and speaking time for participants
Complexity	**Complexity before** = one's perceived complexity concerning the central topic of the intervention before the start of the GMB intervention **Complexity during project** = one's perceived complexity concerning the central topic of the intervention and/or the GMB intervention in general, during the timespan of the GMB intervention
Dynamics	**Session 1** = events happening in session 1 and/or how these events affected one, especially in their PC and PSE **Session 2** = events happening in session 2 and/or how these events affected one, especially in their PC and PSE
Output GMB intervention	**Changed perspective or awareness** = a change in one's perspective or awareness across the time span of the GMB intervention, related to the behaviour that is the central topic of the intervention **Motivation to change** = new energy and/or encouragement for new initiatives, to improve the problematic situation that is the central topic of the intervention, as a result of the GMB intervention **Useful from GMB intervention** = other insights and positive outcomes than a changed perspective or awareness that one sees as the result of the GMB intervention
PC	**PC** = Perceived Control regarding the behaviour that is the central topic of the intervention **Change PC** = change in one's Perceived Control across the time span of the GMB intervention, regarding the behaviour that is the central topic of the intervention
PSE	**PSE** = Perceived Self Efficacy regarding the behaviour that is the central topic of the intervention

	Change PSE = change in one's Perceived Self Efficacy across the timespan of the GMB intervention, regarding the behaviour that is the central topic of the intervention
Use of model	**Model** = the CLD that is developed during the GMB intervention
Position	**Position related influence** = the degree of influence one has over the central topic of the intervention, that is the result of one's position and/or job description in the organisation

E2 Codebook Study 2

Table E2

Codebook used in Coding Interviews Study 2

Code category	Code(s) and definition(s)
Actions	**Action points before** = one's knowledge of action points to improve or foster the behaviour that is the central topic of the GMB intervention, before the start of the GMB intervention **Action points during project** = one's knowledge of action points to improve or foster the behaviour that is the central topic of the GMG intervention, that is developed during the timespan of the GMB intervention **Doing yourself** = highlighting one's own influence and control in improving or fostering the behaviour that is the central topic of the GMB intervention
Communication	**Discussions** = conversations between participants during a GMB intervention discussing ideas, opinions, variables, etc. **Facilitation** = the process of facilitating discussions between participants during the GMB intervention **Individual differences and similarities** = insights into individual differences and similarities between participants, gained during the GMB intervention **New conversations** = conversations with new people one previously had no conversations with before the GMB intervention and/or new topics of conversations that one did not talk about with people before the GMB intervention
Complexity	**Complexity before** = one's perceived complexity concerning the central topic of the intervention before the start of the GMB intervention **Complexity during project** = one's perceived complexity concerning the central topic of the intervention and/or the GMB intervention in general, during the timespan of the GMB intervention
Dynamics	**Session 1** = events happening in session 1 and/or how these events affected one, especially in their PC and PSE **Session 2** = events happening in session 2 and/or how these events affected one, especially in their PC and PSE **Session 3** = events happening in session 3 and/or how these events affected one, especially in their PC and PSE
Factors influencing well-being	**External forces** = forces beyond one's control that influence one's well-being **Financial resources** = one's available financial resources that influence one's well-being **Positive mindset** = one's positive mindset that influences one's well-being

	Walking and exercising = walking and exercising or doing sports, that positively influences one's well-being **Work/life balance** = one's work/life balance that influences one's well-being
Output GMB intervention	**Changed perspective or awareness** = a change in one's perspective or awareness across the timespan of the GMB intervention, related to the behaviour that is the central topic of the intervention **Useful from GMB intervention** = other insights and positive outcomes than a changed perspective or awareness that one sees as the result of the GMB intervention
PC	**PC** = Perceived Control regarding the behaviour that is the central topic of the intervention **Change PC** = change in one's Perceived Control across the timespan of the GMB intervention, regarding the behaviour that is the central topic of the intervention
PSE	**PSE** = Perceived Self Efficacy regarding the behaviour that is the central topic of the intervention **Change PSE** = change in one's Perceived Self Efficacy across the timespan of the GMB intervention, regarding the behaviour that is the central topic of the intervention
Use of model	**Model** = the CLD that is developed during the GMB intervention
Writing	**Writing** = writing concepts, variables and ideas down on post-its during various tasks in a GMB intervention

Appendix F – Interview Results

F1 Matrixes Interview Results Study 1

Table F1

Interview Results Study 1

Participant number:	**Participant 2**	**Participant 3**
Date:	Thursday, June 6, 2024	Tuesday, June 4, 2024
Time:	9:00 AM – 9:20 AM	10:30 AM – 11:00 AM
Location:	Online via Microsoft Teams	Radiology Department RadboudUMC
What stood out	Equal input by members due to democratic nature of the project.	Remarkable and nice that (1) in such a short time, you can build such a big model, (2) people were very one minded / unanimously, (3) hearing different perspectives from AIOS (doctors in learning). Also remarkable that it is difficult to keep such things in one's agenda after scheduling it. Suggests a less formal invitation that stresses the value for the team.
Learning	Insight into new things. Because you build the model piece by piece, you get an overall structure that you yourself would not have come up with easily. Interesting way to approach problems. Many factors were obvious and familiar, but to get the whole picture these are also necessary.	-
PC - general	Limited control. (1) limited by function (AIOS, doctor in learning), but as you gain more experience you get more inclined to actively contribute. (2) many people involved, not easy to change things (protocols, etc.)	(1) no influence on patient inflow due to function, but (2) from the model..(see below)
Change PC – what	Project showed (1) factors you indeed have no control on, but (2) also created awareness of the added value of the MR-Linac and that we can do more with it than currently is done, so it created motivation or energy for change / to work on things.	Yes. More influence than previously thought, you can still direct others to work on the issues or focus on communication that was identified as factor. Normally more focus on direct influence, now insight into indirect influences to help the department.
Change PC – why	-	Model helped to bring things maybe already familiar, under attention again. Model helps as visual tool, but the discussions building the model are key. Agreement there helps to get back control together.

Change PC – when	Only present in first session.	Both sessions were necessary to come to the insights. Session 1: feeling of powerlessness due to growing model, session 2: by looking into impact / attainability, still taking away some concrete actions you can do yourself.
PSE – general	Yes – knowledge of indications, the added value, when to implement by which patients No – developing protocols, the technical side	On one hand (1) having the analytical view to understand the model and what you can't influence, on the other hand (2) the result of communication as factor is something he/she can't influence oneself due to function. But for his/her own part, he/she feels confident.
Change PSE – what	No	No change. Change of knowledge of factors you have influence on yourself, but no change in one's perception of own abilities.
Change PSE - why	-	-
Change PSE - when	-	-
Knowledge of concrete action points - before	Limited.	Before stuck in an circle about referrals and new indications, knowing they had to do something with it but not knowing what.
Knowledge of concrete action points during	Not really a change – some variables were already focus point of interviewee 2 and others simply can't be influenced. But it did create more awareness of the added value of the MR-Linac and energy to go and try things again. This is caused mostly by the discussions with others who are also interested in the topic and want the best concerning the use of the MR-Linac.	Now more concrete points and also new points, such as communication as target factor. Now new insights and new energy to go back to work again. Works as a motivator.
Complexity - before	Fairly complex, at least the part of new protocols. But indications and patient categories not so complex. The fact that many factors are interrelated and you have limited influence, makes the topic less complex, because there are many actions you can eliminate since you don't have the necessary influence on it, such as patient referrals.	Yes, very complex. You can pull strings but you are not sure whether the outcome is the desired outcome.
Complexity during	More clear because it helps to structure thoughts. When zooming in into the	More complex due to seeing such a big model with many variables where you

	model it can become chaotic, but zooming out and seeing overarching topics and themes makes it more clear, also because a part is just information that you can't influence but needs to be in the model for completeness.	maybe should do something with. But with concrete actions you focus again on specific parts of the model. Submodel is less complex. Due to previous trial and error of what works and what doesn't, it was easy to see places in the model that you can influence.

F2 Matrixes Interview Results Study 2

Table F2

Interview Results Study 2

Participant number:	**Participant 2**	**Participant 6**	**Participant 7**
Date: Time: Location:	Wednesday, May 29, 2024 2:00 PM to 2:30 PM Online via Microsoft Teams	Wednesday, May 29, 2024 10:00 AM to 10:30 AM Online via Microsoft Teams	Monday, June 3, 2024 4:30 PM–5:00 PM Online via Microsoft Teams
What stood out	Positive experience. Nice to talk about it with colleagues you don't see or speak often. Remarkable that if one started talking, others would follow.	Useful to talk about the topic with others and nice to hear differences and similarities between colleagues and what they are up to regarding their well-being.	Interesting to see what colleagues are dealing with that you don't see often. Interesting to see similarities / differences.
Learning	Learning about topics, how people view these. Also insightful since not everybody had same function.		Eyeopener that despite it often doesn't feel like it, you in fact have quite much free time to do things you like.
PC - general	Average PC, due to (1) no control on government and related current issues, but (2) you do have control on your own job satisfaction. So it is 50/50.	Good. He/she has resources to do what they want – money , nice working hours (36 hrs per week). You have control over well-being: choosing to watch TV or go outside.	Good. You have control over your well-being, due to (1) positive mindset (seeing the positive side of everything), (2) own choices in what you do and how much you do.
Change PC – what	Yes. Sparring together, especially about job satisfaction, gives new insights of what you can do yourself to improve job satisfaction and thus well-being.	Maybe a little. More own control than previously thought.	No change. More awareness what he/she is doing right now: what do you do, why do you do it, what influence does that have on you? Do you do you this for yourself, or for someone else?

Change PC – why	Sparring with others.	Linking variables created awareness: stress influences your job, but also your private life.	Putting it on the table and discussing with others how they feel about it / view it. Getting a new perspective by them.
Change PC – when	Absent during session 2. Change started in session 1, seeing topics of others that you can often influence yourself.	After session 2 it became vivid. Session 2 was also an intense and tiring session.	Absent during session 1. Awareness started already in session 2, but became more concrete in session 3.
PSE – general	Good – confident in having the necessary resources to improve well-being: good work/life balance, money is necessary but not fully necessary for happiness.	(Not explicitly mentioned how much, but implicitly: Good). He/she has financial resources to do nice things, due to sharing a house and costs with a partner and having 2 incomes.	Good. Having the resources: own house, own income.
Change PSE – what	No change, more awareness of own influence. Scheduling agenda differently for exampling, being home earlier and focusing on output instead of hours.	No change, but the way you think about it has changed. Awareness that walking, wat he/she already did often, is a way to de-stress and contributes to well-being. Participant 6 appreciates things such as walking, more now.	Awareness/realisation that he/she is often putting others first instead of oneself.
Change PSE - why	-	Model: linking variables and realising that it all plays into each other.	-
Change PSE - when	Session 3 talking about work/life balance with other participants.	-	-
Knowledge of concrete action points - before	Average, but not specifically with well-being in mind but more with sustainable employability, for which the company also made some changes to improve this.	Good, he/she already had solutions ready before the project, already thought about it once what would be nice.	Good. Already had ideas about what would be better for your well-being. Ideas such as doing more for a family member or sporting more often. Before more insight into own well-being.
Knowledge of concrete action points during	Especially during session 3. Awareness that he/she needs to stand up for himself more, focusing on output instead of exact working hours.	Hearing struggles of others thinking along how they could deal with it. But it was not that the ideas were all new.	Now more insight into it, due to writing it down and discussing it. Realisation that he/she is doing enough already, but that he/she is

	Also in session 3 valuable output for company, of which he/she thinks the company can act upon.	He/she did not think about new solutions. In session 3: making ideas / actions more concrete. No new ideas, but they have become more concrete and formulated.	doing more things for others than for oneself. The actions discussed in session 3 caused a different way of thinking. He/she is motivated to try them out and see what works and what doesn't. After project more insight into collective well-being, well-being related to work.
Complexity - before	Not complex, more not really involved with it. Also not realizing he/she has influence him/herself on well-being.	Not complex. Just a matter of doing things: get up, get active, go sporting, etc.	Not complex.
Complexity during	Group makes topic more complex, because together you have far more topics than alone. But for yourself, you scale it down since there are only a few factors really relevant for your own well-being. During all discussions, the topic was always kept in eye, so there was rom for discussion but everyone was also redirected to the topic. This kept complexity low / handable.	In the beginning the model was quite vague, but as the model become more filled and time progressed it became clearer. When the workbook was sent after session 1, were the model was presented clearer, it started to become more clear/less complex. In session 3, stuck in the same patterns. He/she suggests a change of location next time or starting blanco again.	No change in complexity. Tries to keep it simple and not overthink it. Model was well understandable, only needed to catchup after missing the first session but this was very doable.

Note. Interview durations varied between 20 – 30 minutes.

Appendix G – Models Based on Interviews

G1 Study 1 – Models per Participant

Figure G1.1.

Model Based on Interview with Participant 2 from Study 1, Based on his/her Experiences

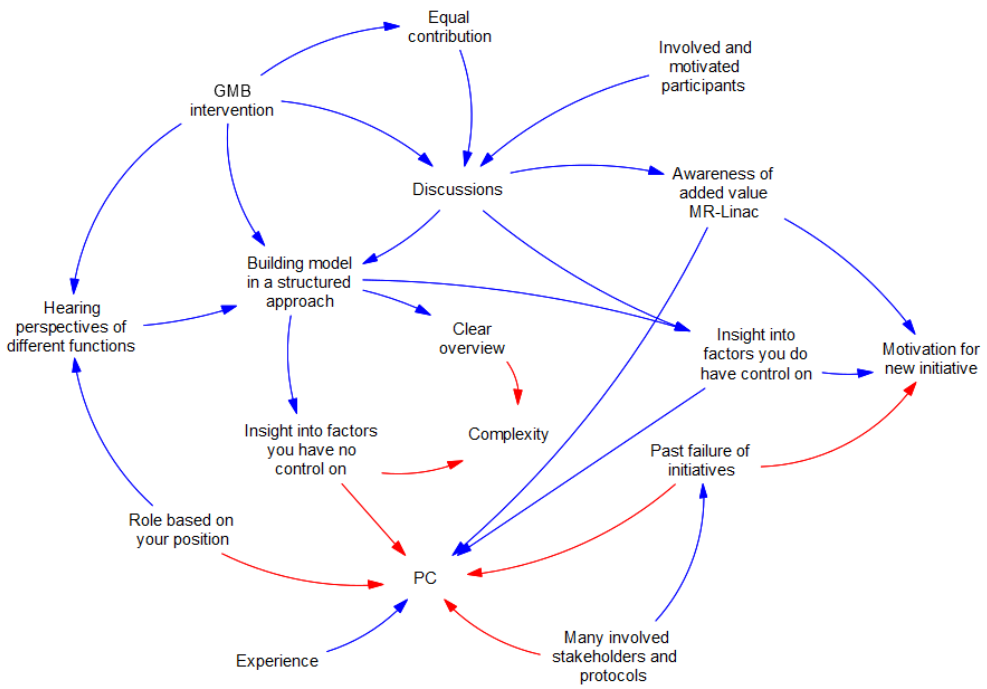
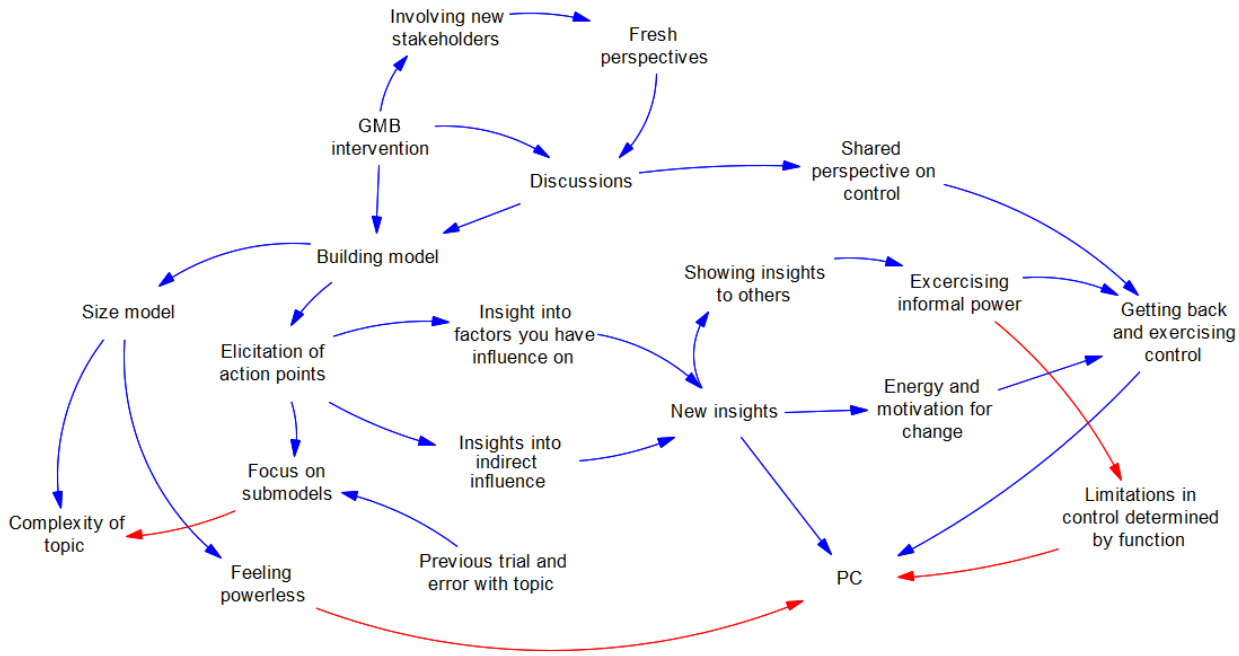


Figure G1.2.

Model Based on Interview with Participant 3 from Study 1, Based on his/her Experiences



G2 Study 1 – Integrated Model Interviews

Figure G2

Integrated Model Based on all Interviews from Study 1

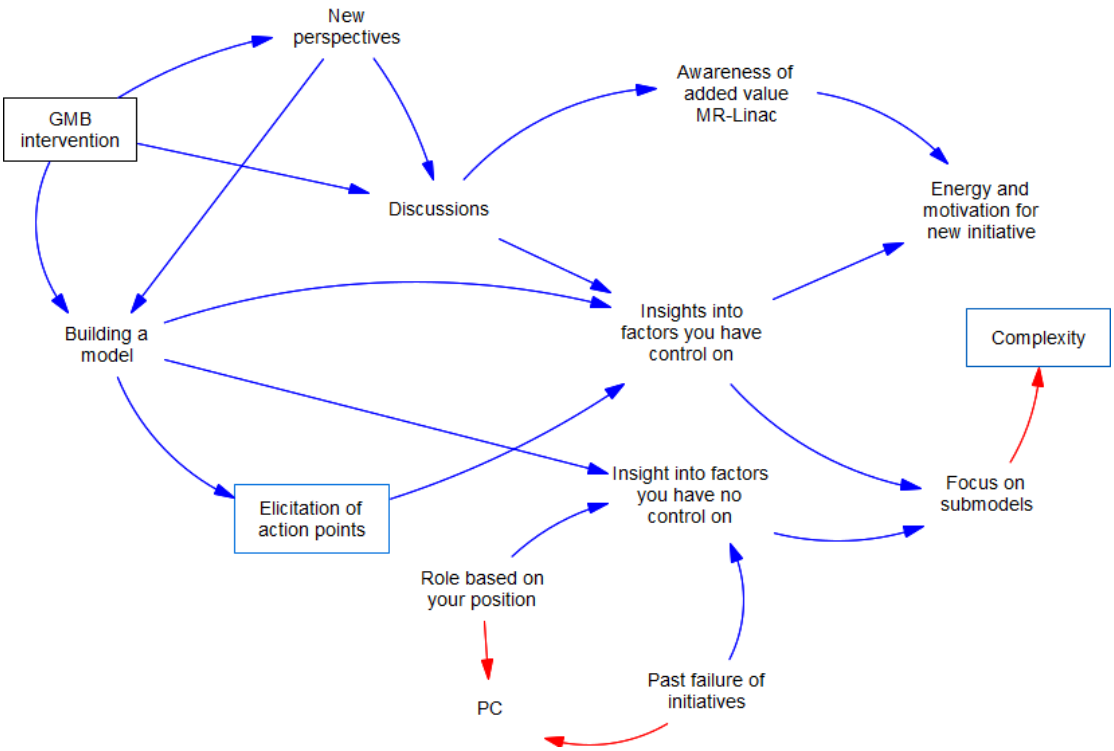


Table G2 2

Argumentation for Figure G2 Based on Interviews from Study 1

Relation	Argumentation
GMB intervention -> discussions -> insights into factors you have control in GMB intervention -> building a model -> insights into factors you have control in	Interviewee 2 mentioned that he/she noticed that by discussing it with others, he/she saw that there are some factors they do have influence on. Interviewee 3 said that the model helped to realise he/she had more influence than previously thought.
GMB intervention -> discussions -> insights into factors you have control on -> energy and motivation for new initiative	Interviewee 2 mentioned that the result is very practical because the question is very practically oriented. Although interviewee 2 did not explicitly mention insights you have control on influencing energy and motivation for new initiative, this might be because interviewee 2 was only present during session 1. Since the relation included is in line and not contradictory to things said by interviewee 2 in the interview, this relation is deemed valid.

	Interviewee 3 said that especially the discussions and conversations they had to come to the model helped in gain insight into factors you have control on. Participant 3 also mentioned that these new insights give new energy to get working on the topic again.
GMB intervention -> discussions -> awareness of added value MR-Linac	Interviewee 2 mentions that discussions with people similarly interested in the MR-Linac technology helped to create awareness of the added value of the MR-Linac and that the technology is something you want to move forward with. Interviewee 3 did not specifically mention more awareness of the added value, but did sound very enthusiastic about working on the topic again: taking the insights to colleagues to make changes and further implement the MR-Linac, making it reasonable to assume that this relation holds for interviewee 3 too.
Awareness of added value MR -Linac -> energy and motivation for new initiatives	Interviewee 2 mentioned that the project created awareness of the added-value of the technology and that he/she noticed that everybody was motivated to optimally implement the technology. For interviewee 3, see the same argumentation as given by 'GMB intervention -> discussions -> awareness of added value MR-Linac' given in one cell above.
GMB intervention -> new perspectives -> discussions GMB intervention -> new perspectives -> building a model	Interviewee 2 mentioned that people had different contributions based on their role and position in the department, focusing on different aspects probably because they set different priorities based on their role. Interviewee 3 mentioned liking the fresh perspective of AIOS (doctor's in training) which are normally not involved in such activities due their busy schedule.
Building a model -> insight into factors you have no control on	Interviewee 2 mentioned that session 1 showed that there also many factors you have no control on. Interviewee 3 mentioned already knowing some factors were they had prove to have not much control on, but it is reasonable to assume that building the model helped identifying these again, since interviewee 3 also pointed out that looking to actions was relatively simple because he/she could skip the part of the model were they did not have influence on.
Building a model -> elicitation of action points -> insights into factors you have control on	*Interviewee 2 was not present during session 2 were action points were elicitated.* Interviewee 3 said that they now have more concrete action points and new action points.
Insight into factors you have no control on ->	When asked about complexity, interviewee 2 mentioned that zooming out you can see certain overarching themes and that on certain factors you

focus on submodels -> (-) complexity	simply have no influence, making it a given. *We implicitly read here that the latter reduces complexity because it brings focus.*
Insight into factors you have control on -> focus on submodels -> (-) complexity	Interviewee 3 mentioned that the concrete action points helped to focus on part of the model with which you think you can do something and that such submodels were less complex.
Role based on your position -> (-) PC	Interviewee 2 mentioned that his/her control is limited because of his/her position in the department. Interviewee 3 mentioned that there are parts in the process of implementing the MR-Linac where he/she does not have influence on because of her position/job.
Role based on your position -> insight into factors you have no control on	Interviewee 2 mentions not being in the position to change certain factors, such as referral patterns or patient inflow and that he/she already knew this before the project. Interviewee 3 mentioned that looking at the patient inflow, he/she does not have control because of his/her position/job.
Past failure of initiatives -> (-) PC	In the context of perceived control, interviewee 2 mentioned that a previous attempt by him/her to implement the MR-Linac on a new target group failed because of resistance by others since it was not in line with protocols. interviewee 2 says that thus his control is relatively limited. Interviewee 3 said that with department they have experience with factors that turned out to be not much under their influence. *We implicitly assume here that this lowers their PC.*
Past failure of initiatives -> Insight into factors you have no control on -> focus on submodels	Although interviewee 2 does not mention this relationship explicitly, it does not contradict what participant 2 said in the interview. Since it was explicitly mentioned by interviewee 3, saying that previous experiences of things that have been tried and did not work (factors they turned out to have not much control on), make it easier to focus on submodels in the model that are new and not yet explored/tried.

G3 Study 2 – Models per Participant

Figure G3.1.

Model Based on Interview with Participant 2 from Study 2, Based on his/her Experiences

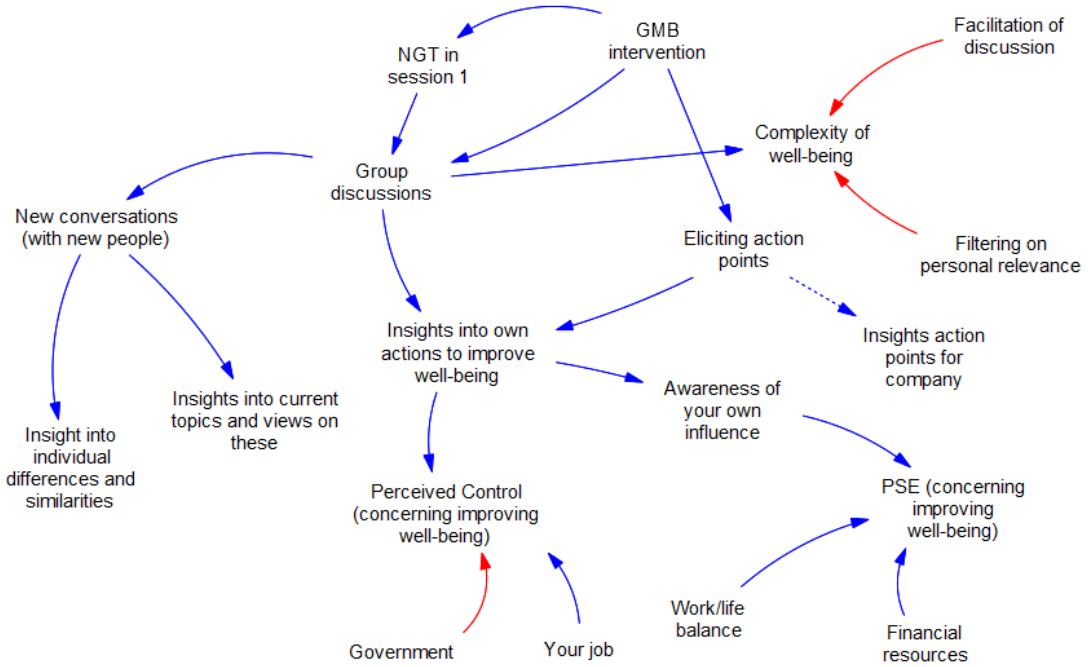


Figure G3.2.

Model Based on Interview with Participant 6 from Study 2, Based on his/her Experiences

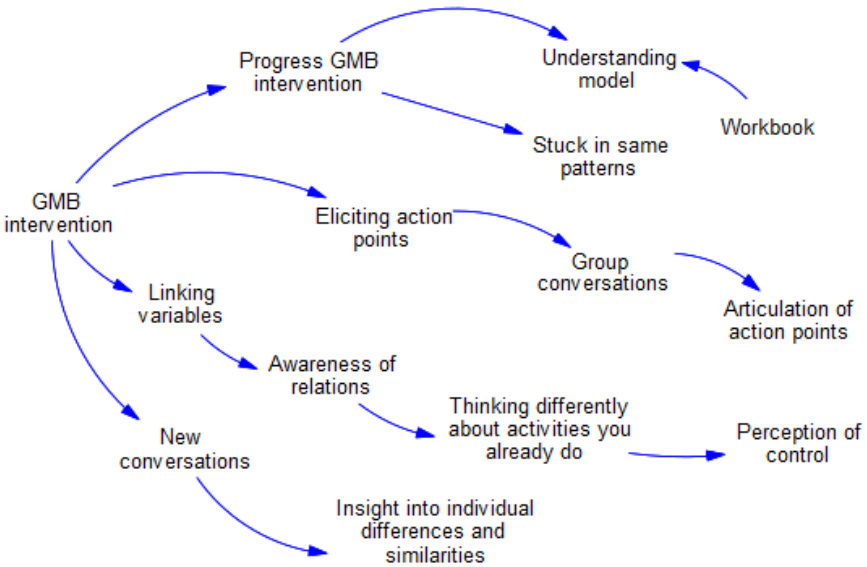
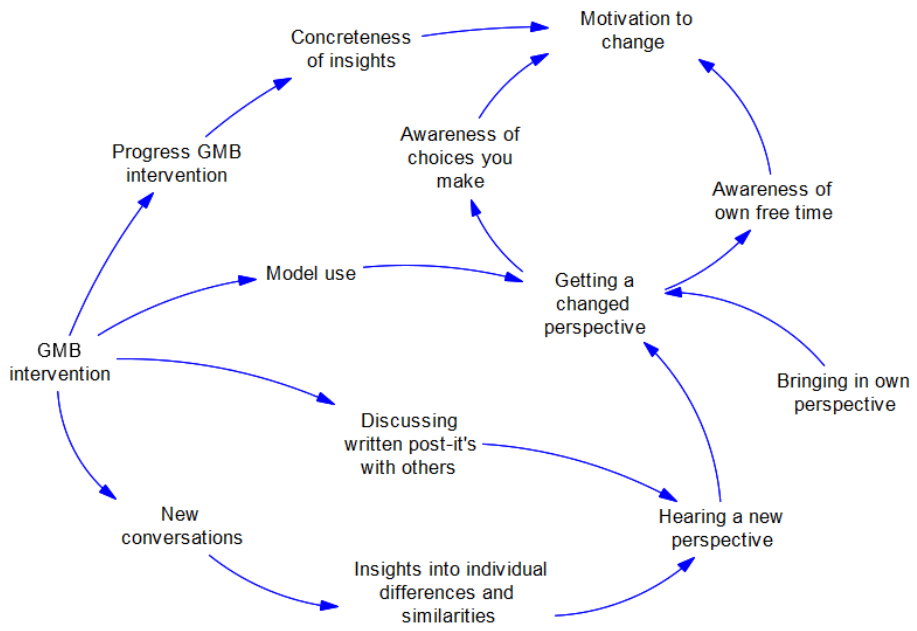


Figure G3.3

Model Based on Interview with Participant 7 from Study 2, Based on his/her Experiences



G4 Study 2 – Integrated Model Interviews

Figure G4

Integrated Model Based on all Interviews from Study 2

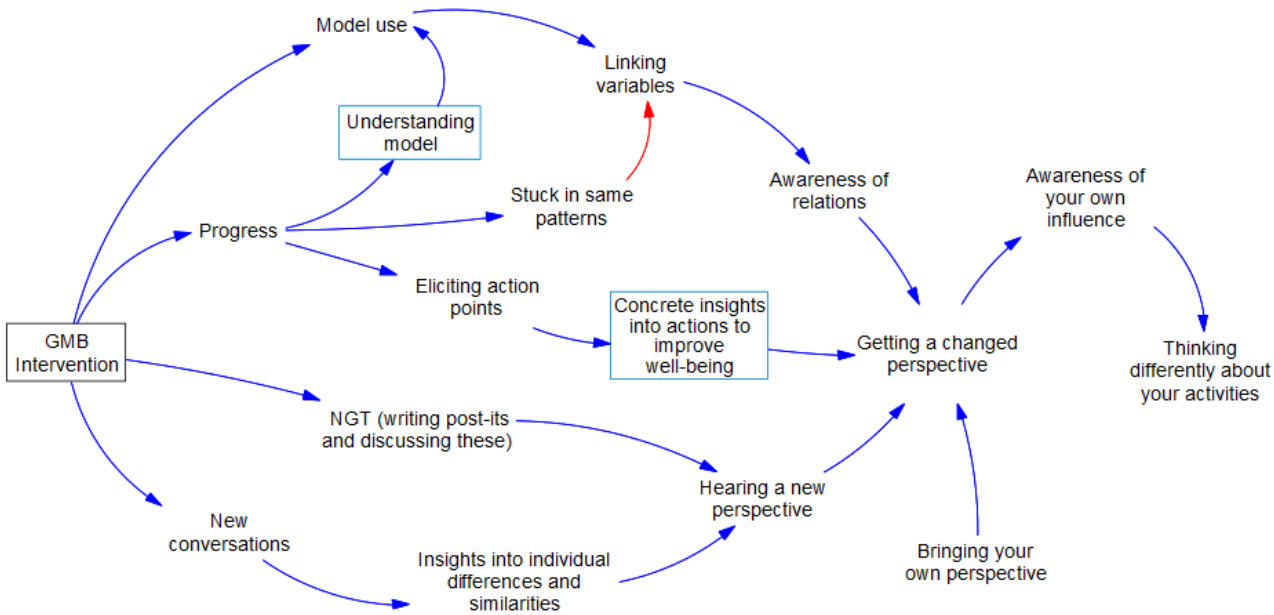


Table G4

Argumentation for Figure G4 Based on Interviews from Study 2

Relation	Argumentation
GMB intervention -> new conversations -> insights into individual differences and similarities	All three interviewees experienced talking to colleagues normally not talking to, and talking about a topic (well-being) they normally don't talk about with each other, as insightful since they get to know similarities and differences between each other. These differences and similarities relate to how people experience their well-being, but also what they are up to (searching a house, for example) and what their view is on certain topics related to society and their workplace.
GMB intervention -> NGT (writing post-its and discussing these) -> hearing a new perspective	Interviewee 2 mentioned group discussions gave insights, already starting in the first session discussing post-its of each other. Interviewee 7 mentioned that the writing of ideas and concepts and then discussing them, especially helped to get the topic out of your head into the open and to gain new insights. Interviewee 6 mentioned group discussions shortly in the context of eliciting action points, in that talking about it in the group and exchanging ideas gives more insights.
Hearing a new perspective -> getting a changed perspective	All interviewees expressed exchanging experiences, ideas and views with colleagues about well-being was interesting, all of them in the beginning of the interview when asking what stood out to them and/or how they had experienced the GMB intervention. Interviewee 7 especially mentioned that hearing the perspective of others, changes your own way of thinking. The other participants did not explicitly mentioned this, but since it was also not contradicted and can be assumed to be true for them too considering the fact that all of them mentioned it in the beginning of the interview as interesting, this relation is included in the model.
Bringing your own perspective -> getting a changed perspective	Interviewee 2 mentioned that although the topic is big in size of many factors, for oneself you downsize it based on a few number of factors that have really direct influence on your own well-being. In this, one can also read the influence of an own mental frame one has before the GMB intervention, that one brings into the GMB intervention. Interviewee 7 mentioned bringing own ideas and visions of how things worked into the GMB intervention, which then changed based on conversations. Interviewee 6 mentioned bringing one's own perspective indirectly, in the sense of previously not thinking about the value walking or exercising for one's well-being directly, but now being more aware of this.
GMB intervention -> model use -> linking variables ->	Interviewee 2 acknowledges the model created insights but did not put focus on this during the interview, possibly because this interviewee was not present during the second session.

awareness of relations -> getting a changed perspective	Interviewee 6 mentioned that linking variables created awareness of relations between concepts which created a new perspective. Interviewee 7 mentioned that the model created insight into how people think and that some parts were more complex or easier than expected.
GMB intervention -> progress -> understanding the model	Interviewee 2 did not mention anything in particular concerning understanding the model. Interviewee 6 mentioned experiencing the start of the model as vague, but when going to fill it in, it becomes more vivid and clear. Interviewee 7 missed the first session so experienced a little struggle in comprehending the model at start, but also mentioned this quickly improved and that the model was not that difficult to understand.
GMB intervention -> Progress -> stuck in the same patterns -> linking variables	Interviewee 2 was not present during the second session, but did feel that the group was quite done with the model in the third session. Interviewee 6 mentioned in the second session they were quite stuck in the same patterns and did not know what to change / link anymore. A change of scenery (going outside) or starting over again with a brainstorm could have helped according to interviewee 6. Interviewee 7 did not mention being stuck halfway, but this can be explained by the fact that this interviewee missed the first session, so this person experienced everything as new in the second session.
GMB intervention -> progress -> eliciting action points -> concrete insights into actions to improve well-being	Interviewee 2 experienced the third session as giving input that could have real value for the company and also as giving insight into having more influence than previously expected. Interviewee 6 mentioned that talking about ideas in the actions in the third session helped to make thoughts more concrete and formulated. Interviewee 7 expressed that insights became concrete in the third session.
Concrete insights into actions to improve well-being -> getting a changed perspective	The researcher assumes, given from the overall interpretation of the 3 interviews, that having concrete insights into actions to improve well-being, contributes to getting a changed perspective. Several times it was mentioned that ideas started to get more shape and concreteness in the final session, contributing to the overall insights learned from the session. This was most clear for interviewee 7 for example mentioned this concreteness helped to think what he/she did not want to do anymore.
Getting a changed perspective -> awareness of your own influence -> thinking differently about your activities	Interviewee 2 mentioned being more aware of one's own influence on one's well-being, such as scheduling your own agenda differently, for example. Interviewee 6 mentioned two times in the interview that you can decide to sit at home and watch TV, or do sports and that the latter is much better for one's well-being. The realisation that activities interviewee 6 already did, such as sporting or walking, can actively contribute to one's well-being, can be implicitly assumed to go through one's realization of one's own influence.

	Interviewee 7 mentioned being more aware of choices you make yourself concerning how to use your free time and where to spent your money on, causing interviewee 7 to rethink choices he/she makes in these activities.