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CUSTOMER BEHAVIOUR CHANGE THROUGH GAMIFICATION:

GOAL FRAMING AND TEMPORAL EFFECTS

By Jacqueline Nortje

Student number 1476012

A thesis submitted to the Faculty of Commerce Law and Management,
University of the Witwatersrand,
Johannesburg,
in fulfilment of the Degree of Doctor of Philosophy

Abstract

Gamification is a widely used design strategy deployed across a range of contexts to encourage individuals to participate in key behaviours. Gamification deploys a range of mechanics typically associated with games to leverage underlying behavioural dynamics. A frequently used game mechanic is the use of goal setting, where these goals are either explicit aspects of the game or implicit through other game mechanics. Despite the widespread use, and continuous growth, of gamification there are aspects that are poorly researched or insufficiently grounded in theory. This thesis investigates two such aspects of gamification: the use of goal setting and the use of gamification over extended periods of time.

The thesis aims to answer the research question: Does framing impact the success of goal setting in gamification design, and what is the long-term effect of such a gamification design on behaviour change and performance? This thesis consists of four related papers that addresses this question.

According to goal setting theory, goals that are specific and challenging, while still being achievable, are more successful at driving positive outcomes compared to easy goals (i.e., where the goal is easily attained with little or no additional effort) or no goals at all. Furthermore, goal setting theory describes four moderators that impact how successful a goal may be, namely, ability, task complexity, goal commitment and feedback. Focusing on ability (measured as self-efficacy) and task complexity (measured as motivation), research typically describes two types of goal framing approaches and when each would be most appropriate. In this context, "framing" refers to how the goal is positioned or worded and on the focus are of the underlying goal. Performance framing is most appropriate when self-efficacy is high, or task complexity is low. Learning framing is most appropriate when task complexity is high, or self-efficacy is low. Despite the distinction between performance framing and learning framing within goal setting, performance framing tends to be the predominant choice in practice, even when there are indications that a learning-framed approach would be more suitable. Furthermore, little research exists on the appropriate framing approach when considering the interaction between the moderators.

Paper 1 presents a literature review of goal setting theory and introduces an alternative model for improved goal framing within a gamification design framework that formalises the recommended framing approach based on an individual's underlying psychological states. The model also introduces a novel hybrid approach to goal framing to accommodate scenarios where an individual has higher levels of self-efficacy with lower levels of motivation, and vice versa.

Paper 2 presents a quasi-experimental field experiment that tests the various framing approaches based on an individual's self-efficacy and motivation at the onset of the experiment. The experimental case site was Vitality Active Rewards, a gamification platform that is part of Discovery Vitality, a wellness program in South Africa. The targeted behaviour in this study is physical activity as measured through the gamification platform. The researcher grouped study participants based on their self-efficacy and motivation using

latent profile analysis and deployed a difference-in-differences analysis to assess the effects of the framing conditions within each group. Notably, each framing condition was successful at improving physical activity in at least one group and the researcher was able to refine the proposed optimal framing following the results of the field experiment.

When considering the broader gamification design framework, despite the prevalence of gamification as a design strategy, little research or documentation of the long-term effects is available. Studies tend to be over shorter periods and there is some scepticism about whether gamification can be used in the long-term or if results are purely due to the novelty of the initial design. Furthermore, gamification design is seldom grounded in theory, leading to a somewhat fragmented view of the field.

Paper 3 presents a literature review of gamification design and expands on the model introduced during the goal setting portion of the study to consider various scenarios with the intent of better understanding the effects of time on the efficacy of gamification design. The researcher provides a recommendation for the optimal approach to ensuring that a gamification platform may have longer lasting effects on the targeted behaviour.

Finally, Paper 4, presents a mixed methods case study that evaluates the key propositions from the model against the Vitality Active Rewards gamification platform. Vitality Active Rewards has been live since September 2015 and underwent two major updates since its deployment. The platform presents a rich source of secondary data as well as the opportunity to conduct qualitative research in a novel population represented by financial advisors. The research highlights the initial positive effects of gamification on a target variable followed by the inevitable decline over time once the novelty of the intervention wears off. Furthermore, the study investigates the effects of making changes to a gamification platform over time and provides a recommendation for practitioners on how to approach these changes in a way that will ensure the longevity of the platform.

The thesis makes several key contributions to both fields of gamification design and goal setting theory. Firstly, it enhances the use of goal setting theory within a gamification context through an alternative framing methodology. Additionally, the thesis delivers theoretical insights, elucidating the long-term impact of gamification on behaviour change and performance. The study provides a methodological contribution to gamification design by presenting an alternative implementation of gamification design strategies to ensure efficacy over time. Furthermore, the research contributes empirically by providing an understanding of the lasting effects of gamification on behaviour change and performance by examining an existing intervention that has been successful over an extensive period.

Keywords: Gamification; Temporal effects; Goal setting theory; Goal framing; Behaviour change

Declaration

I, Jacqueline Nortje, declare that work submitted is my own, except for work which has formed part of jointly authored publications in which case the work includes input from co-authors.

It is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in 2024 at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination in this or any other university.

In the case of statistical findings, I have sought various help and input including guidance and advice from my supervisor.

Jacqueline Nortje

Johannesburg

February 2024

Ethical consideration

This research is conducted in compliance with the code of research conduct as required by the University of the Witwatersrand.

Permission has been provided by Discovery Vitality to both conduct the study and make use of the data (see Appendix A).

Ethical approval for the study was obtained from the Human Research Ethics Committee (non-medical) of the University of the Witwatersrand, clearance certificate number H20/10/21 (see Appendix B).

Dedication

This thesis is dedicated to my daughter, Maeve, and my husband, Chris.

Maeve, while the journey started well before your birth, you were one of the driving forces behind me finishing. I hope you see this as a testament that you can do whatever you set your sights on achieving.

Chris, thank you for your support throughout this journey. Without you, none of this would have been possible. I appreciate that you picked up a lot of the slack while I pursued this dream.

I love you both.

Acknowledgements

As much as it is said that it takes a village to raise a child, the same can be said for this thesis. I am grateful to all the people who helped and encouraged me on this journey.

- I would like to start by thanking my supervisor, Prof. Greg Lee. I learned so much from this experience and his input was invaluable. There were times during the process that were difficult, particularly as it took time for the study to divulge its secrets during the analysis phase. His support and guidance pointed me in the right direction and the findings were that much sweeter thanks to the hard work that went behind it.

- I don't think Dr Karen Johnson realises what an impact she has made in my life. If it wasn't for her advice and positive nudging, I might not have embarked on this journey. Thanks to her I met Prof. Lee and, as they say, the rest is history.

- I thank my employer Discovery Vitality for allowing me to conduct the study and to access the data that I needed.

- I am forever grateful to my managers, Chris Jones, and Irene van Zyl. They gave me the freedom and time to pursue my studies and were understanding throughout the journey.

- The Vitality Marketing team, specifically Anna Stroud, played an instrumental role in the field experiment. I am grateful for their time and expertise during the study.

- To all my colleagues and friends who were always happy to hear my talk through my research and who gave me encouragement throughout the journey – thank you. The kind words and encouragement are hugely appreciated.

- Thank you to Andrew Leighton for his advice and support during the qualitative study.

- To my family, without you this would have been infinitely more challenging. Thanks goes to my parents, Jacques and Charlene de Greef for the support and believing in me (even if the thesis is "not available in normal English"). To my husband, Chris, thank you for keeping our household in one piece and keeping our toddler occupied for many long hours. I would be remiss not to thank my canine companions, Milly and Enzo, who made sure I was never alone during the process.

- I thank God for giving me the strength to persevere to the end.

I am so grateful for this journey.

Academic outputs from this research

- Textbook chapter contribution:
  Nortje, J., Lee, G. (2022). A theory of the temporal unfolding of gamification. In Lee, G., & Dagada, R. (Eds.), *Research in Southern African Digital Business Vol I* (pp. 147-177). Silk Route Press.

- Textbook chapter contribution:
  Armstrong, B., & Lee, G. (2023). Gamification. In *Digital Business Vol III: Digital Transformation & Maturity* (pp. 581-599). Silk Route Press.

Table of Contents

Abstract ..... **i**
Declaration ..... **iii**
Ethical consideration ..... **iv**
Dedication ..... **v**
Acknowledgements ..... **vi**
Academic outputs from this research ..... **vii**
Table of Contents ..... **viii**
List of Tables ..... **xi**
List of Figures ..... **xii**
Introduction **1**
I Research problem *1*
II Purpose of the study *3*
III Context of the study *4*
IV Research question *5*
V Significance of the study *6*
VI Delimitations of the study *8*
VII Assumptions *10*
VIII Overall methodology and thesis outline *10*
IX Case site *13*
X Supporting theory *16*
XI The theoretical foundations of gamification *21*
XII A critical review of the success of gamification *31*
XIII Conclusion *34*
Paper 1. Goal Setting in Gamification: Towards a Formal and Expanded Theory **35**
1.1. The theoretical foundations of goal setting *35*
1.2. Framing within goal setting *39*
Paper 2. The Effect of Goal Framing in Gamification: A Field Experiment **50**
2.1. Review of Paper 1's theoretical framework *50*
2.2. Research methodology *53*
2.3. Reliability and Validity *79*
2.4. Limitations of the field experiment *82*

2.5. Ethical considerations ... *83*
2.6. Results ... *83*
2.7. Discussion ... *111*
2.8. Conclusion ... *126*
Paper 3. A Theory of the Temporal Unfolding of Gamification ... **128**
3.1. Base theory of gamification ... *128*
3.2. The state of understanding time in gamification ... *129*
3.3. Temporal theory of gamification ... *132*
3.4. General temporal proposition ... *144*
Paper 4. Investigating the Temporal Aspects of Gamification: A Natural Case Study **145**
4.1. Review of Paper 3's theoretical framework ... *145*
4.2. Overarching mixed methods research methodology ... *148*
4.3. Quantitative study ... *152*
4.4. Qualitative study ... *178*
4.5. Overall discussion ... *205*
4.6. Conclusion ... *215*
Reference list ... **217**
Appendix A: Permission to conduct research ... **232**
Appendix B: Human research ethics committee clearance certificate ... **233**
Appendix C: Background on Vitality and Vitality Active Rewards ... **234**
I Discovery Vitality ... *234*
II Vitality Active Rewards ... *234*
Appendix D: Vitality Active Rewards Benefit Guide ... **238**
I Who qualifies for Vitality Active Rewards? ... *238*
II Sharing information ... *239*
III What you pay ... *239*
IV How it works ... *239*
V Rewards ... *241*
VI Fair usage limits ... *244*
VII Privacy ... *244*
VIII Limits ... *245*
IX Ending this benefit ... *245*
X Vitality Active Rewards for Teens ... *245*

XI Find out more *248*
Appendix E: Discovery Vitality Physical Activity Points Earning Activities **249**
Appendix F: Supporting Theories **250**
I Self-Determination Theory *250*
II Social Cognitive Theory *253*
Appendix G: Survey Instruments **256**
I Bandura's Self-efficacy for Exercise scale *256*
II The Behavioural Regulations in Exercise Questionnaire (BREQ-3) *257*
Appendix H: Example of Additional Framed Content **259**
Appendix I: Results for Combined Performance Group **260**
Appendix J: Qualitative Interview Discussion Guide **262**
I Purpose of the discussion *262*
II Broad discussion structure *262*

List of Tables

Table 1 Motivation continuum introduced by Ryan and Deci (2000) 18
Table 2 Game mechanics used during gamification designs (Armstrong & Lee, 2023) 25
Table 3 Game dynamics used during gamification designs (Armstrong & Lee, 2023) 27
Table 4 Relationship between game mechanics and game dynamics 29
Table 5 Framed content based on optimal matching 54
Table 6 Framed content opposite to optimal matching 55
Table 7 Breakdown of demographics for surveyed population 61
Table 8 Breakdown of sample demographics completing the survey 62
Table 9 Reporting factor loadings of final model for self-efficacy 67
Table 10 Reporting factor loadings of final model for motivation 68
Table 11 Summary of fit statistics for confirmatory factor analyses conducted 69
Table 12 Summary of Cronbach's Alpha for each factor 71
Table 13 Groups identified through latent profile analysis 72
Table 14 Gender breakdown per group identified through latent profile analysis 72
Table 15 Age breakdown per group identified through latent profile analysis 73
Table 16 MANOVA test criteria and F approximations showing no overall group effect 73
Table 17 Range per psychological factor 74
Table 18 Group means per psychological factor 74
Table 19 High and low designations per group 77
Table 20 Initial allocation compared to updated definitions used during analysis 78
Table 21 Group sizes when framing content is considered 79
Table 22 Summary of results per group 86
Table 23 Summary of field experiment results per group 112
Table 24 Summary of results per hypothesis 114
Table 25 Groups with higher levels of self-efficacy and motivation 115
Table 26 Group with lower levels of self-efficacy and motivation 117
Table 27 Groups with higher levels of self-efficacy and lower levels of motivation 120
Table 28 Group with lower levels of self-efficacy and higher levels of motivation 123
Table 29 Notable moments in Vitality Active Rewards history 150
Table 30 Summary of case study sample (as of December 2023) 153
Table 31 Breakdown of demographics for unexposed and exposed populations 154
Table 32 Vitality status distribution for identified populations as at August 2015 155
Table 33 Breakdown of demographics for unexposed and exposed populations 157
Table 34 Summary of results for the quantitative portion of the case study 171
Table 35 Summary of financial advisors interviewed 180
Table 36 Summary of results for the qualitative portion of the case study 195
Table 37 Summary of overall case study results 205
Table 38 Groups with higher self-efficacy and motivation 260

List of Figures

Figure 1 Diagrammatic view of thesis methodology and flow 12
Figure 2 The Vitality programme serves as a chassis to support the South African and international insurers 13
Figure 3 Discovery Vitality shared value model in action 14
Figure 4 Vitality points requirements per status 15
Figure 5 Core visual features relating to physical activity goal tracking in Vitality Active Rewards 16
Figure 6 Vitality Active Rewards evolution over time 16
Figure 7 Difference between different uses of game elements 22
Figure 8 Triadic reciprocity between personal, behavioural and environmental processes 23
Figure 9 Essential elements of goal setting theory and the high-performance cycle 36
Figure 10 Goal setting theory and the high-performance cycle when goal is set incorrectly 38
Figure 11 Optimal framing approach based on self-efficacy and task complexity 41
Figure 12 Relationship between task complexity/difficulty and motivation to engage in the goal behaviour 42
Figure 13 Optimal framing approach based on self-efficacy and motivation 43
Figure 14 Goal framing in gamification design based on starting psychological states – positivist model 44
Figure 15 Interaction between self-efficacy and motivation 46
Figure 16 Goal framing in gamification design based on starting psychological states – normative model 49
Figure 17 Optimal goal framing based on self-efficacy or motivation 50
Figure 18 Goal framing based on starting self-efficacy and motivation – normative model 52
Figure 19 2 × 2 matrix plotting the interaction between self-efficacy and motivation 56
Figure 20 Sample sizes for the various population groups 60
Figure 21 Physical activity events contributing towards the weekly goal 63
Figure 22 Path diagram for self-efficacy 70
Figure 23 Path diagram for motivation 70
Figure 24 Groups mapped relative to each other for SEI 75
Figure 25 Groups mapped relative to each other for SEE 75
Figure 26 Groups mapped relative to each other for $M_{\text{intrinsic and identified}}$ 76
Figure 27 Groups mapped relative to each other for $M_{\text{introjected}}$ 76
Figure 28 Graphical representation of field experiment timelines 84
Figure 29 Graphic representation of the D-I-D design 84
Figure 30 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 1 under all framing conditions 87
Figure 31 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 1 under Hybrid Framing with a Performance Bias 88

Figure 32 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 1 under Hybrid Framing with a Learning Bias 89
Figure 33 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 2 under all framing conditions 90
Figure 34 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 2 under Hybrid Framing with a Learning Bias 91
Figure 35 Average Points to Goal Ratio in the 10 weeks before the intervention compared to the 10 weeks after the intervention for Group 2 under Hybrid Framing with a Performance Bias 92
Figure 36 Average Points to Goal Ratio in the 4 weeks before the intervention compared to the 4 weeks after the intervention for Group2 under Learning framing 93
Figure 37 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 3 under all framing conditions 94
Figure 38 Average Points to Goal Ratio in the 10 weeks before the intervention compared to the 10 weeks after the intervention for Group 3 under Performance framing 95
Figure 39 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 3 under Hybrid Framing with a Learning Bias 96
Figure 40 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 4 under all framing conditions 97
Figure 41 Average Points to Goal Ratio in the 9 weeks before the intervention compared to the 9 weeks after the intervention for Group 4 under Hybrid Framing with a Performance Bias 98
Figure 42 Average Points to Goal Ratio in the 7 weeks before the intervention compared to the 7 weeks after the intervention for Group 4 under Hybrid Framing with a Learning Bias 99
Figure 43 Average Points to Goal Ratio in the 7 weeks before the intervention compared to the 7 weeks after the intervention for Group 4 under Performance framing 100
Figure 44 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 5 under all framing conditions 101
Figure 45 Average Points to Goal Ratio in the 9 weeks before the intervention compared to the 9 weeks after the intervention for Group 5 under Learning framing 102
Figure 46 Average Points to Goal Ratio in the 9 weeks before the intervention compared to the 9 weeks after the intervention for Group 5 under Performance framing 103
Figure 47 Average Points to Goal Ratio in the 8 weeks before the intervention compared to the 8 weeks after the intervention for Group 5 under Hybrid framing with a Performance bias 104
Figure 48 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 6 under all framing conditions 105
Figure 49 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 6 under Performance framing 106

Figure 50 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 7 under all framing conditions 107
Figure 51 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 7 under Performance framing 108
Figure 52 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 8 under all framing conditions 109
Figure 53 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 8 under Performance framing 110
Figure 54 Average Points to Goal Ratio in the 6 weeks before the intervention compared to the 6 weeks after the intervention for Group 8 under Learning framing 111
Figure 55 Updated normative model for goal framing based on starting self-efficacy and motivation 113
Figure 56 Optimal framing approach based on self-efficacy and motivation 119
Figure 57 Updated 2 ×3 framework plotting the interaction between self-efficacy and motivation with updated framing conditions 125
Figure 58 Positivist model for goal framing in a gamification design context 129
Figure 59 Game design framework: same game, repeated 133
Figure 60 Net game effect: same game, repeated 135
Figure 61 Game design framework: existing game changed, or a new game introduced, repeated for *k* cycles 138
Figure 62 Proposed changes in self-efficacy, motivation, and game performance after refreshed games 140
Figure 63 Game design framework: existing game changed, or a new game introduced, changed again within *k* cycles 142
Figure 64 Proposed changes in self-efficacy, motivation, and game performance in repeated games 143
Figure 65 The impact of gamification design on performance over time 147
Figure 66 Vitality Active Rewards 1.0 150
Figure 67 Surprise Rewards 150
Figure 68 Vitality Active Rewards 2.0 151
Figure 69 Switch to Discovery Miles 151
Figure 70 Vitality Active Rewards 3.0 152
Figure 71 Graphic representation of the D-I-D design, adjusted from Warton et al. (2016) 162
Figure 72 Average weekly Vitality fitness points earned in the 6 weeks before vs after the Vitality Active Rewards 1.0 platform going live 163
Figure 73 Voucher selection over time for Sep 2015 to Aug 2018 164
Figure 74 Differenced time series for the Vitality Active Rewards 1.0 time series 165
Figure 75 Gameboard plays over time for Nov 2018 to Mar 2023 166
Figure 76 Differenced time series for the Vitality Active Rewards 2.0 time series 167
Figure 77 Difference in average monthly Vitality fitness points between population with and without Vitality Active Rewards active 168
Figure 78 Actual experience vs ARIMA forecast for Sep 2016 to Jul 2019 169
Figure 79 Actual experience vs ARIMA forecast for Nov 2019 to Nov 2023 170

Figure 80 Illustration of timeline for D-I-D analysis 171
Figure 81 Investigating effect of introducing Vitality Active Rewards 2.0 (3.0) 174
Figure 82 Vitality Active Rewards 1.0 vs Vitality Active Rewards 2.0 174
Figure 83 Vitality Active Rewards 2.0 vs Vitality Active Rewards 3.0 175
Figure 84 Difference in rate of decline for Vitality Active Rewards game iterations 177
Figure 85 Main themes identified during the in-depth interviews 186
Figure 86 Positivist model for goal setting within a gamification design framework 192
Figure 87 Themes that support the gamification design framework 192
Figure 88 Aesthetic elements to assist with education regarding new game features 202
Figure 89 Illustration of timeline for D-I-D analysis 206
Figure 90 Rate of declining engagement in Vitality Active Rewards 1.0 and Vitality Active rewards 2.0 209
Figure 91 Investigating effect of introducing Vitality Active Rewards 2.0 (3.0) 210
Figure 92 Actual experience vs ARIMA forecast for Sep 2016 to Jul 2019 212
Figure 93 Actual experience vs ARIMA forecast for Nov 2019 to Nov 2023 212
Figure 94 Vitality Active Rewards 1.0 journey 235
Figure 95 Vitality Active Rewards 2.0 journey 236
Figure 96 Determinants of social cognitive theory 254
Figure 97 Triadic reciprocity between personal, behavioural and environmental processes 255
Figure 98 Average points to goal ratio in the 5 weeks before the intervention compared to the 5 weeks after the intervention for the combined group under Performance framing . 261

Introduction

This thesis examines the role of gamification in supporting motivation, behaviour change, and performance; focusing on the role framing plays in goal setting and on temporal effects in a platform deploying gamification. The following sections will present the research problem, the purpose, context and significance of the study, the research question as well as delimitations and assumptions.

I RESEARCH PROBLEM

This research examines behaviour change through gamification design, focusing on two key elements to improve how gamification design may be implemented in an organisational or practical context, namely: (1) the effect of framing in goal setting based on starting self-efficacy and motivation, and (2) the temporal effects of gamification, investigating strategies to reduce the negative effect of time on game design platforms to ensure they remain relevant over extended periods. This research introduces an enhanced approach to goal framing in a gamification context and strategies to improve long-term implementation of gamification design, which will lead to improved performance outcomes in a more sustained manner.

i Goal setting in gamification design

Goal setting is a frequently used mechanic in gamification design, both implicitly (e.g., through elements such as leaderboards) or explicitly (e.g., through game challenges or missions). Goal setting theory teaches that specific, challenging, achievable goals are more successful at increasing motivation and improved outcomes than general goals or no goals. Furthermore, goal setting theory introduces four moderators of goal setting that need to be considered to ensure performance: namely feedback goal commitment, task complexity and self-efficacy (Locke & Latham, 1979, 2002, 2019). Gamification design frequently uses goal setting due to its success at increasing motivation and performance (Tondello et al., 2018) as well as its ability to direct focus and increase energy allocated to a task (Locke & Latham, 1979, 2002, 2019). Paper 1 will discuss goal setting theory in detail.

Goal setting theory introduces that it is possible to differentiate between different types of framing in goal setting. Studies have shown that when tasks become too complicated or when individuals are not capable of completing the tasks, performance decreases with traditional performance-framed goals (Locke & Latham, 2006; Seijts & Latham, 2005; Seijts et al., 2004). An appropriate learning-framed goal may be more successful at improving performance in these scenarios where an individual first needs to acquire a new skill or knowledge. Such a learning goal still needs to be specific and challenging to achieve the desired outcome (Seijts & Latham, 2005), and once the individual develops the skills required to complete the activity, their self-efficacy increases, which in turn has a positive effect on performance.

Despite the literature differentiating between performance and learning framing in goal setting, in practice, it is seldom that interventions outside of education employ learning-framed goals, and the focus still tends to be on performance-framed goals (Sullivan & Strode,

2010; Swann et al., 2020; Swann et al., 2023; Swann et al., 2021). Especially in gamification, learning tends to be implicit rather than a focus area (Tondello et al., 2018). It is necessary to understand how framing can improve goal setting to increase motivation and performance, particularly in situations where the underlying task is complicated, too difficult for the participant, or where the participant lacks the necessary skill or self-efficacy to engage in the activity effectively.

This research introduces an alternative approach to goal framing, focused on a gamification context, based on an individual's starting self-efficacy and motivation to improve outcomes.

ii Gamification over extended periods

This research focuses on the most common definition of gamification as the "use of game elements in non-game contexts", for example, education, marketing and the work-place (Deterding et al., 2011). Paper 3 discusses gamification design in detail.

In 2023 the gamification industry was estimated at $18.05 billion and is projected to grow to $56.7 billion by 2028 (Research and Markets, 2024). Gamification is a design strategy (Landers, 2019) that uses common elements traditionally found in games, including but not limited to points, leaderboards, badges or goals in a broader context than games (Deterding et al., 2011; Sailer et al., 2017). Gamification is a widely implemented design strategy frequently used to increase motivation, encourage behaviour change or to encourage individuals to participate in a specific activity (Ciuchita et al., 2023; Johnson et al., 2016; Landers et al., 2018; Sailer et al., 2017; Seaborn & Fels, 2015; Tondello et al., 2018).

Despite the widespread use of gamification across industries and behaviours, some aspects are still poorly understood, including the long-term applicability of gamification tools (Cugelman, 2013). There are concerns that gamification is only successful due to the novelty of the techniques, and that once this wears off, so does the motivation to continue engaging (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015). Some research shows that once the gamification intervention gets removed, behaviour declines once more (Landers et al., 2018) – this observation is consistent with self-determination theory, assuming the individual's motivation to engage was purely extrinsic driven by the gamification platform (Ryan & Deci, 2000). Due to the widespread use across contexts and the relative ease with which some elements may be implemented due to the prevalence of smartphone technology (Research and Markets, 2024), it is necessary to understand whether organisations can rely on these tools over extended periods. Once there is a clearer understanding of the long-term application of gamification, it is necessary to understand how to implement the design strategy to ensure that the platform remains both effective and relevant over prolonged periods.

The objective of this research is to investigate the long-term effects of a gamification platform to understand how the efficacy may change, or even decline, over time. Furthermore, the study will consider an alternative approach to implementing gamification design over prolonged periods to ensure that the gamification platform remains effective and relevant.

II PURPOSE OF THE STUDY

Following from the research problem introduced in the previous section, the purpose of this study is to examine the impact of alternative framing on goal setting in a gamification context and the long-term efficacy of gamification. The objective is to propose an alternative approach to gamification design to improve outcomes based on the findings of the research.

i Goal framing

Briefly introduced previously, goal setting is a key game mechanic frequently employed in gamification designs. Although the findings from this study are likely generalisable to other contexts that use goal setting theory, this study focuses on goal setting theory in a gamification design context.

Goal setting theory defines effective goals as those that are specific, challenging, often time-bound and achievable (Locke & Latham, 1979, 2002, 2019). Furthermore, goal setting theory differentiates between performance and learning framing, depending on the underlying task complexity or the individual's skill level and self-efficacy relating to the goal behaviour. Performance-framed goals are most appropriate when an individual has high self-efficacy and has the necessary skills to achieve the goal; these are employed when it is necessary to increase an individual's effort or output and when the task is uncomplicated. In contrast, learning-framed goals are most successful when individuals have low self-efficacy, when they do not have the required skills or when the underlying behaviour is complicated (Locke & Latham, 2006; Seijts & Latham, 2005; Seijts et al., 2004). Some researchers have even proposed that a combination of learning and performance goals can lead to improved results (Sullivan & Strode, 2010). Despite the differences between performance and learning framing in goal setting, performance-framed goals tend to be the most prevalent in practice, particularly in gamification interventions (Tondello et al., 2018).

This research proposes a different method for evaluating the optimal goal framing approach by considering the interplay between an individual's self-efficacy and motivation. It introduces a novel "hybrid" framing condition for situations where a pure framing condition might not be clearly suitable. Additionally, the study investigates the impact of these diverse goal framing strategies in the context of gamification design: the research conducted a field experiment to explore whether outcomes show improvement due to the various framing conditions.

ii Gamification over time

The use of gamification is widespread across a range of industries and behaviours (Cugelman, 2013; Hamari et al., 2014), including in management, education, wellness and marketing (Hamari et al., 2014; Landers, 2019). This widespread use of gamification is largely due to the prevalence of smartphone technology (Research and Markets, 2024) and the relative ease of implementing features such as points within existing frameworks (Landers, 2019; Landers et al., 2018). Despite the broad applicability and widespread usage of gamification, some elements are still poorly researched and poorly understood (Ciuchita

et al., 2023; Floryan et al., 2019; Hamari et al., 2014; Krath et al., 2021; Landers et al., 2018; Seaborn & Fels, 2015). The focus area of this research is the long term efficacy of gamification design over an extended period; within research the long-term relevance and ongoing impact on engagement is not well-researched, and there is uncertainty if some of the positive results are simply due to the novelty of the interventions (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015).

This research examines the long-term effects of gamification on behaviour change as well as investigates possible strategies to implement gamification design successfully over extended periods. The research focuses on gamification design platforms that are iterative in nature (for example, a goal setting platform that repeats over frequent intervals) and examines ways to implement such a platform such that users remain engaged, and the platform remains effective. This investigation is conducted through a case study of an existing intervention in the South African wellness industry that has been using gamification design since 2015 to promote behaviour change and continues to drive enhanced engagement in the study population. The case site examined is the Vitality Active Rewards gamification platform of Discovery Vitality. Paper 3 discusses and builds on the required theory and Paper 4 presents the results of the case study.

III CONTEXT OF THE STUDY

Both Papers 2 and 4 of this research focus on the use of gamification in a South African wellness program that focuses on increasing physical activity engagement through goal setting, namely the Vitality Active Rewards benefit those clients of Discovery Vitality access. The purpose of this research is to evaluate the impact of framing on goal setting in a gamification design and to evaluate the temporal effect of gamification on behaviour change. This research contributes to both goal setting and gamification methodology by proposing an alternative approach to implementation that will likely lead to improved outcomes. Even though the test site for both phases of the research is the South African wellness industry, it is possible to generalise the learnings more broadly to other contexts and behaviours due to the generalisability of both goal setting theory and gamification design principles (Hamari et al., 2014; Locke & Latham, 1979, 2002).

Goal setting theory is a well-understood motivational theory that is effective across a broad range of industries and applications (Ambrose & Kulik, 1999). As part of this research, we focus on goal setting as defined by Locke and Latham (Locke & Latham, 1979, 2002, 2019) where goals must be specific, challenging, and attainable to increase performance. Goal setting is frequently used in games and gamification design, either explicitly or implicitly, due to its ability to increase motivation and performance (Landers et al., 2017; Tondello et al., 2018). Within the context of this study, goal setting is explicit through the weekly physical activity goals set by the gamification platform.

Gamification is an extensively used design approach across a range of contexts, including in education and marketing. Despite the widespread use of gamification as a design strategy, there is no clear unifying theory associated with it (Hamari et al., 2014; Krath et al., 2021;

Krath & von Korflesch, 2021). Furthermore, there is some debate around the definitions and applicability, particularly between game scientists and researchers focusing more broadly on the relevance of game design elements in behaviour change (Klabbers, 2018). An apparent key differentiator between gamification and game science is that the end result is not necessarily a game, although it may be. This research focuses on the use of gamification as a design strategy or process that leverages game design thinking and methodology in contexts outside of games (Landers et al., 2018), in this case in the wellness industry. While gamification may be employed in service or organizational contexts to enhance client sentiment and loyalty (Ciuchita et al., 2023), this research primarily emphasizes its application in boosting motivation. The focus of this study is on encouraging individuals to engage in specific activities with the aim of achieving a particular behavioural outcome, namely increasing physical activity through the Vitality Active Rewards gamification platform.

IV RESEARCH QUESTION

Based on the previous sections, the following question summarises what this study will investigate.

Can an improved framing methodology impact the success of goal setting in gamification design, and how might such a gamification design be implemented over extended periods to ensure an ongoing improvement on behaviour change and performance?

The sub-questions associated with this are:

- To what extent does framing a goal in a learning, performance, or hybrid orientation impact resulting performance in a gamification context?
- To what extent does gamification impact behaviour change over more extended periods?
- How may the apparent negative effects of time on gamification design be mitigated?

Papers 1 and 3 will focus on the theory informing these research questions. Papers 2 and 4 will discuss the experiments that address these questions in detail.

It is essential that these sub-questions are researched in relation with each other. Literature indicates that for gamification designs to be successful, the platform needs to incorporate the appropriate underlying psychological and behavioural theories (Landers, 2019). Both game and gamification contexts frequently use goal setting, but the relevant goal setting theory is not always applied appropriately. Particularly in gamification design, the focus of goal setting is too much on performance, and when the design includes learning as an objective of the platform, it is often implicit (Tondello et al., 2018).

This research examines a theory-driven alternative to implementing goal setting within a gamification context that balances goal framing against an individual's underlying psychological states to lead to improved outcomes over time. Furthermore, this research

presents an improved approach to implementing such a gamification platform over extended periods and ensure that these platforms remain effective and relevant over time.

V SIGNIFICANCE OF THE STUDY

This study adds value to the respective fields, as summarised below.

i Goal setting theory

Goal setting theory has become one of the most prominent theories of motivation (Ambrose & Kulik, 1999; Fried & Slowik, 2004; Locke et al., 1986). Although initially introduced in the context of work-place motivation (Locke & Latham, 1985; McEwan et al., 2016) it has been shown to apply to a broad range of contexts and applications (Locke & Latham, 2002, 2019) including in gamification (Tondello et al., 2018). According to goal setting theory (Locke & Latham, 1979, 2002, 2019), a specific challenging goal leads to better performance than a specific easy goal, a broad "do your best" goal or no goal and results improve further if the individual receives feedback regarding their progress towards the goal. Successful goal setting assumes that the individual has the required skill and knowledge to achieve the goal and that the individual has accepted and is committed to the goal.

Methodological contribution enhancing goal setting in a gamification context

Research shows that where the task is too complicated relative to an individual's underlying skill level or self-efficacy, challenging goals may be more likely to harm performance; especially if the participant lacks the necessary skill or knowledge to achieve the goal (Locke & Latham, 2006; Seijts & Latham, 2005). Particularly in complex tasks, an individual needs to be able to focus on acquiring skills rather than on performance (Seijts et al., 2004). Research shows that reframing goals in a learning orientation is likely to lead to improved outcomes provided that these learning framed goals are still specific and challenging, per goal setting theory requirements (Seijts & Latham, 2005; Swann et al., 2021). Despite literature differentiating between performance and learning framing in goal setting, goal setting in practice, particularly in gamification design, still mainly focuses on performance framed goals, even when there are indications that learning framed goals or a hybrid approach may lead to greater success (Sullivan & Strode, 2010; Swann et al., 2020; Swann et al., 2023; Swann et al., 2021; Tondello et al., 2018).

The field experiment presented in Paper 2 investigates the impact of goal framing based on starting self-efficacy and motivation to improve subsequent performance in a gamification platform. In essence, there is very little literature around this approach to goal setting, especially in the context of gamification design. Any empirical research will contribute to further developments in the field. Locke and Latham (2006) suggested that future research could include studies on the effects of different learning goals as well as combining learning and performance goals.

Furthermore, the study introduces and evaluates an alternative "hybrid" approach to goal framing based on the interaction between self-efficacy and motivation to accommodate

scenarios where current research does not provide a clear recommendation regarding the most appropriate framing condition. This novel approach to goal setting contributes to an enhanced approach to goal setting in practice. The researcher found no evidence of a hybrid goal in goal setting theory, however, the researcher found studies that either combine performance and learning goals or phase them which may provide comparable results (Sullivan & Strode, 2010; Swann et al., 2020; Swann et al., 2023; Swann et al., 2021).

ii Gamification

This research focuses on one of the most general definitions of gamification, namely the use of elements (such as points, badges, and leaderboards) typically associated with games in a context outside of traditional games (such as in education) (Deterding et al., 2011). Gamification is a design strategy that is frequently used to enhance motivation and behaviour change across a broad range of contexts (Ciuchita et al., 2023; Cugelman, 2013; Hammedi et al., 2021; Harrison et al., 2019; Lowensteyn et al., 2019; Patel et al., 2017; Research and Markets, 2024; Richter et al., 2015). Despite a lack of consensus around gamification research (Cugelman, 2013; Klabbers, 2018; Krath & von Korflesch, 2021; Landers, 2019), it is a widely used design strategy in practice showing no signs of slowing down (Research and Markets, 2024).

Methodological contribution to an alternative implementation of gamification design strategies

Research exists showing the effects of removing gamification design, showing that behaviour gradually returns to the levels observed before the introduction of the gamification platform (Landers et al., 2018). Researchers also suspect that gamification design efficacy reduces as the novelty of the platform wears off (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015). There is research on using iterative design processes to create an initial gamification platform (Morschheuser et al., 2017), but no evidence of studies investigating the impact of changing game elements in a mature platform could be found. Particularly in an organisational context where users might access a platform for prolonged periods, it is necessary to understand how to maintain the efficacy of the platform and continue to support behaviour change and ongoing engagement. This research study contributes an alternative methodology for improved implementation of gamification designs that may mitigate the negative effects of time on performance and long-term engagement.

Theoretical contribution explaining the long-term impact of gamification on behaviour change and performance

Typically, research implementing gamification techniques tend to be over a short duration (Hamari et al., 2014; Lowensteyn et al., 2019; Patel et al., 2017; Seaborn & Fels, 2015; Swann et al., 2020). There are questions around the long-term applicability and efficacy of gamification interventions, with some research implying that once the novelty wears off the behaviour change cannot be sustained (Cardador et al., 2017; Hamari et al., 2014; Johnson et

al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015). The case study focuses on Vitality Active Rewards, which is a gamification-based behaviour change intervention that has been live since September 2015 and is still ongoing.

Empirical contribution explaining the long-term impact of gamification on behaviour change and performance

There is a vast amount of systematic reviews on whether gamification works (Hamari et al., 2014; Johnson et al., 2016; Sardi et al., 2017; Seaborn & Fels, 2015); literature mapping app-based interventions to behaviour or motivation principles (Cotton & Patel, 2019; Cowan et al., 2013; Edwards et al., 2016; Lister et al., 2014); some investigating how gamification impacts motivation (Johnson et al., 2016; Sailer et al., 2017; Tondello et al., 2018) and studies using gamification methods as a tool to drive behaviour change (Harrison et al., 2019; Lowensteyn et al., 2019; Patel et al., 2017). Despite this apparent widespread use of gamification (Cugelman, 2013; Patel et al., 2017), there are limited resources that can be drawn on to inform new interventions grounded in theory (Floryan et al., 2019) and results tend to be anecdotal (Cugelman, 2013).

Landers et al. (2018) describe a framework illustrating how game elements influence distal outcomes through their impact on psychological states and behaviours. Most of the literature focuses on the impact of game design elements on psychological states and behaviour, and less on the resulting "distal goals" (i.e. the desired behaviour change). In studies where the outcomes are measured (e.g. Lowensteyn et al. 2019), the studies do not explicitly interrogate the game elements or link to the outcomes. There is limited research highlighting the relationship between the game elements and the resultant behaviour change (Landers et al., 2017; Patel et al., 2017). There is an opinion in the extant literature that gamification analysis lacks statistical rigour, with few comparative or longitudinal designs available (Seaborn & Fels, 2015) and control groups are seldom considered appropriately (Johnson et al., 2016). This study contributes a more rigorous view of the impact of crucial gamification elements on behaviour change and performance.

VI DELIMITATIONS OF THE STUDY

The following sections describe the limitations of this research.

i Goal setting theory

Although there are other research paradigms that use the concept of goal setting, this study focuses on goal setting as described by Locke and Latham (1979). In other words, for goals to be effective they need to be specific, challenging, and achievable.

The research introduces the four mediators of goal setting theory in Paper 1 and discusses them briefly in relation to self-determination theory, however, this study does not interrogate or test them further as part of the study.

The research introduces the four moderators of goal setting theory in Paper 1 and expands on them in relation to self-determination theory. For the purposes of this study, the

researcher focuses on self-efficacy and task complexity, using motivation as an outcome of task complexity. Feedback and goal commitment are not interrogated or tested further as part of the study.

The research focuses on the impact of an enhanced framing methodology within a gamification framework that leverages goal setting and is primarily concerned with how this enhancement supports future action participation.

ii Gamification

Although multiple design strategies fall under gamification, this study focuses on the Deterding et al. (2011) definition of gamification as the "use of game elements in a non-game context" with the intention of encouraging motivation and behaviour change. For example, the study will not consider game-based learning or serious games.

While gamification may use numerous game mechanics, this research focuses predominately on goal setting as deployed in the Vitality Active Rewards context.

The study does not explicitly question why or how gamification elements work and will not present a framework for implementing or assessing gamification interventions in future.

Although personality factors may impact how games are perceived and how the elements may be received by participants, personality factors will not be considered as a critical variable when evaluating the effect of gamification on behaviour change. Furthermore, despite the emergence of adaptive gamification (Lopez & Tucker, 2021; Sezgin & Yüzer, 2022) based on participants' player types and game preferences, this research does not investigate this design approach.

The research focuses on the long-term effects of gamification on behaviour and resultant performance, as well as the effects of changing game design elements over time.

iii General delimitations

Even though this research uses an existing gamified intervention in the South African wellness industry as the case site, this research will not focus on the impact of the platform on health outcomes. The study will use physical activity and changes in physical activity over time as an indication for improved performance.

This study uses self-determination theory to understand foundational aspects of gamification and goal setting theory, and the necessary theory will be included in one of the next sections. However, this thesis will not investigate self-determination theory explicitly, and this thesis will not contribute significantly to this field.

This research will not interrogate the effect of incentives on behaviour change.

VII ASSUMPTIONS

During this thesis, the study assumes that behaviour can be changed, and that gamification can be an effective tool for driving change when adequately implemented. It is assumed that gamification is widely used in organisational structures and that organisations can implement and change these interventions without substantial restrictions that make implementation infeasible. It is expected that organisations have the necessary capabilities to implement a gamification platform appropriately.

Any reference to goals and goal setting assumes that the goals align with the parameters introduced by Locke and Latham (1979, 2002, 2019), described in Paper 1. In other words, the goals are specific, challenging, and achievable. Where this is not the case, which will be described in detail in the relevant sections, it is most likely that the goal is not *perceived* as achievable, although from an impartial perspective it likely is achievable. In these scenarios, primarily in Paper 2, appropriate framing will be implemented to attempt to mitigate the perception that the goal is unachievable.

Any reference to "games" implies the underlying gamification design or platform, although it is not a requirement that the resulting platform is an actual game.

It is assumed that tools and techniques implemented to change individual behaviour are generalisable across behaviours.

It is assumed that individuals participating in the interventions or experiments do so voluntarily, are aware of the intervention and are willing and capable to change the underlying behaviour (in the context of the research, this refers to engaging in physical activity behaviours).

The case study design assumes that game participation is a function of game self-efficacy and motivation and that it is sufficient to measure game participation on its own.

VIII OVERALL METHODOLOGY AND THESIS OUTLINE

This final thesis document consists of four related Papers, described below, and illustrated in Figure 1 below.

i Paper 1

Paper 1 seeks to develop a novel theory for an improved approach to the use of framing in goal setting, predominately within the context of gamification design. Paper 1 includes a literature review of goal setting theory, initially developed by Locke and Latham (1979).

Goal setting theory introduces two types of goal framing approaches: performance and learning (Locke & Latham, 2002; Seijts & Latham, 2005; Seijts et al., 2004). When each of these types of goal framing is correctly applied, they are successful in improving outcomes. Performance framed goals are most appropriate when it is necessary to increase an individual's effort whereas learning framed goals are most relevant when the individual needs to acquire a new skill or to improve proficiency in a task (Seijts & Latham, 2005).

Despite the difference in framing approaches, some scenarios predominately implement performance framed goals despite the indication that learning framed goals would be more appropriate (Sullivan & Strode, 2010; Swann et al., 2020; Swann et al., 2023; Swann et al., 2021).

Paper 1 presents an improved model for goal framing, including a novel hybrid framing approach that caters to less straightforward combinations of self-efficacy and motivation. Paper 1 provides the outline for the hypotheses that the field experiment in Paper 2 investigates.

ii Paper 2

Paper 2 presents a field study using an existing gamification platform in the South African wellness industry that tests the model and hypotheses introduced in Paper 1 and investigates the impact of framing goals in gamification design context. The goal framing is based on an individual's starting psychological state (defined as self-efficacy and motivation), observing the effect on an individual's future performance in the gamification platform. The output of this study is an improved methodology to implement goal framing in a gamification design context that balances learning and performance goal framing in a way that will be more likely to increase action performance over time.

iii Paper 3

Paper 3 presents a literature review on the success of gamification and seeks to develop a novel strategy to improve implementation of gamification platforms that reduce the declining effects of time and ensures that the platform maintains it relevance and efficacy.

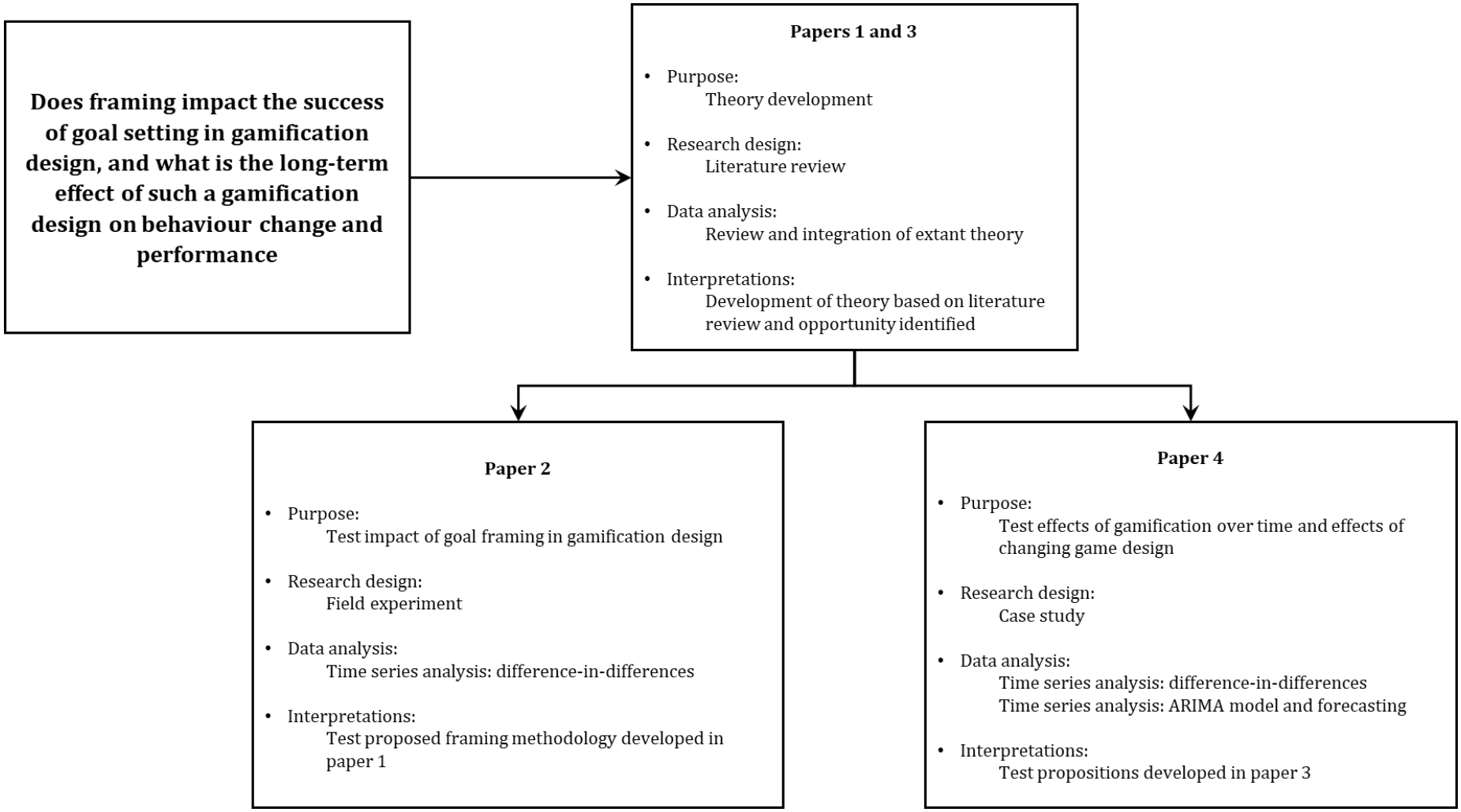
A wide range of industries and behaviours use gamification, often to increase motivation to participate in an activity or to encourage behaviour change (Deterding et al., 2011; Hamari et al., 2014). Despite the prevalence of gamification as a design strategy, little research or documentation of the long-term effects is available. Studies tend to be over shorter periods (Hamari et al., 2014; Lowensteyn et al., 2019; Patel et al., 2017; Seaborn & Fels, 2015; Swann et al., 2020) and there is scepticism about whether gamification can be used in the long-term or if results are purely due to the novelty of the initial design (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015).

Paper 3 provides an improved strategy for implementing gamification designs and provides the outline for the propositions that the case study presented in Paper 4 investigates.

iv Paper 4

Paper 4 presents a mixed methods case study that investigates the enduring impact of a gamified intervention within the South African wellness industry. This intervention, namely Vitality Active Rewards, was introduced in September 2015 and remains in active use as a voluntary benefit within Discovery Vitality. The output of this study is an improved strategic methodology for implementing gamification design over extended periods that aims to reduce the declining effects of time on performance and ongoing engagement.

Figure 1 Diagrammatic view of thesis methodology and flow



IX CASE SITE

Both papers 2 and 4 use the same case site in the experiment design, namely the South African wellness programme Discovery Vitality, focusing on the gamification platform Vitality Active Rewards.

i Discovery Vitality

Discovery Vitality, launched in 1997, is a wellness programme that is available to clients of the Discovery Health Medical Scheme and Discovery Life. Discovery Vitality employs behavioural science techniques to provide clients with tools to improve their health and wellbeing. Furthermore, core tenets of the Vitality programme has been exported successfully to various international partner markets to support the insurers in those markets (for example, the UK, Germany, Jaman, amongst others). Figure 2 bellow illustrates how the insurers are built on, and supported by, the Vitality model.

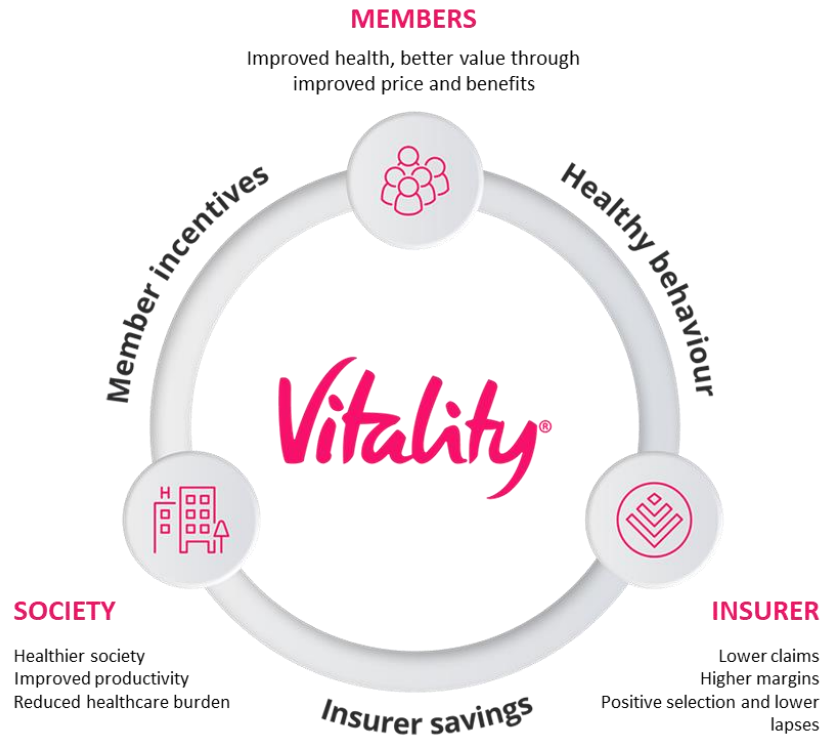
Figure 2 The Vitality programme serves as a chassis to support the South African and international insurers



Shared value model

Discovery Vitality is underpinned by the shared value model presented in Figure 3 below. This model highlights how all stakeholders benefit from health improvements and shows how Discovery Vitality supports the medical aid scheme and the life insurer (Discovery Health, 2020; Porter et al., 2014).

Figure 3 Discovery Vitality shared value model in action



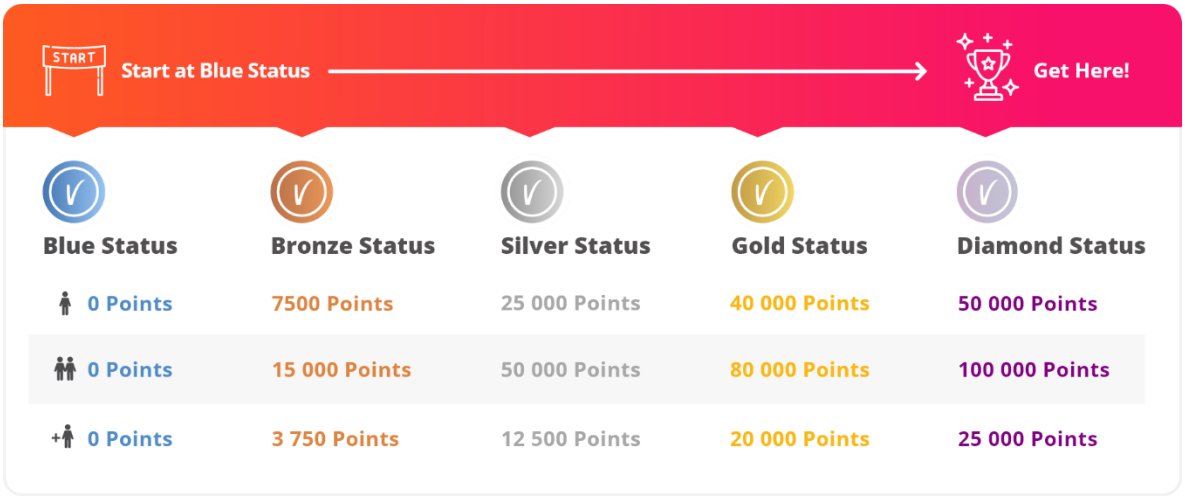
Clients that engage in health-promoting activities through the Vitality programme have lower health and life insurance claims as well as lower lapse rates; the improved experience creates savings which in turn create value for the client in the form of greater rewards.

Vitality points and status

Members earn rewards when they engage in health-promoting activities (Discovery, 2020). Rewards include cashbacks on healthy food purchases, discounted flights, discounted gym memberships, and more. Those clients with a linked Discovery Life policy may earn even more rewards through premium discounts based on their engagement with Discovery Vitality.

Members may track these health-promoting activities, their health, and health improvements through the earning of Vitality points, which contribute towards a Vitality Health status. The status levels start at Blue and end at Diamond status, illustrated by Figure 4 below. The Vitality status is earned annually, in other words status resets at the start of each calendar year and members have a year to reach the highest status possible. Vitality status is earned at a policy level, in other words the entire family needs to engage and get healthy.

Figure 4 Vitality points requirements per status



Points earning activities are associated with health-promoting behaviours including screening activity, nutrition, and physical activity. Examples of points earning activities include completing an annual health check, purchasing healthy food, completing key lifestyle questionnaires, or engaging in physical activity. A higher status is associated with greater rewards and benefits, thereby rewarding clients for making improvements to their health.

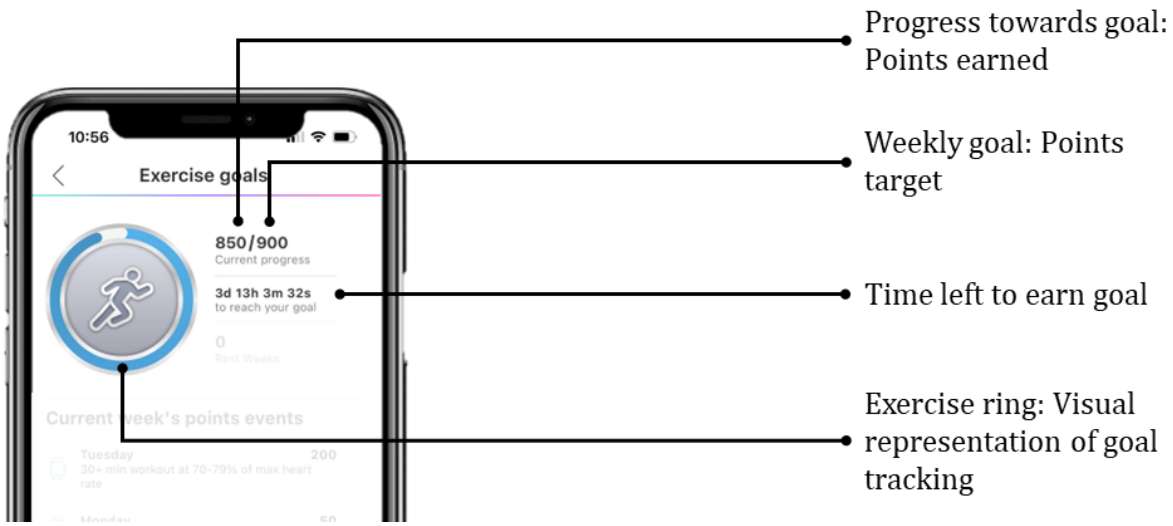
ii Vitality Active Rewards

Vitality Active Rewards, launched in September 2015, is a voluntary benefit of Discovery Vitality, in other words, members need to explicitly activate the programme. Vitality Active Rewards is a gamified intervention that encourages participants to increase or maintain their physical activity levels through goal setting. The platform has undergone minor and major changes since it went live in September 2015. These changes will be discussed in detail in Paper 4.

Vitality Active Rewards leverages the points platform described previously, specifically focusing on points earned through physical activity behaviours. The game sets participants a weekly points goal based on their physical activity levels and previous engagement. Members achieve their weekly goals by accumulating sufficient points. When they achieve their goal, they are eligible to earn a reward. The goal resets each week and increases/decreases/stays the same based on previous goal achievement. When the participant increases their physical activity, the goal increases to remain challenging, until it reaches a threshold beyond which goal level enters a maintenance phase. The goal cycle is from a Saturday to Friday each week and members earn their rewards on "Rewards Wednesday" the following week.

Active Rewards participants track their weekly progress through a ring that fills up when they complete points-earning activities (Patel et al., 2018). Figure 5 below shows this visual tracking component of Vitality Active Rewards, where the points goal is represented by a ring that "fills up" with the points from the completed activities.

Figure 5 Core visual features relating to physical activity goal tracking in Vitality Active Rewards



Despite changes to the platform over time, this goal setting mechanism has remained unchanged. The rewards have changed over time from a guaranteed coffee or smoothie voucher reward to a virtual currency that may be redeemed for items of value and the aesthetics of the game have changed over time. Furthermore, the game platform has expanded to include other Discovery behaviours, namely driving and spending. Figure 6 below shows a high-level view of this evolution over time – a much more detailed view will be provided in Paper 4.

Figure 6 Vitality Active Rewards evolution over time



This study focuses largely on the physical activity goals, since this portion of the game is the most mature.

X SUPPORTING THEORY

Prior to commencing with the theory-building sections of the thesis it is necessary to introduce some foundational theory that provides further depth to the understanding of the research. Both gamification and goal setting theory rely on theories of motivation and behaviour change to provide insights into why these strategies are successful at driving positive outcomes.

Gamification, defined as the use of game elements in a non-game context, is a widely implemented design strategy across a range of applications, including education, management, wellness and marketing (Deterding et al., 2011; Hamari et al., 2014). Both gamification and goal setting are frequently used to enhance motivation and to encourage users to engage in activities that promote behaviour change (Ciuchita et al., 2023; Floryan et al., 2019; Landers et al., 2018; Locke & Latham, 1979, 2002, 2019). Research shows that it is necessary for gamification designs to be implemented appropriately based on psychological theory applicable to both the underlying population and the targeted behaviour to ensure successful outcomes (Landers, 2019).

Generally, one can separate motivation theories into two categories: content (what is motivation?) and process (how do you motivate?) (Ambrose & Kulik, 1999). Popular content theories include Maslow's hierarchy of needs (Maslow, 1971), McClelland's theory of needs (McClelland, 1985) and self-determination theory (Ryan & Deci, 2000). Popular process theories include reinforcement theory (Skinner, 1958), expectancy theory (Vroom et al., 2015) and goal setting theory (Locke & Latham, 1979, 2002, 2019). Research shows that content theories can inform or explain the process theories. In other words, process theories describe how to motivate individuals, while content theories expand on why they work.

Historically, one of the challenges with understanding motivation was measuring or quantifying motivation (Ambrose & Kulik, 1999; Locke & Latham, 1979), however, more recently task-specific research instruments may be found, for example, the research instrument used in the field study presented in Paper 2 (Murcia et al., 2007). When motivation itself cannot be quantified, then the outcomes because of motivation can be observed and quantified. These are either attitudinal (e.g. sentiment) or behavioural (e.g. performance) (Ambrose & Kulik, 1999).

The following section introduces the fundamentals of self-determination theory to provide additional insights into why goal setting theory and gamification are successful at driving behaviours. This thesis will not research self-determination theory in-depth, and the study will not contribute to the extant literature. Additional information is available in Appendix F.

i Self-determination theory

Self-determination theory is a widely cited motivation theory, and the following sections explore key aspects related to the research.

Motivation continuum

Two critical elements of self-determination theory are intrinsic motivation and self-regulation (i.e., how individuals translate environmental factors into personal values). Self-determination theory seeks to explain what facilitates or undermines these two elements (Ryan & Deci, 2000).

One can define motivation as either intrinsic or extrinsic where intrinsic motivation refers to motivation that comes from within (e.g. the inherent joy experienced from completing a task), and extrinsic motivation refers to external factors providing motivation (e.g. to earn a

reward). The distinction between intrinsic and extrinsic motivation is significant (Ryan & Deci, 2000; Sullivan & Strode, 2010).

Typically, intrinsic motivation is superior and manifests in enhanced performance, persistence and creativity – this is the case regardless of an individual's underlying ability or self-efficacy (Ryan & Deci, 2000). Individuals will be intrinsically motivated if they perceive the behaviour as enjoyable, inherently satisfying, or aligning with their inherent values. However, this is not true of all activities – one cannot reasonably expect individuals to be intrinsically motivated across all types of activity.

Extrinsic motivation refers to external elements acting as the driver of motivation. If motivation relies solely on external regulation, then the motivation may cease with the removal of the external factors. This type of motivation is not sustainable and poses a risk to interventions that rely solely on external elements to drive motivation (Sullivan & Strode, 2010; Thibault Landry et al., 2017). In a gamification design context, external game elements are frequently deployed to make challenging or less appealing activities more appealing (Patrício et al., 2021). The challenge in gamification design lies in getting similar levels of performance seen with intrinsic motivation from extrinsically motivated behaviours.

Table 1 below illustrates the motivation continuum introduced by Ryan and Deci (2000), and depicts a more nuanced view of motivation. In this continuum, an individual can appear between intrinsic and extrinsic motivation where integrated regulation behaves very similarly to intrinsic regulation. Individuals can move along this continuum (Ryan & Deci, 2000). The extent to which motivation falls into each of the categories can vary (Edmunds et al., 2006). Even though it is not realistic for everyone to be intrinsically motivated for all behaviours, it is possible to focus on transitioning them towards more identified and integrated regulation.

Table 1 Motivation continuum introduced by Ryan and Deci (2000)

	Nonself-determined →					*Self-determined*
Motivation:	Amotivation	Extrinsic motivation				Intrinsic motivation
Regulatory style:	Non-regulation	External regulation	Introjected regulation	Identified regulation	Integrated regulation	Intrinsic regulation
Perceived control:	Impersonal	External	Somewhat external	Somewhat internal	Internal	Internal

The following subsections describe each of these types of regulation. In a gamification design context, the platform designer's objective should be to transition individuals from purely extrinsic regulation (i.e., only engaging to earn regards) towards more sustainable intrinsic regulation through the game elements. Gamification designers may do this by creating

experiences that connect the game behaviour more strongly to the individual's underlying values.

External regulation

External regulation is entirely extrinsic, and individuals engage to satisfy an external demand or reward contingency. This type of regulation is, typically, what one refers to as extrinsic motivation and is contrasted directly with intrinsic motivation. It is unlikely that there is autonomy or perceived choice, but individuals feel competent enough to comply. An example in a gamification context is where an individual participates in the platform solely to earn badges or points without having assigned meaning or value to the underlying activity.

Introjected regulation

Individuals have not entirely accepted the control as their own and engage to increase feelings of self-worth or to avoid appearing incapable within a relevant group. This regulation is defined as "extrinsic" since the individual is participating due to externally perceived esteem. An example in a gamification context is when the individual engages in the platform because they feel guilty or anxious about not meeting their game goal. The motivation is driven by a need to avoid external negative emotions or criticism.

Identified regulation

Individuals value the action and have accepted it, even if the behaviour is not inherently enjoyable. Individuals exhibit an improved ability to cope when the situation becomes challenging. An example in a gamification context is where the game elements align with the individual's personal goals or values and the individual recognises the benefits of engaging in the game.

Integrated regulation

Action has been fully assimilated and accepted as part of oneself. This type of motivation is comparable to intrinsic motivation but is still referred to as extrinsic since the motivation is not due to an inherent sense of joy or satisfaction; rather engagement is in the pursuit of a separable outcome. In this scenario, the individual accepts the behaviour as essential and may lead to improvements elsewhere (Sullivan & Strode, 2010). An example in a gamification context is where the individual has integrated the game behaviour as part of themselves and engaging in the game contributes towards personal growth.

Factors of self-determination theory

Self-determination theory expands on how it is possible to move individuals along the motivation continuum even when the motivation is more extrinsic. Ryan and Deci (2000) introduced self-determination theory as a needs-based theory of motivation that specifies three psychological needs that are essential for optimal functioning and growth: autonomy, competence, and relatedness.

Autonomy is an individual's internally perceived ability to control a situation. In a gamification context any feature that introduces task volution or choice will promote autonomy. For example, in Vitality Active Rewards, individuals may choose what type of physical activity actions to participate in to achieve their goal.

Competence is one's belief in one's ability and the ability to engage in behaviour that aligns with one's beliefs and values. In a gamification context any feature that highlights the individual's skills in the platform promotes feelings of competence. For example, in Vitality Active Rewards, individuals track their progress towards the goal which shows that the individual is tracking positively towards the goal. Furthermore, key features, including goal streaks and centurion shirts, celebrate key milestones and highlight a member's skills.

Relatedness is the feeling of support and security. Within a gamification context any feature that creates broader connection with the platform and other players will promote feelings of relatedness. For example, in Vitality Active Rewards, even though relatedness is not explicitly catered for through social features, individuals may get an improved sense of relatedness when they speak with peers and talk about the game.

When these three needs are satisfied, it leads to an increase in motivation, performance, and wellbeing. External or social factors can influence these primary needs, and it is possible to engineer an environment (e.g., within a gamification context) that maximises these needs. Gamification platforms are more likely to succeed when motivation is self-determined. In other words, when competence, relatedness and autonomy are satisfied.

External factors will not foster intrinsic motivation if there is none to begin with, but they can foster integrated regulation which is superior to purely external regulation. For an individual to be intrinsically motivated, they need to have an inherent interest in the underlying task or behaviour in the first place (Ryan & Deci, 2000). In other words, if there is no underlying interest at all, then these principles are unlikely to foster pure intrinsic motivation. However, they may assist in moving individuals along the spectrum towards identified or integrated regulation.

It is possible to get similar results from extrinsic motivation by increasing internalisation and integration, but it is necessary to understand what social-contextual effects support or hinder integrated motivation. The three core psychological needs play a significant role in maintaining the self-determined state of extrinsic motivation that the individual has internalised and integrated (Ryan & Deci, 2000). The value of an activity is the perceived importance of an outcome; individuals will be more motivated to achieve goals that align with their values (Schunk & DiBenedetto, 2020).

External factors can impact intrinsic motivation; where external factors can include social-contextual events, for example, feedback, deadlines, threats, imposed goals or rewards. These external factors are often critical components of both gamification and goal setting. For external factors to continue supporting integrated or intrinsic motivation, they need to foster feelings of competence, autonomy and relatedness in individuals (Ryan & Deci, 2000). It is necessary to keep these principles of self-determination theory in mind when implementing

a gamification design strategy to ensure successful interventions since these strategies can either foster or diminish self-determined motivation and self-efficacy.

Impact of incentives

A hotly debated topic in literature is whether rewards undermine intrinsic motivation (Lohmann et al., 2018; Ryan & Deci, 2000; Thibault Landry et al., 2017). Although this research does not investigate the impact of incentives, it is worthwhile mentioning it briefly due to the relevance in gamification as well as the case site investigated in Papers 2 and 4, namely Vitality Active Rewards (see p. 15).

There is concern that rewards or incentives can harm feelings of autonomy (Ryan & Deci, 2000) and that by assigning a monetary value to an activity, one devalues the intrinsic motivation and moves attention away from the underlying behaviour (Thibault Landry et al., 2017). Introduced earlier, it is possible for extrinsic motivation to be self-determined and for external influences (including incentives) to support motivation – this largely depends on the underlying design of the intervention (Lohmann et al., 2018). There are challenges to implementing incentive schemes correctly, and if done incorrectly, it can lead to unintended consequences (e.g. unethical behaviour) (Landers, 2019; Lohmann et al., 2018). However, when done correctly, incentive structures (e.g., gamification platforms) may support and sustain motivation (Thibault Landry et al., 2017)

Since motivation differs between individuals and what may be intrinsically motivating for one might not be intrinsically motivating for another(Lohmann et al., 2018; Ryan & Deci, 2000; Seaborn & Fels, 2015) this makes implementing incentive structures for a range of individuals even more challenging. It is unlikely to design an incentive programme that will work for all individuals exposed to it. However, there are strategies to mitigate some of the negative impacts of incentive structures, for instance, allocating incentives in a manner that the individual perceives as fair and other autonomy supporting structures (Lohmann et al., 2018; Thibault Landry et al., 2017). It is important to reiterate that external elements, including but not limited to, incentives or other gamification features, will only undermine intrinsic motivation if it existed in the first place (Edmunds et al., 2006; Ryan & Deci, 2000).

XI THE THEORETICAL FOUNDATIONS OF GAMIFICATION

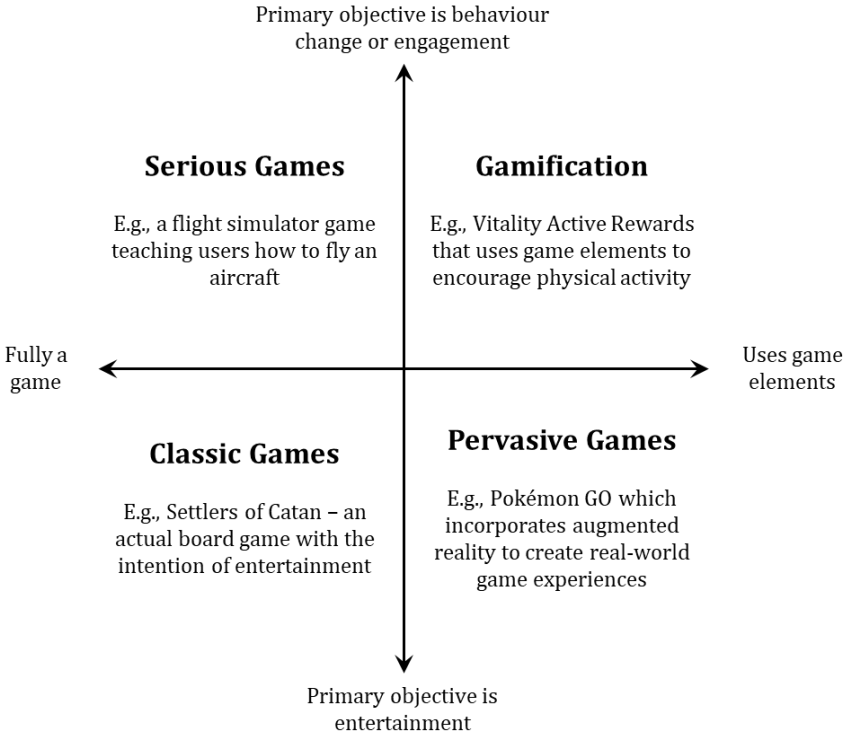
Gamification has become a massive industry, estimated at $18.05 billion in 2023 and is projected to grow to $56.7 billion by 2028 (Research and Markets, 2024). The growth is largely attributed to technological advancements and the prevalence of smartphones (Research and Markets, 2024). The application of gamification is broad, ranging from education, marketing, wellness, within organisational contexts and more (Hamari et al., 2014; Landers, 2019; Research and Markets, 2024). Despite the size of the industry and the widespread use, results are inconclusive, and some researchers even disagree with gamification as a legitimate design strategy (Cugelman, 2013; Klabbers, 2018; Krath & von Korflesch, 2021; Landers, 2019).

Gamification is a blanket term used to describe the context-specific use of design elements typically seen in games in a context that is not associated with games or game behaviour

(Landers et al., 2018). An example of gamification is in the audiobook service, Audible, where listeners can earn badges for certain behaviours (e.g., the "Mount Everest" badge is earned when completing a title longer than 30 hours): in this example badges (a game design element) are awarded for listening to audiobooks or podcasts (not a game, or game activity). Gamification can be used to improve motivation to engage in a specific behaviour (Ciuchita et al., 2023; Johnson et al., 2016; Sailer et al., 2017; Tondello et al., 2018) or to change targeted behaviours (Landers et al., 2018; Seaborn & Fels, 2015). Even though literature often discusses "gamification" as a single concept, this is not an accurate assessment – there are numerous elements that may be combined and that act differently depending on the underlying context (Ciuchita et al., 2023; Sailer et al., 2017).

When researching gamification, many design strategies fall under this banner, including serious games and pervasive games, amongst others. There is a common overlap between gamification and these broader design strategies, with terms being used interchangeably (Ciuchita et al., 2023; Johnson et al., 2016; Richter et al., 2015). Figure 7 below illustrates how these concepts relate to each other.

Figure 7 Difference between different uses of game elements



"Game-science" refers specifically to the study and analysis of games, either as a form of entertainment or as a tool to drive behaviour change (for example, in serious games). Game-science focuses on cases where the end result is an actual game, represented by the left side of the above figure. In contrast, "gamification" typically refers predominately to the use of game elements to drive behaviours or outcomes not typically associated with games. In gamification the end result need not be a game (Landers, 2019; Landers et al., 2018). Furthermore, there is often a shared vocabulary with games (Landers et al., 2018). The

overlap of terminology and the blurred lines between the concepts might be because these elements are perceived differently by individuals and are dependent on both the context and the designer (Hamari et al., 2014; Richter et al., 2015; Seaborn & Fels, 2015).

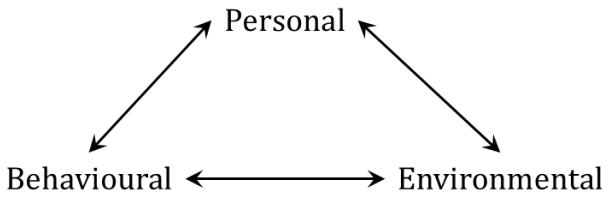
In the context of this research, the researcher focuses on the definition introduced initially: the "use of game design elements in non-game contexts" (Deterding et al., 2011, p. 9) for the primary purpose of encouraging motivation and behaviour change, and will not consider any other broader definitions.

i Gamification as a design strategy

Gamification is a fast-growing field (Hamari et al., 2014; Johnson et al., 2016; Sailer et al., 2017; Werbach, 2014) and despite the field having attained a reasonable degree of maturity with anecdotal cases of gamification observed since the 1900s and one of the first formal definitions introduced in 2002 (Dreimane, 2021), there is still no clear, unified theory or framework associated with it (Floryan et al., 2019; Hamari et al., 2014; Krath et al., 2021; Landers et al., 2018; Seaborn & Fels, 2015). Even as recently as 2023 has there been some contention in the definition of the term (Ciuchita et al., 2023; Deterding et al., 2011; Landers et al., 2018; Seaborn & Fels, 2015) and researchers need to be very explicit upfront regarding the definition that they ascribe their research to.

The objective of gamification is to leverage the motivational effects of game elements in other contexts to encourage engagement and support behaviour change (Deterding et al., 2011; Johnson et al., 2016; Landers et al., 2018; Sailer et al., 2017; Seaborn & Fels, 2015; Tondello et al., 2018). Considering gamification in this light, it should be noted that the effectiveness of gamification is context-dependent and design needs to take the underlying context into consideration (Cugelman, 2013; Landers et al., 2018). In other words, the gamification elements implemented need to be appropriate based on both the underlying behaviour and the individuals targeted (Cugelman, 2013; Landers, 2019; Landers et al., 2018). A "one-size-fits-all" approach is unlikely to have long-term positive outcomes and the observation has been made that individuals may respond to gamification techniques differently or that even the environment could impact how a gamified intervention is perceived (Hamari et al., 2014; Johnson et al., 2016; Krath et al., 2021; Seaborn & Fels, 2015; Tobon et al., 2020). This observation may be explained by further by social cognitive theory (Bandura, 2004), which introduces a triadic reciprocity between personal, behavioural and environmental processes, illustrated in Figure 8 below.

Figure 8 Triadic reciprocity between personal, behavioural and environmental processes



One can, therefore, consider gamification as a design strategy that relies on the underlying context and implementation, where outcomes are improved when the intervention is sufficiently grounded in theory (Landers, 2019; Tondello et al., 2018). Designers need to consider all these factors when applying game-design thinking to behaviour change interventions.

There is disagreement amongst researchers when they compare gamification to game-science (Klabbers, 2018). A significant critique comes in when designers simply layer game elements (especially points) on top of an existing structure without relating the elements directly to the underlying experience (Floryan et al., 2019; Landers, 2019). Frequently points are layered onto existing platforms in the hopes of driving engagement, and this has led to the term "pointification" (Landers, 2019). Merely layering elements does not elevate the experience or the motivational impact. Gamification needs to be a fully considered design philosophy that aims to enhance the underlying experience, rather than merely layering unrelated elements in the hopes of success.

ii Gamification frameworks

There is the common belief that there is no clear standard for implementing gamification techniques successfully (Krath et al., 2021; Lister et al., 2014). The range of definitions and game elements used in gamification design further emphasise this apparent lack of structure: while there is significant overlap, there is no consistent definition or definitive list of elements or mechanics (Cugelman, 2013; Floryan et al., 2019; Johnson et al., 2016; Landers et al., 2018; Lister et al., 2014; Miller et al., 2016; Sailer et al., 2017; Seaborn & Fels, 2015).

In the literature, some attempts have been made to present a framework for describing or assessing gamification in interventions (Cugelman, 2013; Floryan et al., 2019; Landers et al., 2018; Seaborn & Fels, 2015; Tondello et al., 2018; Warsinsky et al., 2021). While there is some overlap, each framework approaches gamification from a different perspective, reiterating that the study and implementation of gamification are context-specific and subjective. The lack of clear implementation frameworks highlights the importance of gamification design to take into account the target population as well as the appropriate underlying behavioural theories (Landers, 2019).

MDA Framework

A frequently used framework is the so-called "MDA framework" and refers to three components that make up gamification design: mechanics, dynamics and aesthetics (Armstrong & Lee, 2023; Deterding et al., 2011; Nortje & Lee, 2022) where these are fundamental in game design.

Game Mechanics

Mechanics refers to the tools or elements used during the design process (Kim & Lee, 2015). In other words, these are the building blocks that may be incorporated into an intervention or design. Table 2 below summarises the possible game mechanics that may be included, providing practical examples.

Table 2 Game mechanics used during gamification designs (Armstrong & Lee, 2023)

Game Mechanic	Further detail	Example
Badges / trophies / ribbons	Provides individuals with an indication of progress or achievement and may be used to reflect status or prestige. These are frequently issued as a "reward".	Apple Fitness allows users to earn badges based on engagement (e.g., first 5km), improvement (e.g., fastest 5km) or special events (e.g., World Yoga Day).
Gifting and charity	Gives players the opportunity to "gift" game elements to other players or to donate to real-world charities.	Vitality Active Rewards, the primary case site for this research, gives users the option to select charitable donations (MoveToGive) in lieu of a personal reward.
Leaderboards	Ranks users relative to each other based on the underlying game metric or other game features.	Strava ranks users on leaderboards for different run segments based on pace.
Levels	Proves an indication of either difficulty or progress within the "game" context. Individuals typically progress from one level to the next when they gain experience and improve. Indirectly, levels are an indication of engagement, proficiency, or progress.	Audible introduces levels based on total listening time, ranging from "Newbie" to "Master".
Meaningful stories	The introduction of narrative that is meaningful to the user to increase motivation to engage (Sailer et al., 2017). This mechanic is not related to performance or progress, but rather creates a way for the user to identify more personally with the target behaviour.	Habitica is an app-based habit-building and productivity app that uses role-playing elements to drive the narrative and encourage users to engage.
Missions (goals)	Traditional goal setting, in other words, a goal within the gamification context. Goals in a gamification context may or may not align with the requirements presented by goal setting theory (Tondello et al., 2018).	Vitality Active Rewards sets weekly points goals as the weekly "mission". E.g., earn 300 fitness points this week
Notifications	Game platforms may include mechanisms to notify individuals of key aspects within the platform. These can be related to achievements or to set reminders for users, amongst other factors.	Vitality Active Rewards gives users push notifications to inform them that they have achieved their weekly goals.
Personal design	Ability to personalise features, for example profile pictures, avatars or design of some game elements	Habitica, mentioned previously, has a personalised avatar, and allows users to customise their tasks, amongst other features.

Points	Points are a way of assigning a numerical value to an individual's progress when completing activities successfully and may be used as a feedback mechanism or even as a reward.	Vitality Active Rewards uses the Discovery Vitality points structure to assign value to tasks and track performance.
Unlocks	Often used as a reward at the end of a mission (goal), "unlocks" make something desirable in the game available, for example unlocking new ways of engaging, virtual goods, new levels, etc. These unlocked features may enable improved game play (e.g., new ways of engaging) or they may be more superficial (e.g., a new "skin" for the app).	Noom is a weight management app that "unlocks" new content, quizzes and levels as users engage and pass each level of proficiency.
Virtual goods	In-game digital objects that may or may not have value in a real-world context. These may be issued as a reward for successful completion of a mission.	In Habitica one may unlock or earn virtual goods such as armour for your avatar (further enhancing the personalisation aspects of the game)..
Visual progress	A visual display of progress within the game (e.g., towards achieving a mission). This may be through status bars, trackers, or some other visual mechanism.	In Vitality Active Rewards the iconic ring that "fills up" as members earn points is a visual way of tracking progress towards the weekly goal.

Many of these mechanics are suited to being implemented in combinations, for example, unlocks that provide individuals with virtual goods, or points that place individuals on a leaderboard. This research focuses on goal setting as the primary game mechanic.

Game Dynamics

Dynamics refers to the behavioural or psychological processes that are being affected or being stimulated by the game mechanics (Kim & Lee, 2015). Introduced in Section X of the Introduction (see p. 17), self-determination theory (Ryan & Deci, 2000) is frequently used as an underlying theory of motivation when evaluating gamification design (Krath et al., 2021; Sailer et al., 2017). It is possible to map each of the game dynamics to one of the motivational constructs required for self-determined regulation:

- Relatedness: Need for affiliation or connection. In a gamification context, this is supported by dynamics that enhance social interaction or expression.
- Competence: Need to feel capable and confident in one's ability. In a gamification context, this is supported by dynamics that create feelings of accomplishment in the game context.
- Autonomy: Need for individual freedom and control over one's choices. In a gamification context, this is supported by dynamics that allow for task volition or aligns with one's personal values and interests (Sailer et al., 2017).

In addition to these three constructs, the researcher includes self-actualisation (from Maslow's Hierarchy of Needs (Maslow, 1971) to better explain two of the dynamics

(Armstrong & Lee, 2023). Table 3 below summarises the game dynamics and the underlying psychological construct.

Table 3 Game dynamics used during gamification designs (Armstrong & Lee, 2023)

	Game Dynamic	Description
Relatedness	Collaboration	Frequently manifests in games as forming teams or other social constructs with the objective of working together to achieve a common goal.
	Community	Related to collaboration and speaks to constructs that allow participants to engage with each other through forming teams or being able to socialise through the game (for example, giving other participants "kudos" after completing a run in Strava).
	Altruism	Some games allow gifting and donations, either within the game specifically or more broadly related to real-world contexts such as charitable donations.
Competence	Reward	Rewards are commonly used to incentivise behaviour and are suited to gamification design. For example, earning virtual goods when achieving a goal or mission. The quantum and nature of the rewards depend on the underlying game platform and may influence both the motivational and behavioural reactions of the user.
	Status	This dynamic may relate to either personal status or status within the game, where status implies relative position with respect to other players or serve as a way to track personal progress compared to past engagement. For example, Vitality status is a proxy for the wellness of the member and is very focused on the individual's "success" (in terms of getting healthy) relative to the previous year.
	Achievement	Achievement is largely associated with goal setting. Reaching a goal stimulates a sense of achievement, with is motivational and enhances feelings of accomplishment or competence relative to the game behaviour.
	Progress	For example, progressing towards a goal (either implicit or explicit). Similar to achievement, seeing progress towards a target stimulates feelings of being capable.
	Competition	Some individuals are stimulated by competition and enjoy tracking their progress relative to others, with the underlying objective of "winning" compared to their peers.
	Collection	For example, of badges or other virtual goods within a game. Collection of items in a game context is frequently associated with rewards for achieving goals.
Autonomy	Self-expression	Some mechanics allow the user to express themselves within the game through personalisation, for example, personalised avatars.
	Volitional engagement	Some game elements introduce volitional engagement through allowing the user to select which elements to engage with. For example, selecting a goal that aligns closely with the user's values, rather than an assigned goal with little user input.

Self-actualisation	Surprise	Surprise and delight, most likely positive and meaningful in a gamification context, may enhance the underlying needs that contribute to feelings of self-actualisation and fulfilment. These features may contribute to the hedonic, or "fun", elements of the game.
	Exploration	The pleasure of exploring the game and uncovering various features (e.g., discovering and unlocking a new game level) can elevate the fundamental requirements that play a role in fostering a sense of self-actualization and fulfilment.

The Relationship between Game Mechanics and Game Dynamics

It is apparent that there is a relationship between the game mechanics and dynamics. Table 4 (Armstrong & Lee, 2023) below illustrates how closely game mechanics and dynamics are related.

Game Aesthetics

Aesthetics refers largely to the visual aspects of the platform (Armstrong & Lee, 2023). This research focuses predominately on game mechanics (most notably, goal setting) and game dynamics. However, the game experience is largely driven by aesthetics, since this is how the user accesses the game elements in general. Furthermore, aesthetics may contribute to aspects of the game design such as "meaningful stories" since these elements may manifest through the visual elements that users engage with. Research observes that motivation may be impacted by the appeal of the elements, in addition to the mechanics and dynamics (Johnson et al., 2016; Manzano-León et al., 2021; Seaborn & Fels, 2015). The researcher suggests that even practical aspects of a game (for example, the process of linking a wearable fitness device to track activity in the context of a physical activity gamification platform) would fall under the "game aesthetics" banner of the design, since these are journeys that the user engages with to enable core game features and this interaction still needs to contribute positively to the overarching game design. The qualitative research in Paper 4 identifies how fundamental game aesthetics are to the success of gamification design.

Table 4 Relationship between game mechanics and game dynamics

	Competence						Relatedness			Autonomy		Self-actualisation	
	Reward	Status	Achievement	Progress	Competition	Collection	Collaboration	Community	Altruism	Self-expression	Volitional engagement	Surprise	Exploration
Badges/trophies/ribbons	✓	✓	✓	✓	✓*	✓		✓*				✓*	✓*
Gifting and charity								✓	✓		✓		
Leaderboards	✓*	✓	✓	✓	✓			✓					
Levels	✓*	✓	✓	✓	✓*		✓*	✓*				✓*	✓*
Meaningful stories								✓*		✓	✓	✓*	✓*
Missions (goals)	✓		✓	✓	✓*	✓*	✓*	✓*		✓*	✓*	✓*	✓*
Notifications			✓*	✓*				✓*				✓*	
Personal design	✓*	✓*	✓*	✓*		✓		✓*		✓	✓	✓*	✓*
Points	✓	✓*	✓	✓	✓*	✓							
Unlocks	✓*		✓	✓		✓*						✓	✓
Virtual goods	✓	✓*	✓	✓		✓			✓*	✓		✓*	✓*
Visual progress		✓*	✓	✓	✓*								

Note: * These relationships are dependent on the game design, alternatively, they can be absent if the game has not designed for them.

iii Goal setting in a gamification context

Goal setting, also referred to as "missions" in a game context, is a frequently used game mechanic in gamification design contexts. The researcher previously introduced that gamification designs are most likely to be successful when the design is grounded in theory. The following sections introduce key concepts from goal setting theory as they apply within a gamification context. Goal setting is the focus for Paper 1.

Goal setting in the context of other game mechanics

Game mechanics that are frequently associated with goal setting include (but are not limited to) points, badges, and leaderboards. This combination of game mechanics is so iconic, that it may be referred to as the so-called "PBL triad" (Sailer et al., 2017). Points, badges, and leaderboards are frequently deployed in games and non-game contexts to reward players, indicate progress or achievements of sorts, or may even reflect status in the game. These mechanics provide the opportunity for both explicit and implicit goal setting within a platform (Landers et al., 2017; Tondello et al., 2018). Furthermore, these game mechanics provide a way for players to track their progress, or receive feedback, relating to the platform and their goal(s).

Feedback is one of the moderators of goal setting theory, which will be discussed in detail in Paper 1, and both game and non-game contexts rely strongly on feedback mechanisms to show progress in the game (and therefore the goal, where applicable) (Locke & Latham, 1979). Once again there may be a relationship between the underlying game mechanics. For example, leaderboards and points may be closely related in a gamification platform: points provide feedback to individuals based on their individual performance compared to their past self, whereas leaderboards provide feedback on overall progress relative to other participants by ranking individuals based on points accumulated (Sailer et al., 2017; Seaborn & Fels, 2015; Tondello et al., 2018). These feedback mechanisms give the participant a view of their progress relative to the underlying goal. Literature suggests that when individuals repeatedly reference these feedback mechanisms, they increase their commitment to the goal (which is another moderator for goal setting theory) (Tondello et al., 2018).

In addition to the game mechanics, which frequently overlap and provide either explicit or implicit goal setting and goal feedback, goal setting and feedback is frequently also represented through the visual elements and aesthetics of the game. As an example, Figure 5 above (see p. 16) illustrates goal setting within the case site, Vitality Active Rewards. The points goal/target is represented by a blue ring that needs to be "closed" or "filled up" each week. Points earned towards the weekly goal "fill" the ring and members have a clear view of how much time they still have left to achieve their goal.

Since many of these game mechanics are relatively easy to implement, there is a risk that designers add them to interventions without the supporting design strategies that are essential for successful gamification (Landers, 2019). It is essential to consider the impact of

game design elements on motivation, particularly within the specific context in which the elements are deployed. Using leaderboards as an example: it can be demotivating if there are consistently the same individuals at the top of the leaderboard (Seaborn & Fels, 2015). For those individuals who are always at the top the goal is no longer challenging, and for the rest of the participants the implied goal to be at the top of the leaderboard no longer seems attainable. Furthermore, an individual's position on the leaderboard is not always fully in the individual's control since it is somewhat contingent upon other participants' engagement. Therefore, removing some autonomy, reducing motivation further.

XII A CRITICAL REVIEW OF THE SUCCESS OF GAMIFICATION

Two questions that researchers frequently ask in gamification research are "Does it work?" and "How does it work?" The previous sections introduced gamification as a design strategy and discussed goal setting as a frequently used game element. This section reviews the success of gamification as a design strategy, focusing on its efficacy ("Does it work") and mechanics ("How does it work").

i Efficacy of gamification

There exist numerous literature reviews on the efficacy and success of gamification (Hamari et al., 2014; Hammedi et al., 2021; Krath et al., 2021; Sailer & Homner, 2020; Seaborn & Fels, 2015; Tondello et al., 2018), and a common thread between these and other literature is that there is little empirical evidence available regarding its success.

In an attempt to answer if gamification works, Hamari et al. (2014) reviewed gamification techniques implemented in a broad range of areas: learning, health promotion and data gathering amongst others, reiterating that it is a versatile tool with general applicability (Deterding et al., 2011; Seaborn & Fels, 2015). One of the notable observations is that there may be some contexts that gamification is better suited to than others (Hamari et al., 2014) and with the proliferation of app-based interventions, there are some elements that are simply easier to implement in this context (Cugelman, 2013; Floryan et al., 2019; Johnson et al., 2016; Lister et al., 2014). This observation highlights that the implementation of game-like elements needs to be appropriate based on the underlying context: both the behaviour that is being targeted, as well as the population impacted.

Since some game mechanics are easier to introduce than others (e.g., points), Floryan et al. (2019) introduced the need to differentiate between interventions that merely layer game elements on top of an existing platform (e.g. simply adding points to an activity) and interventions that incorporate game elements as an integral part of the intervention (e.g. goal setting incorporating points and leaderboards that link directly to engagement). Landers (2019) also discusses the importance of distinguishing between the superficial inclusion of game elements compared to a genuine gamification design approach. One cannot assume that the mere presence of game elements is sufficient to increase motivation (Cugelman, 2013; Floryan et al., 2019; Hammedi et al., 2021; Lister et al., 2014; Seaborn & Fels, 2015) – these elements need to be incorporated coherently and it is also essential to link the behaviour to a meaningful purpose appropriately (Floryan et al., 2019; Johnson et al., 2016).

Literature seems to be inconclusive whether or not gamification is successful (Cugelman, 2013; Floryan et al., 2019; Hamari et al., 2014; Hammedi et al., 2021; Johnson et al., 2016; Patel et al., 2017; Sailer & Homner, 2020; Seaborn & Fels, 2015). This lack of conclusive results may be due to poor implementation of the interventions, poor experimental design, or a combination of both.

ii Mechanics of gamification

Since gamification design is frequently utilised in an attempt to increase motivation (Hammedi et al., 2021; Johnson et al., 2016; Sailer et al., 2017; Tondello et al., 2018), it is sensible that researchers turn to theories of motivation and behaviour change to answer the question of how gamification works. One of the criticisms of "pure" motivation theories is that there is often a gap between intention and action, leading to limited or no behaviour change (Armitage & Conner, 2000) – it may well be that, when correctly implemented, gamification design helps to bridge that gap in practice.

Numerous game elements can be mapped back to theories of behaviour change or motivation (Floryan et al., 2019; Johnson et al., 2016; Krath et al., 2021; Richter et al., 2015; Sailer et al., 2017; Seaborn & Fels, 2015) and many researchers reference self-determination theory as their underlying framework, noting the importance of intrinsic versus extrinsic motivators. Sailer et al. (2017) completed an experimental study to investigate the effects of game design elements to improve motivation, focusing on self-determination theory. Key observations from the study were that the participant needs to be aware of the game elements for them to work as intended and the implementation of the components need to be appealing (Johnson et al., 2016; Seaborn & Fels, 2015). This observation highlights the importance of game aesthetics in gamification design.

Rewards and incentives are often included in interventions to improve behaviour due to the ease of introducing elements such as badges or virtual goods within a gamification design. These rewards "may not enhance engagement with an intervention if they are not directly linked to its overarching purpose" (Floryan et al., 2019, p. 1134). Tondello et al. (2018) further noted that when motivation relies solely on extrinsic rewards, the individual can lose sight of the importance of the underlying goal, which in turn harms goal commitment. Self-determination theory (Ryan & Deci, 2000) introduces this motivation continuum, described previously in Table 1(see p. 18). While intrinsic motivation is superior in driving behaviour change, it is possible for extrinsic elements to support more self-determined regulation if they foster autonomy, competence or relatedness (Ryan & Deci, 2000). If the rewards or incentives introduced into a gamification platform aligns with the user's underlying values, then they are more likely to be successful. While Johnson et al. (2016) imply that well-designed games can be intrinsically motivating there is a concern in the literature that gamification too frequently relies on extrinsic reward elements (Hamari et al., 2014; Hammedi et al., 2021; Johnson et al., 2016; Richter et al., 2015; Seaborn & Fels, 2015).

Research observes that motivation may very likely decrease when individuals perceive success as unobtainable. In a gamification context, a lack of success will likely be perceived

as “losing” against the game. Especially if the reason for not attaining a goal is perceived as out of the individual’s control it is more likely that the user will disengage or that the user will try cheat the system (Donovan & Williams, 2003; Mazar et al., 2008; Seaborn & Fels, 2015). This observation is consistent with goal setting theory, where goals must still be perceived as achievable, even when they are challenging. Despite goal setting theory being a well-accepted motivational theory (Ambrose & Kulik, 1999; Locke & Latham, 2019) and gamification designs frequently deploying goals or missions to drive behaviour, there is little empirical research combining these tools in interventions or broad studies (Landers et al., 2017). Researchers have observed that gamification interventions employing goals are seldom grounded in goal setting theory (Tondello et al., 2018), explaining why goals in gamification platforms may not always perform as expected (Latham, 2016; Locke & Latham, 2002, 2006, 2019).

iii Limitations of gamification design

It is clear that gamification design relies on numerous factors to be successful. Despite the mixed results from evaluating the efficacy of gamification platforms, it is clear that this is a design strategy that will remain in use (Research and Markets, 2024). It is, therefore, necessary to understand how to design these platforms to ensure long-term efficacy.

Some of the challenges in researching gamification are that there are often limitations in the underlying experimental design and there is a lack of theoretical understanding (Hamari et al., 2014; Sailer et al., 2017; Seaborn & Fels, 2015; Tondello et al., 2018) – “A large majority (87%) of applied gamification research did not mention or address theoretical foundations” (Seaborn & Fels, 2015, p. 27). Other frequently mentioned design flaws include inconsistency of definitions used, lack of theory as a foundation, gaps between theory and practice, lack of comparative or longitudinal designs (Seaborn & Fels, 2015), the lack of appropriate control groups and multiple game elements included per study making it difficult to isolate the effect of these elements (Johnson et al., 2016). The mixed results in gamification research may also be due to the context-specific nature of gamification and poorly implemented platforms that do not apply the necessary design thinking (Landers, 2019; Seaborn & Fels, 2015).

In the process of understanding “Does it work?” and “How does it work?” gamification researchers reiterate that for interventions to be successful, they need to be grounded in theory (Cugelman, 2013; Landers, 2019; Patel et al., 2017). Landers et al. (2018) observed that when researching the effects of gamification, one needs both the theoretical knowledge of the underlying behavioural theories as well as the practical understanding of a game designer. In an earlier literature review, Seaborn and Fels (2015) made a similar suggestion that during the design process of gamified interventions experts in the underlying fields (e.g. psychologists or behavioural economists) should be included. Apps and other digital interventions frequently include gamification due to its scalability as a design approach (Lister et al., 2014; Research and Markets, 2024). Reviews of gamification show that despite the need for theoretical rigour, the interventions seldom apply behaviour change theories appropriately, and when there are theory-based elements included, these elements are

frequently implemented weakly (Cotton & Patel, 2019; Cowan et al., 2013; Edwards et al., 2016; Lister et al., 2014).

XIII CONCLUSION

The introductory section of the thesis focused on introducing the thesis as well as introducing the case site and fundamental theoretical concepts. The following chapter presents the first paper, which reviews the literature of goal setting theory as it relates to this study and introduces a novel model for improved goal framing that formalises the recommended framing approach based on an individual's underlying psychological states.

Paper 1.
Goal Setting in Gamification: Towards a Formal and Expanded Theory

The objective of Paper 1 is to review goal setting theory literature to inform the hypotheses tested by the field experiment presented in Paper 2. This research presents a novel theory that introduces an expanded approach to goal framing in the context of gamification design based on an individual's starting psychological states. The focus is specifically on self-efficacy and motivation, examining these states relative to the behaviour targeted by the goal.

Briefly, goal setting theory introduces goals as specific and challenging, while still being achievable to improve future performance and enhanced motivation to engage in the targeted behaviour (Locke & Latham, 1979, 2002). Literature describes four moderators to goal setting that are essential for the goal to be successful. These moderators are: goal commitment, ability, feedback and task complexity (Latham, 2016). Furthermore, to improve outcomes, literature describes two primary framing approaches in goal setting: performance framing and learning framing, and describes when each would be most appropriate (Seijts & Latham, 2005; Seijts et al., 2004). Despite literature differentiating between performance and learning framed goals, design strategies in practice (including gamification design) tend to focus on performance framing even when a challenging learning framed goal may be more effective (Locke & Latham, 2002; Seijts & Latham, 2005; Seijts et al., 2004; Swann et al., 2023; Tondello et al., 2018).

1.1. THE THEORETICAL FOUNDATIONS OF GOAL SETTING

Discussed previously in the introductory section of this thesis, there are two types of theories relating to motivation: those that explore "how to" motivate individuals, and those that describe "what" motivation is (see p. 16). Within the practical category of theories there are multiple theories that use goals to improve motivation, including, but not limited to, expectancy theory (Vroom et al., 2015), social cognitive theory (Bandura, 1991), and achievement goal theory (Elliot et al., 2018). This research focuses on goal setting theory as introduced by Locke and Latham (1979).

According to goal setting theory (Locke & Latham, 1979, 2002, 2019), a specific and challenging, but achievable, goal leads to better outcomes than a specific easy goal, a broad "do your best" goal or no goal. If a goal does not align with these requirements (specific, challenging, and achievable), then it does not align with goal setting theory as introduced by Locke and Latham (1979), and the outcomes may not be as expected.

Goal setting theory has been used extensively in practice across a range of contexts and industries, including within an organisational context, within health behaviour change and education (Locke & Latham, 1979, 1985, 2002, 2006, 2019).

An accepted proposition in goal setting literature can be presented as:

> **Proposition 0: Goal setting is associated with higher goal performance than when there are no goals set.**

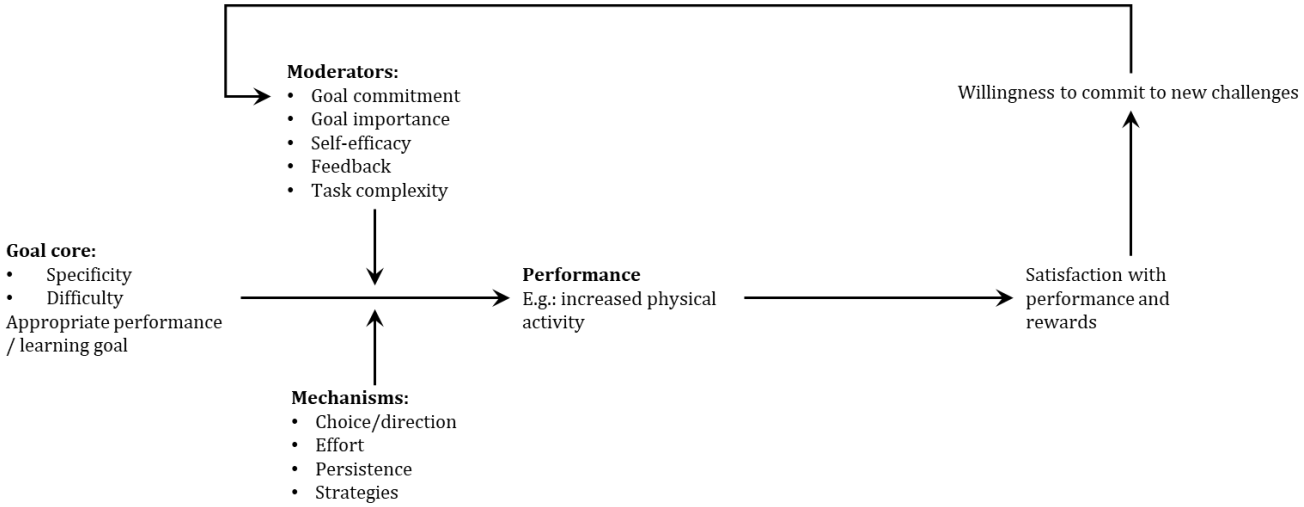
P_0 is not a focus area of this research, and it is assumed that goal setting is successful at driving positive outcomes when the goals are appropriately set. This proposition is included for completeness.

1.1.1. Mediators of goal setting theory

Goal setting theory describes four mediators that provide clarity regarding the effectiveness of goal setting in improving performance. Appropriate goal setting leads to increased performance by (1) expanding the *effort* an individual applies to achieve the goal, (2) focusing and orienting an individual's *choice/direction* of attention, (3) increasing *persistence* and (4) encouraging participants to adjust their *strategy* or gain more *knowledge* (Latham, 2016; Locke & Latham, 2019; McEwan et al., 2016; Schunk & DiBenedetto, 2020; Swann et al., 2021; Tondello et al., 2018).

Figure 9 below illustrates this relationship between the goal set, outcomes (i.e., increased performance), and the mediators and moderators of goal setting. This view assumes that the goal has been set appropriately based on the individual's abilities, interests, and values (Locke & Latham, 2002).

Figure 9 Essential elements of goal setting theory and the high-performance cycle



These mediators are related to the requirements of goal setting theory and the researcher employs self-determination theory (Ryan & Deci, 2000) as a foundational motivational framework to elucidate the efficacy of appropriate goal setting.

A. Effort and choice

A specific goal invokes an element of *choice* to participate in the goal: a goal that is sufficiently specific is autonomy-supporting, since there is a clear decision made by the individual to

pursue the goal whereas a less clear goal would open questions regarding what the individual has committed to. Autonomy-promoting structures may lead to an increase in self-determined motivation to engage in the behaviour or task required. A challenging specific goal increases feelings of autonomy further since the challenging goal is more likely to stimulates an increase in *effort* compared to an easy goal, where the heightened effort is contingent upon the individual's discretion in determining the requisite exertion to accomplish the goal.

B. Persistence and knowledge

A specific goal encourages an individual to *persist* until the goal has been achieved. The specific nature of the goal provides individuals with a clear definition of success compared to a more general, "do your best" goal where it may likely be more challenging to measure progress or success. This persistence and ability to clearly assess progress is competence-promoting and therefore may lead to an increase in self-determined motivation. A challenging specific goal likely requires the individual to apply previous *knowledge/strategy* to ensure goal attainment compared to easier goals that may not require as much thought. This deployment of effective strategy to ensure goal achievement increases feelings of competence even more, especially if the individual is successful in achieving the goal.

1.1.2. Moderators of goal setting theory

Furthermore, goal setting theory introduces four moderators (Locke & Latham, 2002, 2019; Tondello et al., 2018): (1) ability, (2) task complexity, (3) feedback, and (4) goal commitment. Goals aligning with the requirements introduced by goal setting theory (specific, challenging, achievable) have been proven to be a successful and repeatable approach leading to improved outcomes. When the results are not as expected it is usually because these moderators have not been appropriately considered (Latham, 2016; Locke & Latham, 2002).

Similar to the mediators of goal setting described previously, the moderators may be connected to self-determination theory to provide an improved understanding of the underlying theory.

A. Ability, task complexity and feedback

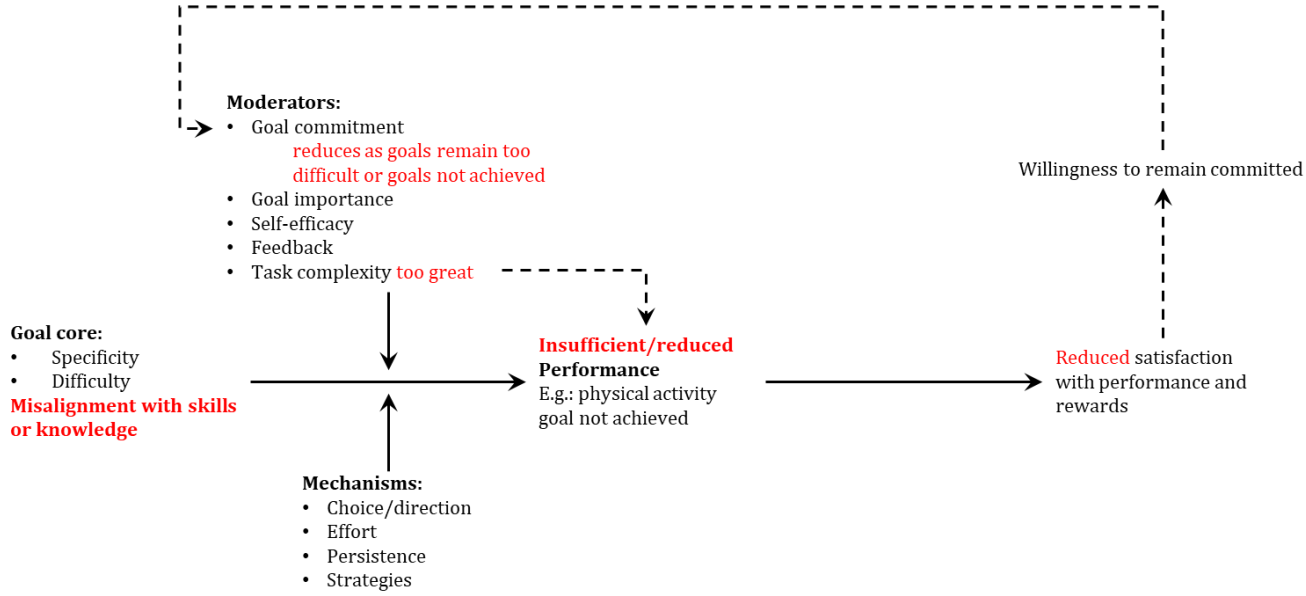
Goal setting theory requires effective goals to be specific and challenging. How challenging a goal is perceived is related to the underlying ability or skill of the goal recipient. If an individual is familiar with the underlying activity and is able to achieve the goal, then a challenging goal that is within the individual's abilities to achieve the goal promotes feelings of confidence and increases the individual's motivation to complete the activity. However, if the individual is unable to achieve the goal due to insufficient skill, then the increase in effort promoted by the goal is not guaranteed to result in success which will negatively impact the individual's feelings of competence and, therefore, negatively impacts motivation.

Related to ability, if goals are perceived too complicated or difficult to achieve, then the improved performance usually associated with goal setting is diminished. As task complexity increases the goals either need to be broken up into smaller goals, the individual first needs

to attain the necessary skills to achieve the goals, or the individual needs the perception that they have sufficient autonomy over their strategy to achieve the goal. If goals are consistently not achieved, for example, in an iterative goal setting framework, the individual's willingness to remain committed may very likely reduce and the goal may no longer be sufficient at driving improved outcomes until the goal is appropriately revised (Donovan & Williams, 2003). It is plausible that this increased task complexity challenges the individual's feelings of competence and autonomy relating to the task, thereby reducing motivation to engage in the goal activity.

Figure 10 below illustrates how the performance cycle introduced previously might break down if, as an example, task complexity becomes too great. The sections in red exemplify instances wherein the model may cease to maintain its validity.

Figure 10 Goal setting theory and the high-performance cycle when goal is set incorrectly



Feedback relating to goal progress and achievement promotes feelings of competence by highlighting the individual's skill relative to the goal. Incorporating feedback mechanisms is a key strategy that gamification designers can employ to increase the positive outcomes of goal setting (Armstrong & Lee, 2023).

B. Goal commitment

Goal commitment is largely associated with an individual's feelings of autonomy to engage with the goal and is influenced by how closely the goal aligns with an individual's values. Based on both self-determination theory and goal setting theory goals that are personally meaningful are more likely to be motivating and lead to the increased effort associated with improved performance due to goal setting (Latham, 2016; Ryan & Deci, 2000).

1.1.3. Goal setting theory as it relates to gamification

Both games and non-game contexts frequently use goals to enhance performance (Deterding et al., 2011; Landers et al., 2018; Tondello et al., 2018). One can only consider gamification platforms as using Locke and Latham's (1979) goal setting theory as an underlying motivational framework if the goals conform to the underlying principles described (Tondello et al., 2018). In other words, the goals must be specific and challenging, while still being achievable.

Extant literature shows that goal setting theory works with self-set goals, assigned goals and goals set collaboratively between the individual and an external party (Locke & Latham, 2019). Goal setting also works with both explicit and implied or subconsciously primed goals (Locke & Latham, 2002). Within a gamification context, the goals are either externally set through the underlying platform (e.g., in the case site for this research, the weekly goals are set by the Vitality Active Rewards game), or they are implicit through other game mechanisms (e.g., to be at the top of a leaderboard or to attain a certain level)(Landers et al., 2017).

The previous section introduced the moderators of goal setting theory: ability, task complexity, feedback, and goal commitment. When goal setting performs poorly at driving motivation it is most likely because the goals disregard the moderators in some fundamental way (Latham, 2016; Locke & Latham, 2002, 2019; Seijts & Latham, 2005).

In a gamification design context, many of the game mechanics address the moderators highlighting that goal setting theory is a complementary motivational theory within gamification design. For example, game levels are an effective way of ensuring that task complexity is scaled based on player ability and that goals become progressively more difficult as the player "levels up".

1.2. FRAMING WITHIN GOAL SETTING

Based on the moderators of goal setting, for goals based on the requirements of goal setting theory to have the expected results, it assumes that the individual has the required skill or knowledge to achieve the goal and the individual needs to perceive their skill as sufficient, relative to the complexity or difficulty of the goal, to achieve the goal. In the case where an individual does not have the necessary skills to complete the task, or does not perceive the task as achievable, results are unlikely to be as expected. This section expands on the importance of the moderators and introduces how appropriate framing may be used to improve outcomes in goal setting.

Literature introduces two primary approaches to framing goals, performance framing versus learning framing, and provides guidelines on when each would be most appropriate (Seijts & Latham, 2005). Regardless of the framing approach, the goals should still be specific, challenging and adhere to the broader principles of goal setting theory (Locke & Latham, 2002; Seijts & Latham, 2005; Swann et al., 2021). These framing approaches relate to similar concepts within the other theories relating to motivation and goal setting (for example,

achievement goal theory) and may also be referred to as "performance goals" and "mastery goals". In essence, performance goals refers to goals that demonstrate competence and learning or mastery goals refers to goals that encourage developing competence (Senko et al., 2011).

1.2.1. Fundamentals of goal framing

Typically, performance framing in goal setting is most appropriate when "an increase in effort and persistence is required" (Seijts & Latham, 2005, p. 124). Performance framed goals are effective in simple activities where the individual has high self-efficacy (Seijts et al., 2004). When an individual does not have the ability required to achieve the goal or when task complexity is too high then performance framing is less likely to demonstrate the desired increase in performance and motivation (Locke & Latham, 2006; Seijts & Latham, 2005; Seijts et al., 2004). In these settings, an increase in effort may not be sufficient to guarantee success, and a performance framed goal may even be detrimental.

Learning framed goals facilitate mental processes that lead to improved future performance, including enhanced planning (Locke & Latham, 2006). A critical difference between learning and performance framed goals is that learning goals are appropriate when the desired outcome is the "acquisition of knowledge and skills". Learning framed goals enable individuals to acquire skills which lead to an increase in their confidence related to the goal behaviour (Sullivan & Strode, 2010). In studies focusing on motivation in education, researchers observed that learning framed goals could foster sustained motivation (Schunk & DiBenedetto, 2020).

If an individual is required to participate in an activity that they are not ready for yet (e.g. due to insufficient skill), then their motivation is likely primarily extrinsic, falling under external or introjected regulation (Ryan & Deci, 2000), which is liable to result in suboptimal outcomes. This aligns with what is seen in goal setting theory where individuals display lower levels of success with performance framed goals when they do not have the required skill levels, or the task is too complicated (Seijts & Latham, 2005). Therefore, introducing learning framed goals to increase ability before progressing to performance framed goals is in line with both goal setting theory and self-determination theory.

A related concept is that of a process goal, where the individual has a set series of tasks to achieve the desired outcome and in some scenarios, can be similar to learning goals (Swann et al., 2021). Armitage and Conner (2000) introduced Gollwitzer's implementation intentions as one of the behavioural enaction models, which introduces the distinction between goal and implementation intentions. This theory suggests that behaviour change is more likely if one pairs goal intentions with implementation intentions and when the participants plan before the intervention. Learning or process goals are complementary to this concept of setting implementation intentions as they also focus on the planning/strategy aspect of goal setting as opposed to the performance aspect.

Research has shown that in a performance setting individuals are "sensitive to discrepancies between their current levels of performance and their goals" (Donovan & Williams, 2003, p.

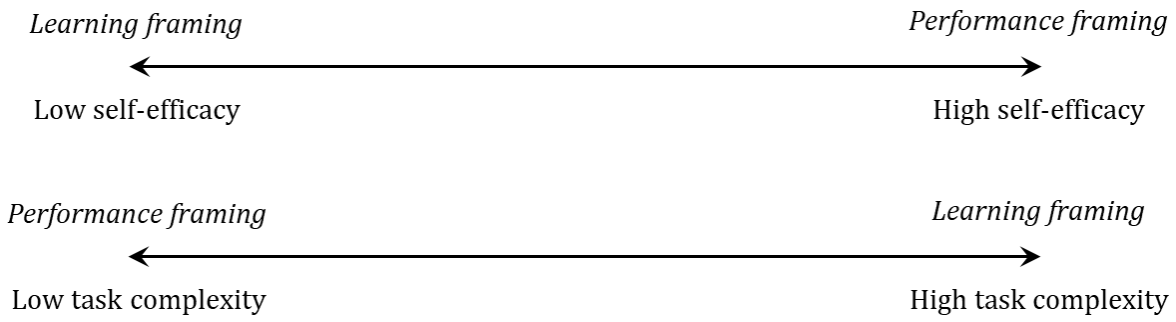
387). It would be informative to investigate if individuals show similar sensitivities in a learning setting where the focus is no longer purely on performance but the acquisition of skills. In a performance context, continuous failure may lead to disengagement over time, but this might not be the case in a learning context where the focus is on growing one's skills to be better equipped to attain future performance. If an individual perceives the learning goal as a way of ensuring future success, despite initial failure, there may be a higher tolerance to continue engaging with the task.

Individuals may have an inherent bias towards either a performance or learning orientation (Seijts et al., 2004). Those who are more learning oriented may be more attracted to tasks which focus on developing new skills whereas those who are more performance oriented may avoid these and prefer tasks where they can prove their abilities (Locke & Latham, 2006). This goal orientation explains the reasons behind wanting to attain a goal and should not be confused with the type of goal setting during an intervention (Schunk & DiBenedetto, 2020; Seijts et al., 2004). This research does not explicitly consider goal orientation and focuses on framing in goal setting.

1.2.2. The current view of optimal framing

From the previous section, it is clear that appropriate framing may be used to address the moderators of self-efficacy and task complexity. Based on the current view of goal setting theory, the recommendation on which goal framing approach to use can be summarised graphically in Figure 11 below.

Figure 11 Optimal framing approach based on self-efficacy and task complexity

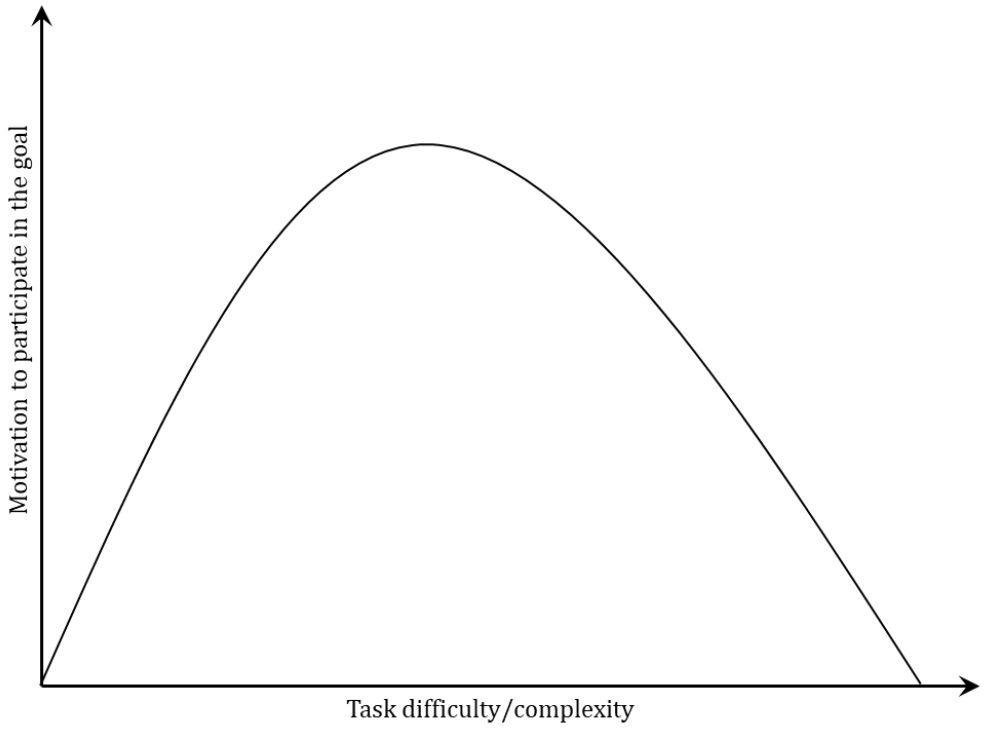


It is possible to quantify self-efficacy based on appropriate research scales and further guidelines exist on constructing such self-efficacy scales (Bandura, 2006; Everett et al., 2009). In contrast, task complexity, or goal difficulty, would largely be based on an individual's perception of the task, driven by their underlying skills/ability, rather than a standardised concept. It is of value for the purposes of this study to understand if an alternative, measurable psychological state may be considered as an outcome of task complexity.

Self-determination theory (Ryan & Deci, 2000) provides a reasonable framework to introduce this alternative psychological state. When task complexity exceeds an individual's

skills or ability relating to the goal one may reasonably assume that it will lead to reduced feelings of competence, thereby reducing the individual's levels of self-determined motivation. When task complexity is at an optimal level compared to an individual's skills or ability then achieving the task is likely to promote feelings of competence, thereby increasing the individual's levels of self-determined motivation. When task complexity is lower than an individual's skill level it is unlikely that achieving such a task would have a meaningful impact on feelings of competence and therefore on self-determined motivation – in a goal setting context it would be most appropriate to reevaluate the goal. Figure 12 below is a likely representation of the relationship between task complexity/difficulty and motivation. For the purposes of this study, the researcher will use self-determined motivation as an outcome of task-complexity through appropriately developed scales (Murcia et al., 2007).

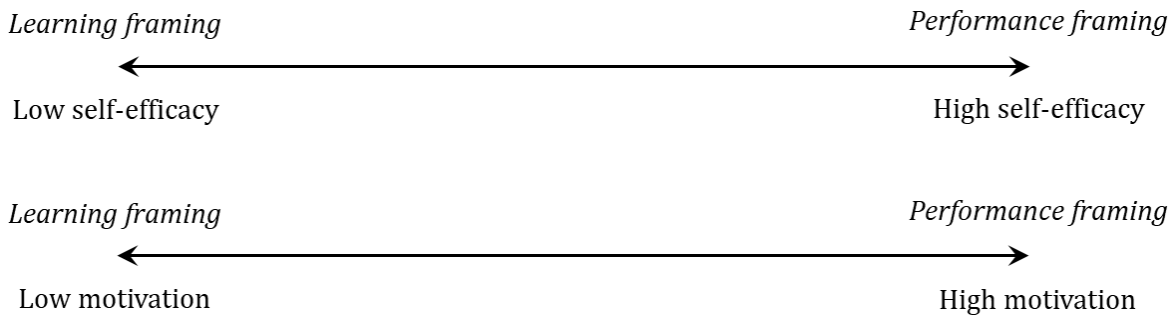
Figure 12 Relationship between task complexity/difficulty and motivation to engage in the goal behaviour



When task complexity/difficulty is optimal and promotes motivation, it is reasonable that a performance framed goal will be appropriate. When task complexity/difficulty is too great and does not promote motivation, then a learning framed goal is expected to be more appropriate. Learning framing encourages the individual to develop the required skills and strategies to increase the likelihood of achieving the task, thereby promoting future feelings of competence, and building future motivation. The scenario where motivation is low due to a task that is too simple/easy is not considered since the more appropriate response is to reevaluate the goal and set a sufficiently challenging goal, per the foundations of goal setting theory (Latham, 2016; Locke & Latham, 1979, 2002, 2006, 2019).

Figure 13 below illustrates the updated proposal of the goal framing approach based on self-efficacy and motivation.

Figure 13 Optimal framing approach based on self-efficacy and motivation



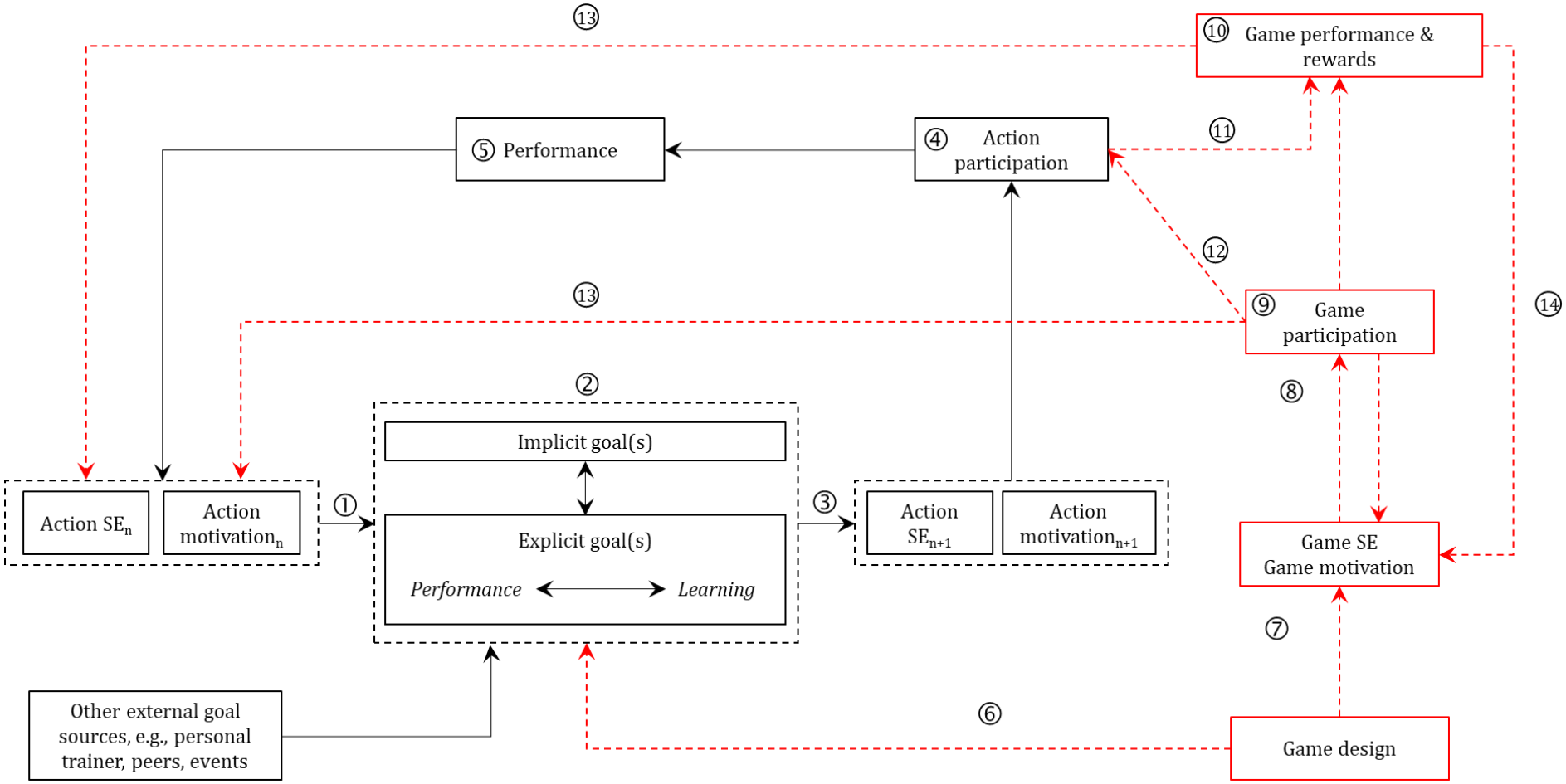
1.2.3. A novel approach to goal framing

Based on task complexity (where the study measures motivation) or self-efficacy, assessed independently, it is clear when to implement performance versus learning framed goals as illustrated in Figure 13 above. Figure 14 below introduces a new model for considering goal setting within a gamification design context and demonstrates the positivist goal setting view (i.e. the "what is" scenario). The portions of the framework in red relates to the gamification design aspects of the broader framework and are discussed in more detail in Paper 3. The portions in black relate to goal setting and will be discussed in detail in this section.

For the remainder of this research when discussing this model, "game" refers to the resulting platform of the gamification design, although in general, the end-product does not always have to be a game (Landers et al., 2018). Furthermore, for the purposes of this study, the researcher differentiates between "action" self-efficacy and motivation (speaking to the underlying behaviour) and "game" self-efficacy and motivation (speaking specifically to game participation) since individuals can have external, implied goals (either self-set or collaboratively set) over and above the goals presented by the game. Paper 1 focuses on the "action" psychological states.

Considering the positivist framework below, Path 1 shows the relationship between the individual's starting self-efficacy and motivation and the goal. Within a gamification context, the participant's starting self-efficacy and motivation wouldn't impact the explicit goals set through the game as this is set extraneously through the platform. However, these starting states may affect the individual's perception of the goal as well as any implicit goal that the user may have set for themselves in addition to the game goal, indicated by Item 2 corresponding to the goals. Based on current guidelines, the goal(s) will be either performance or learning framed. This goal, and how it is framed, influences the individual's subsequent self-efficacy and motivation (represented by Path 3).

Figure 14 Goal framing in gamification design based on starting psychological states – positivist model



Depending on how successfully the goal was set, the subsequent state may improve or decline. The individual's self-efficacy and motivation at n+1 impacts action participation (Item 4), which consequently impacts performance (Item 5). Performance, either positive or negative, affects the individual's subsequent self-efficacy and motivation for future iterations of the goal.

Particularly in a gamification context where goal setting likely occurs in repeated cycles, this new self-efficacy and motivation is then the starting state for the next cycle. This cyclical view of goal setting is also a likely scenario for unpacking long-term goals into smaller, short-term goals (Donovan & Williams, 2003; Locke & Latham, 2006).

The current approach to framing in goal setting considers the starting states in isolation, and there are no guidelines on how to appropriately frame goals based on the interaction between self-efficacy and motivation. There are indications that improved outcomes may be achieved by combining learning and performance goals or phasing the goals (Sullivan & Strode, 2010; Swann et al., 2020; Swann et al., 2023; Swann et al., 2021). A great deal of research is available on goal orientation; however, there is not as much literature available contrasting learning, process, and performance goals outside of education, academic or management contexts. It appears that practical interventions, including in gamification design, still focus predominately on performance framed goals as the norm (Swann et al., 2020; Swann et al., 2023; Swann et al., 2021; Tondello et al., 2018).

This observation leads to the primary hypothesis that the field study presented in Paper 2 tests.

> **Hypothesis 1: There is an interaction between self-efficacy and motivation in goal setting in gamification design such that goal framing impacts subsequent action participation and performance.**

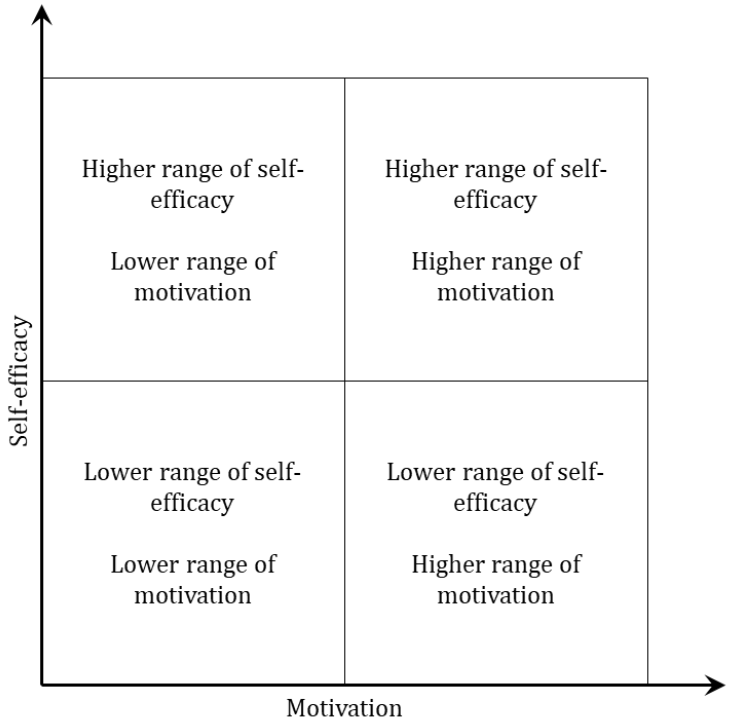
The following sections will expand on this hypothesis, considering the interaction between the starting states, based on Figure 15 below.

A. Pure framing

Where an individual has higher/lower levels of both self-efficacy and motivation the optimal framing is more straightforward and traditional framing may be used. For the purposes of the thesis, traditional performance or learning framing will also be referred to as "pure framing".

Where an individual has high levels of self-efficacy and motivation research indicates that performance framing will be most appropriate (Seijts & Latham, 2005; Seijts et al., 2004). In this scenario, individuals are likely comfortable with the underlying task (indicated by high levels of self-efficacy) and the task is likely suitably difficult, while still perceived as achievable (indicated by high levels of motivation), therefore, the traditional performance approach to goal setting is sufficient to lead to improved outcomes.

Figure 15 Interaction between self-efficacy and motivation



Where and individual has lower levels of self-efficacy and motivation research indicates that learning framing will be most appropriate (Seijts & Latham, 2005; Seijts et al., 2004). In this scenario, individuals are likely less familiar with the underlying task or do not have the necessary skills (indicated by low levels of self-efficacy) and the task is likely perceived as too difficult to achieve (indicated by low levels of motivation). Learning framing has been shown to be successful when it is necessary for an individual to develop the necessary skills or strategy to make goal achievement possible. The focus on skill development supports the lower levels of self-efficacy and motivation, compared to a performance approach which may be detrimental.

These observations regarding pure framing leads us to expand the hypothesis to consider the relationship between self-efficacy and motivation where both states are at the same levels (in other words, both are at higher/lower levels).

> **Hypothesis 1a: Individuals with simultaneously higher/lower self-efficacy and motivation will respond to greater/less performance content with greater subsequent action participation and performance.**

B. Hybrid framing

Where an individual has the psychological states at opposite levels it appears that the most effective framing approach becomes less straightforward. In other words, where an individual has higher/lower levels of self-efficacy and lower/higher levels of motivation there is a question around which state should be prioritised to inform the most appropriate

framing for the goal. In these scenarios the researcher proposes a new strategy to goal framing that considers a "hybrid" framing approach. In this hybrid approach there is still a bias towards either performance or learning, with a secondary layer that introduces the alternative framing to support the interaction between the psychological states.

In the scenario where an individual has lower levels of motivation and higher levels of self-efficacy it is likely that although the individual has the necessary skills to complete the task (indicated by higher self-efficacy), the task is nonetheless perceived as unachievable (indicated by lower motivation). An example in practice using the Vitality Active Rewards case site (see p. 15) is where an individual's goal level has increased to a level that exceeds their degree of comfort. By virtue of attaining a higher goal level the individual has demonstrated that they are able to achieve the necessary physical activity, however, the new goal likely requires them to develop alternative strategies to achieve the goal. In this scenario, since self-efficacy is already in place, additional framing that encourages an increase in motivation is required. The higher levels of self-efficacy implies that the individual likely doesn't need assistance with the underlying behaviour (in this case, physical activity) and a performance focus is still appropriate to encourage an increase in effort traditionally associated with goal achievement (Seijts & Latham, 2005; Seijts et al., 2004). A secondary layer that supports learning is likely necessary to enable the individual to revise their previous strategy, thereby resulting in goal attainment. Therefore, the recommended hybrid framing approach for individuals with lower levels of motivation and higher levels of self-efficacy is hybrid framing with a performance bias.

> **Hypothesis 1b: For individuals with higher self-efficacy but lower motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a "hybrid" goal composed of greater performance and lesser learning content leads to the best outcomes and deviations from this reduces outcomes.**

In the scenario where an individual has higher levels of motivation and lower levels of self-efficacy it is likely that despite a lack of underlying skill or knowledge of the task (indicated by lower levels of self-efficacy) the individual perceives the goal as sufficiently challenging and attainable (indicated by higher levels of motivation). It is most likely that this is the scenario where the goal is newly set or where the individual is new to the platform. It is unlikely that this combination of psychological states will persist over an extended time: either the individual will learn the necessary skills to increase their self-efficacy, or a lack of goal attainment will lead to a reduction in motivation. An example in practice using the Vitality Active Rewards case site is where an individual is new to the platform and still needs to learn how to achieve their weekly physical activity goals. In this scenario the lower levels of self-efficacy indicates that an increase in effort alone is not sufficient to lead to goal achievement and it is most necessary for the individual to acquire the underlying skills required to achieve the goal (Seijts & Latham, 2005; Seijts et al., 2004). Pure learning may contradict the individual's perception that the goal is attainable and a secondary performance focus builds on the motivation already in place. Therefore, the recommended

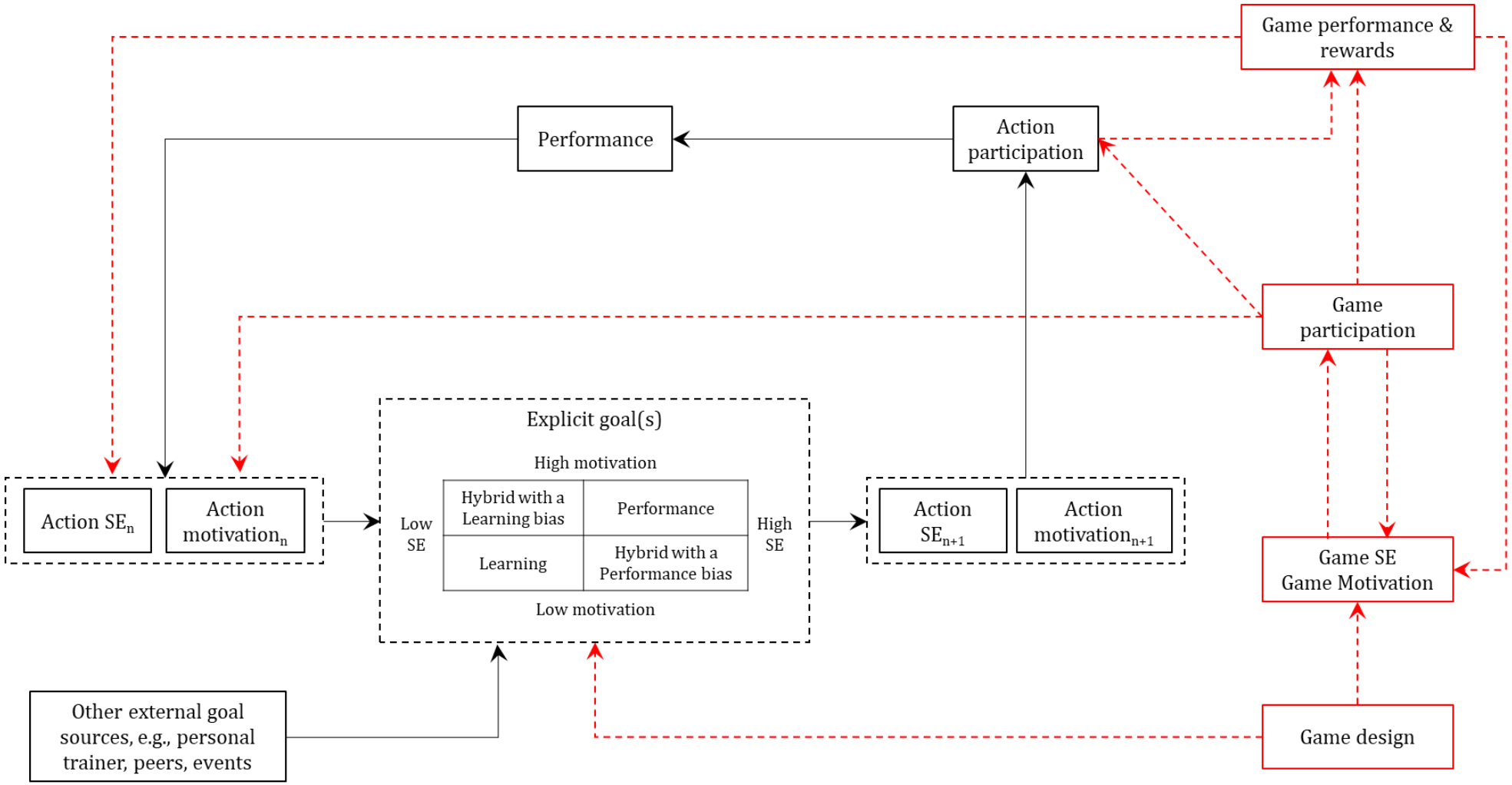
hybrid framing approach for individuals with higher levels of motivation and lower levels of self-efficacy is hybrid framing with a learning bias.

> **Hypothesis 1c: For individuals with lower self-efficacy but higher motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a "hybrid" goal composed of greater learning and lesser performance content leads to the best outcomes and deviations from this reduces outcomes.**

Figure 16 below reproduces the initial model introduced at the onset of this section to illustrate the normative framework (i.e. the "should be" scenario) for goal framing within a gamification design context.

Paper 2 presents a field experiment that tests hypotheses 1a-1c, focusing on the effects of goal framing on subsequent performance.

Figure 16 Goal framing in gamification design based on starting psychological states – normative model



Paper 2.
The Effect of Goal Framing in Gamification:
A Field Experiment

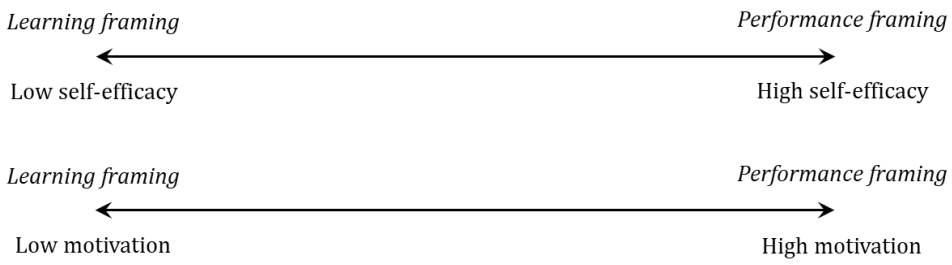
Paper 1 presented a literature review focused on goal setting theory: a practical, motivational framework that is widely believed to be of value in gamification design (Krath et al., 2021; Nuijten et al., 2022; Patel et al., 2021; Tondello et al., 2018). Paper 1 developed a new, extended model for goal framing based on an individual's underlying psychological states. Paper 2 now presents a field experiment that tests the hypotheses presented in Paper 1.

The following section briefly reviews the theoretical framework and repeats the hypotheses developed in Paper 1. Thereafter, Paper 2 describes and presents the findings of the field experiment conducted.

2.1. REVIEW OF PAPER 1'S THEORETICAL FRAMEWORK

Paper 1 introduced goal setting theory (Locke & Latham, 1979, 2002, 2006, 2019), which describes goals that are specific and challenging, while still being achievable, as most likely to lead to successful outcomes. There are four moderators of goal setting theory, that when not considered appropriately may lead to suboptimal outcomes. These moderators are ability, task complexity, goal commitment and feedback. This research focuses on ability (measured by self-efficacy) and task complexity (measured by motivation). One way to optimise the impact of the goal based on an individual's self-efficacy and motivation is through appropriate goal framing. Paper 1 introduced the distinction between performance and learning framed goals, indicating when each is likely appropriate based on underlying task complexity or the individual's self-efficacy (Açıkgöz & Latham, 2022; Jeong et al., 2023; Locke & Latham, 2006; Seijts & Latham, 2005; Seijts et al., 2004; Swann et al., 2023; Swann et al., 2021), illustrated by Figure 17 below.

Figure 17 Optimal goal framing based on self-efficacy or motivation



Despite the difference between performance and learning goals, in practice and especially in gamification design, practitioners tend to focus on performance framing (Tondello et al.,

2018), as is evidenced by the lack of research on explicit learning framing in a gamification context outside of education (where the primary objective is learning) or in workplace motivation strategies (where tasks are frequently more complicated) (Seijts & Latham, 2005). Upon further investigation, it is apparent that goal setting in gamification design is more likely to deploy a self-set or implicit goal strategy (e.g., through leaderboards) over alternative framing approaches (Krath & von Korflesch, 2021; Patel et al., 2021; Schmidt-Kraepelin et al., 2020). To address this shortcoming, Paper 1 introduced the following overarching hypothesis.

> **Hypothesis 1: There is an interaction between self-efficacy and motivation in goal setting in gamification design such that goal framing impacts subsequent action participation and performance.**

This hypothesis may be refined even further to consider the relationship between these psychological states. Relating to traditional performance or learning framing:

> **Hypothesis 1a: Individuals with simultaneously higher/lower self-efficacy and motivation will respond to greater/less performance content with greater subsequent action participation and performance.**

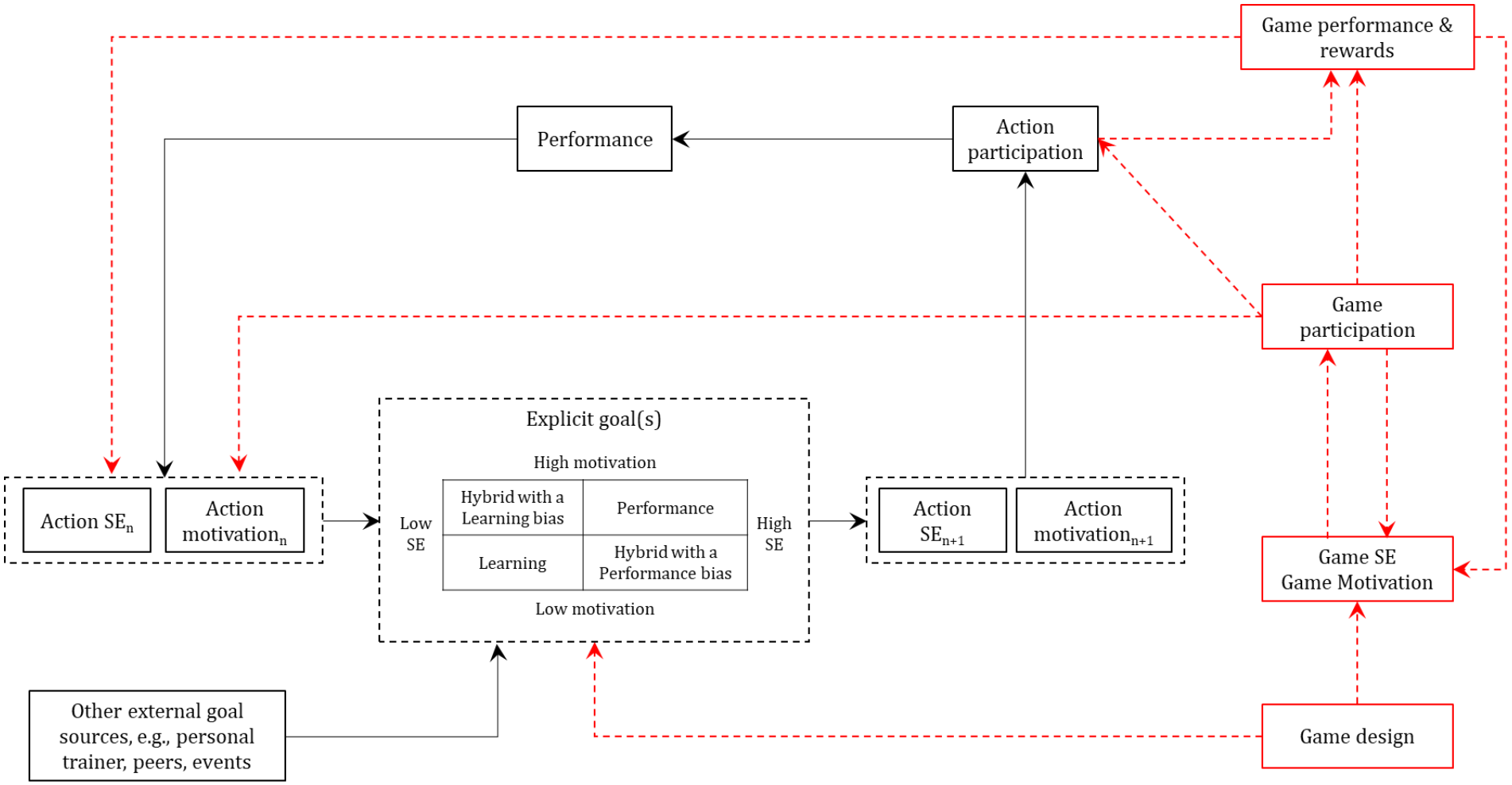
In addition to the rarity of learning framed goals outside of education or workplace interventions, there is also limited research available on most appropriate framing to use based on the interaction between and individual's self-efficacy and motivation. To address this interaction between self-efficacy and motivation when both states are not at similar levels (i.e., only one state is at higher levels), Paper 1 introduces the novel concept of a hybrid framed goals.

The expectation is that framing reinforcing the state already in place would have the greatest impact, and the hypothesis may be expanded as below:

> **Hypothesis 1b: For individuals with higher self-efficacy but lower motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a "hybrid" goal composed of greater performance and lesser learning content leads to the best outcomes and deviations from this reduces outcomes.**
>
> **Hypothesis 1c: For individuals with lower self-efficacy but higher motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a "hybrid" goal composed of greater learning and lesser performance content leads to the best outcomes and deviations from this reduces outcomes.**

Figure 18 below reproduces the normative goal setting theory in a gamification context presented in Paper 1, illustrating the proposed optimal goal framing approach based on the interaction between self-efficacy and motivation. Paper 2 focuses on these goal framing elements of the framework and presents a quantitative longitudinal quasi-experimental design that addresses Hypothesis 1.

Figure 18 Goal framing based on starting self-efficacy and motivation – normative model



2.2. RESEARCH METHODOLOGY

Paper 2 describes a quantitative, longitudinal, quasi-experimental design that investigates the effects of framing on goal setting in a gamification design context. The objective of the experiment is to determine if appropriate goal framing based on starting psychological states, namely self-efficacy, and motivation may improve subsequent action participation and performance.

2.2.1. Overall research design

This research uses a quasi-experimental design, since this type of design is well suited to a real-world context while allowing researchers to conduct rigorous studies where differences in outcomes may be attributed to the experimental conditions with reasonable certainty (Gopalan et al., 2020; Miller et al., 2020; Reichardt, 2019).

The research deploys a quantitative approach, since this type of analysis is generally believed to be able to be extrapolated onto a wider population due to the size of the samples, compared to qualitative designs where the specific nature of the sample population and the nature of data collected lends itself to deepening understanding of phenomena rather than more generalizable findings (Holton & Burnett, 2005; Watson, 2015). Furthermore, the datapoints that the underlying game platform produces is better suited to quantitative analysis than qualitative analysis.

2.2.2. Experimental design

The experiment presented in Paper 2 is a field experiment deployed in a real-world gamification setting, namely Vitality Active Rewards, which is described in detail in the introduction of this thesis (see p. 15). The researcher chose the Vitality Active Rewards platform because as an ongoing gamification platform that has been live since 2015, it offers many benefits. The platform is mature with a large population that may be sampled from and deploys goal setting within a gamified platform. Furthermore, it is feasible to introduce the experiment conditions alongside the existing Vitality Active Rewards game elements with relative ease, while also providing access to secondary data required for the analysis. Based on the size of the member base (in excess of 700 000 individuals) this platform is well suited to quantitative analysis.

Introduced previously, in the introduction section of this thesis, the Vitality Active Rewards gamification platform deploys goal setting as the primary means to drive engagement in key behaviours, with the focus of this study being on the physical activity goals. Vitality Active Rewards members receive a personalized weekly physical activity goal, which is systematically determined based on previous engagement and goal attainment. These goals align with the requirements of goal setting theory in that they are designed to be specific and challenging (noted by the fact that the goal goes up each week if the member achieved their previous goal). These goals are also time based (i.e., weekly, and the goal resets each week). The research did not change or impact the goal setting elements of the Vitality Active

Rewards game in any way during the field experiment; the field experiment is an additional layer introduced alongside the existing game mechanics, designed in such a way as to complement the weekly game goal.

The field experiment consists of a 12-week period where participants received additional weekly framed content over and above their weekly Vitality Active Rewards game goals. An example of the content is provided in Appendix H. The supplemental content did not impact participants' game-generated goals, the way in which the game functioned or any rewards and benefits earnable by the participants. The researcher framed the content based on the principles outlined in Paper 1 namely: learning, performance, or hybrid framed with either a learning or performance bias. While the goal setting occurs in a gamification context, the focus for this experiment is the effect of the additional framed content on subsequent action participation.

Prospective participants received an initial invitation to complete a survey and elect to participate in the experiment. The invitations were framed based on known behavioural principles to increase the likelihood of participation (namely gain-framed vs loss-framed) (Mochon et al., 2017). The purpose of the survey was to establish a starting measure for both self-efficacy and motivation. At the end of the survey, individuals who indicated that they wanted to participate in the field experiment needed to provide consent, which allowed the researcher to collect physical activity data for the relevant period, namely the 12 weeks before the field experiment and the 12 weeks of the field experiment. The researcher allocated those who chose to participate in the field experiment randomly into one of three groups: (1) matched framing, (2) unmatched framing, and (3) random framing.

Those individuals allocated to the "matched framing" group received weekly framed content that was hypothesised to be the optimal framing, as described in Paper 1, and summarised in the following section, based on their starting levels of self-efficacy and motivation. The "matched" or optimal framing conditions are summarised in Table 5 below.

Table 5 Framed content based on optimal matching

	More regulated motivation	**Less regulated motivation**
High self-efficacy	Performance	Hybrid with a Performance bias
Low self-efficacy	Hybrid with a Learning bias	Learning

Those individuals allocated to the "unmatched framing" group received weekly framed content that was opposite to what was hypothesised to be the optimal framing based on their starting levels of self-efficacy and motivation. The "unmatched" (and therefore assumed to be suboptimal) framing conditions are summarised in Table 6 below.

Table 6 Framed content opposite to optimal matching

	More regulated motivation	Less regulated motivation
High self-efficacy	Learning	Hybrid with a Learning bias
Low self-efficacy	Hybrid with a Performance bias	Performance

The researcher allocated those individuals in the random group to one of the four framing conditions randomly.

At the time of the field experiment the researcher used the population, or overall, mean for self-efficacy and motivation based on the standard definitions for these factors derived from the survey instruments to determine the matched and unmatched groups. In other words, the researcher defined individuals with self-efficacy (or motivation) greater than or equal to the population mean as having "high" self-efficacy (or motivation). The researcher used this approach to ensure that the experiment could begin shortly after individuals indicated that they were interested in participating, to reduce drop-off at the onset of the experiment. The researcher then deployed a more in depth, accurate, factor analysis (described in a following section) to refine these definitions. The refined definitions will be used for the remainder of the analyses.

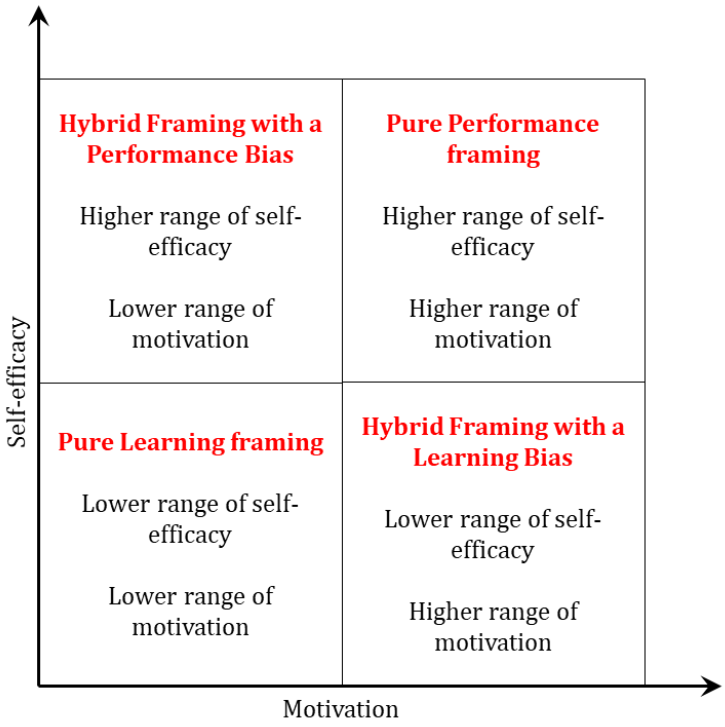
Field experiment participants received the weekly framed content through a bespoke webpage based on the group they were allocated to. Participants received SMS and email nudges intermittently during the field experiment to encourage them to engage with the content.

Those individuals who chose not to participate in the field experiment are used as the control, or unexposed, population during the analysis phase. This population consists of individuals who completed the assessments, and therefore have a benchmark for their self-efficacy and motivation but did not choose to participate in the field experiment. This population received no additional framed content during the field experiment period. There is an element of selection that needs to be considered as this group actively chose not to participate, compared to a true random control group where there would be no engagement with the field experiment whatsoever. The experiment is therefore quasi-experimental rather than a true randomised control trial. However, this unexposed population (i.e., they were not exposed to the additional framed content) is still sufficiently comparable to the experiment population in terms of demographic breakdown for reasonable comparisons to be made. Both populations were exposed to the same environmental trends and underlying gamification platform for the duration of the field experiment – the key difference between the experiment population and the control population is that the control population was not exposed to the framed content.

Paper 1 discusses the reasoning behind the proposed "matched" framing in detail. The following sections summarise the key discussion points, using the 2 × 2 matrix in Figure 19

to reiterate the choice of framing conditions per combination of the psychological states, where the proposed optimal framing condition is included in red.

Figure 19 2 × 2 matrix plotting the interaction between self-efficacy and motivation



A. Pure framing

Pure framing is recommended for individuals where motivation and self-efficacy are both in higher (or lower) ranges, described in more detail below.

i. Performance framing

Performance framing is the traditional framing approach typically encountered during goal setting (Seijts & Latham, 2005; Seijts et al., 2004; Tondello et al., 2018), particularly in a gamification context, and the expectation is this will be well-suited to individuals with higher ranges of motivation and self-efficacy. Since these individuals are already reasonably motivated and are very likely more comfortable with the underlying task (in this case physical activity), the traditional performance approach is likely sufficient to drive improved outcomes. In this scenario an increase in effort is all that should be required to improve outcomes, and no need for learning or skills attainment is expected (Locke & Latham, 2019; Seijts & Latham, 2005).

ii. Learning framing

Learning framing is most commonly recommended when an individual is less familiar with an activity (i.e., the individual may lack the necessary skill or knowledge to complete the activity), or if the underlying task is exceedingly complicated (Seijts & Latham, 2005; Seijts

et al., 2004). The expectation is that members with lower ranges of self-efficacy and motivation will likely respond most favourably to learning framed content since this framing approach would feasibly help individuals develop the necessary goal attainment strategies. Improved goal attainment strategies may very likely lead to an improvement in self-efficacy since individuals are more likely to achieve their goals. The increase in self-efficacy is then very likely to increase subsequent motivation to engage by increasing feelings of competence (Ryan & Deci, 2000).

B. Hybrid framing

Paper 1 introduces hybrid framing for individuals where either motivation or self-efficacy is at a lower level and the other factor is at a higher level. In this scenario one factor is in place, but it is necessary to improve the other psychological state. The hybrid nature of the goal framing implies that the framing bias (either performance or learning) is moderated by a secondary framing layer. The expectation is for this supporting layer to apply a more appropriate strength and direction to the primary framing approach compared to the pure framing approach.

i. Hybrid framing with a performance bias

The researcher initially proposes hybrid framing with a performance bias for individuals with higher levels of self-efficacy and lower levels of motivation. Self-efficacy is already in place in this population and the goal framing needs to address the weaker motivation factor. Higher levels of self-efficacy implies that the individual likely doesn't need assistance with the game behaviour, and that it is less necessary to develop new skills or goal attainment strategies. Literature suggests that performance framing is well suited when self-efficacy is in place (Seijts & Latham, 2005; Seijts et al., 2004). The expectation is that the bias towards performance would likely encourage the individual to increase the amount of effort given to the goal behaviour and the secondary learning element provides the necessary strategy development to direct the increased effort more effectively.

ii. Hybrid framing with a learning bias

The researcher initially proposes hybrid framing with a learning bias for individuals with lower levels of self-efficacy and higher levels of motivation. Motivation to engage in the goal behaviour is already in place and the goal framing needs to address the weaker self-efficacy factor. Higher levels of motivation indicates that task complexity is perceived as appropriate, however, the lower level of self-efficacy indicates that individual does not have the required skills or knowledge to engage successfully in the goal behaviour (in this case, physical activity). Literature suggests that learning framing is well suited when self-efficacy is low (Seijts & Latham, 2005; Seijts et al., 2004). The expectation is that the increased bias towards learning will help the individual to develop the necessary goal attainment strategies while the secondary introduction of performance framing provides an adequate increase in effort (which is typically associated with performance framed goals (Latham, 2016; Seijts & Latham, 2005).

2.2.3. Population and sample

The following sections describe the experiment population and sample.

A. Population

This research applies to platforms deploying gamification design strategies as well as the broader applications of goal setting theory. Although the experiment focuses on physical activity in the South African wellness industry by using the Vitality Active Rewards platform as the case site, extant literature shows that goal setting theory may be generalised to a wide range of contexts (Ambrose & Kulik, 1999; Lee & Lin, 2023; Locke & Latham, 1979, 2002). Therefore, it is likely that this research may very well contribute further understanding to the value of framing in goal setting in more general contexts.

Since the research is conducted in a gamification platform in a wellness setting, it could be argued that the population extends to all recipients belonging to a wellness programme. More specifically, it can be argued that the research applies to recipients of many types of organisational games or programmes leveraging goal setting theory intended to drive key behaviours. Although not the direct population, the results of this experiment may well therefore be beneficial to any practitioner who uses goal setting theory to improve performance, engagement, and motivation across behaviours in a targeted population or organisational setting, particularly through the use of gamification design.

B. Case site

The case site is Vitality Active Rewards, which was introduced in detail in the introduction section of this thesis (see p. 15). Described previously, Vitality Active Rewards is a voluntary benefit of the broader Discovery Vitality programme, which is a South African wellness programme that supports the Discovery Health and Discovery Life products as part of the shared value model (see p. 13) (Discovery Health, 2020; Porter et al., 2014). Vitality Active Rewards is a gamified platform used to increase engagement in key behaviours through weekly goal setting. The Vitality Active Rewards base consists of over 700 000 individuals of varying levels of engagement and ability.

The focus of this study is on the physical activity aspects of the Vitality Active Rewards game and Paper 2 focuses on the goal setting elements of Vitality Active Rewards and not on any of the other game mechanics or features. The game platform sets weekly goals for members systematically based on their previous engagement and goal achievement. The goal is defined in the context of Vitality points, which provide a relative weighting to different health related activities (for example, walking 10 000 steps in a day is worth 100 points, whereas a vigorous 30-minute workout is worth 300 points) – these physical activity points are summarised in Appendix E.

C. Sample and sampling method

The sampling frame for this field experiment is 20 000 randomly selected moderately engaged Vitality Active Rewards members. In this context, a “moderately engaged” Active

Rewards member is defined as one who achieved at least one goal and selected a tile on the gameboard (in other words, they actively engaged with the game element of the platform) at least once in the month prior to being invited to participate in the experiment.

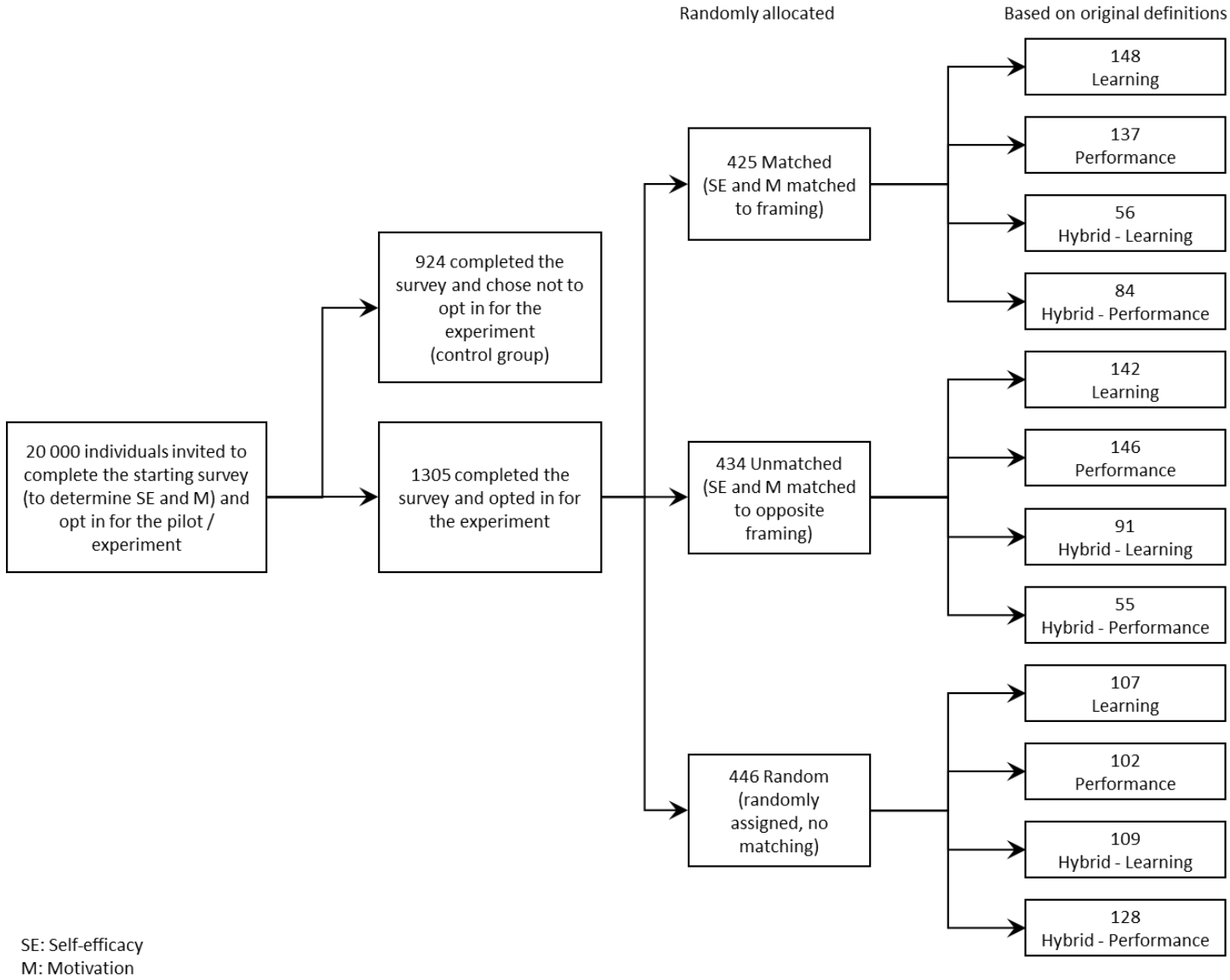
Because this experiment's objective is to determine the effects of framing in a goal setting context, and not specifically on game outcomes, the researcher chose to only include participants who displayed a minimum baseline of engagement. Restricting the eligible participant base in such a way ensures that experimental results are due to the framed content and not because a member is new to the game (in which case the novelty of the game could influence outcomes) or due to existing, unengaged members re-engaging with the game due to receiving the invitation to participate. Goal achievement in the month prior to the experiment implies that the participant knows how the game works (i.e., there is implied game self-efficacy) and playing the gameboard in the month prior to the experiment implies that the participant values the rewards and is actively involved in playing the game (i.e., there is implied game motivation).

Once the researcher identified the random sample of 20 000 members the researcher performed additional checks to ensure that the sample was representative of the broader Vitality Active Rewards population in terms of age, gender, and Vitality status breakdown at the time of selection. In other words, ensuring that the random sample is representative of the broader population.

The identified Vitality Active Rewards members received an invitation via email to participate in the experiment and participation in the experiment was voluntary. Of the 20 000 prospective participants 2 229 (11%) completed the survey. Of these completing the survey 1 305 (59%) chose to participate in the field experiment and 924 (41%) elected not to continue.

Figure 20 below summarises the group allocation process and sample sizes. As part of the analysis stage the researcher removed those participants with missing values (e.g., incomplete survey responses). This eliminated 51 individuals from the sample and the resulting dataset has no missing values for any of the target variables.

Figure 20 Sample sizes for the various population groups



2.2.1. Sample statistics

Table 7 below summarises the demographic breakdown for the 20 000 Vitality Active Rewards members that the study initially surveyed. This breakdown is representative of the broader Vitality Active Rewards population at the time of the field experiment. There is an even distribution between female and male participants. The largest population is those aged 30-49 (60% of individuals), highlighting that the Vitality Active Rewards is appropriate not only at young ages despite the app-based nature of the game.

Table 7 Breakdown of demographics for surveyed population

	Frequency		Percentage	
	Female	**Male**	**Female**	**Male**
20-29	1 898	1 705	9%	9%
30-39	3 378	3 295	17%	16%
40-49	2 655	2 636	13%	13%
50-59	1 438	1 504	7%	8%
60+	640	851	3%	4%

Table 8 below summarises the demographic breakdown of the individuals who completed the survey.

2 229 (11%) of individuals that received the email completed the survey. Upon initial inspection the population completing the sample is not evenly split between females and males: the population completing the survey is marginally skewed towards females with 12% of females completing the survey and 10% of males completing the survey. There was no difference in survey completion between the population that received a gain framed invitation compared to the population that received a loss framed invitation. The greatest survey completion rate occurred in males aged 60+ (19%), followed by females aged 50-59 (16%) and females aged 60+ (14%). The lowest survey completion rate occurred in males aged 20-29 (5%), followed by males aged 30-39 (9%) and females aged 20-29 (10%).

1 305 (59%) participants completing the surveys chose to participate in the field experiment. 62% of those choosing to participate in the field experiment were females, with 66% of invited females choosing to participate compared to 49% of males choosing to participate. 61% of field experiment participants were aged 30-49. The greatest take-up occurred amongst 20–29-year-olds (68%) and the lowest take-up occurred amongst individuals aged 60 or older (42%). There was slightly greater take-up in the population that received a gain framed invitation (60%) compared to those receiving a loss framed invitation (57%).

Table 8 Breakdown of sample demographics completing the survey

		Frequency		Percentage	
	Age	**Female**	**Male**	**Female**	**Male**
Matched	20-29	59	12	14%	3%
	30-39	84	57	20%	13%
	40-49	80	44	19%	10%
	50-59	41	26	10%	6%
	60+	12	10	3%	2%
	Subtotal	276	149	65%	35%
Unmatched	20-29	34	14	8%	3%
	30-39	94	50	22%	12%
	40-49	71	56	16%	13%
	50-59	37	27	9%	6%
	60+	22	29	5%	7%
	Subtotal	255	176	59%	41%
Random	20-29	47	22	11%	5%
	30-39	91	48	20%	11%
	40-49	70	48	16%	11%
	50-59	54	34	12%	8%
	60+	15	17	3%	4%
	Subtotal	277	169	62%	38%
Control	20-29	51	37	6%	4%
	30-39	118	135	13%	15%
	40-49	111	136	12%	15%
	50-59	94	99	10%	11%
	60+	41	102	4%	11%
	Subtotal	415	509	45%	55%

2.2.2. Procedure for data collection

The researcher collected measures for self-efficacy and motivation via email through a survey. Participants needed to provide consent prior to participating in the field experiment. Consent included giving permission for the collection of physical activity and game engagement data for the duration of the experiment and the period 12 weeks before the experiment. The researcher collected the relevant data points directly from the Vitality Active Rewards source tables using SQL.

2.2.3. Research measures and instruments

The following sections discuss the research measures and instruments from the field experiment.

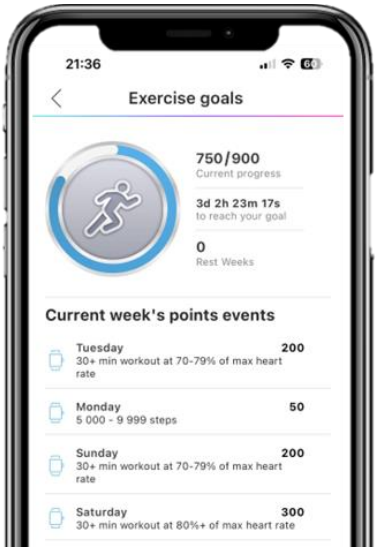
A. Research measures

The measures that the researcher collected and used during the field experiment are described as follows.

i. Action participation (Vitality fitness points earned)

The introduction chapter of this thesis introduced the Vitality Active Rewards game platform in detail (see p. 15). This section introduced that the game uses a points-based construct inherent to the Vitality programme to measure physical activity participation. Each unit of physical activity contributes a fixed points value to the individual's weekly goal (e.g., a 5km timed run event is worth 300 points) that is representative of the effort of the activity as well as its impact on mortality and morbidity (for instance, exercises that improve cardio-respiratory fitness have a greater impact on risk reduction and therefore receive a greater points allocation (Griffin et al., 2023)). The full list of points activities available is available in Appendix E. Figure 21 below illustrates how these activities "full up" the fitness ring.

Figure 21 Physical activity events contributing towards the weekly goal



A noteworthy rule in the programme is that in the event of multiple activities in a single day, only the activity with the greatest points allocation contributes towards the weekly goal (e.g., if an individual logs a running workout worth 300 points as well as swipes in at the gym worth 100 points, only the 300-point activity will contribute to the weekly goal). Since this research focuses on the gamification layer of Vitality Active Rewards and not physical activity improvement in general, the analysis only considers those points activities that contribute directly towards the weekly game goal.

ii. Game goal

The Vitality Active Rewards game consists of an explicit weekly points goal or target that the platform determines dynamically based on engagement with the platform, including previous goals achieved and fitness points earned. The goal ranges from 100 to 900 points per week and increases or decreases in increments of no more than 100 points, depending on goal achievement over time. The experiment does not impact the goal setting element of the gamification layer and the underlying goal setting algorithm remained unchanged for the duration of the experiment. The goal setting algorithm is not being interrogated at all during this research. Since members participating in the study were existing game players and moderately engaged in the game at the time of the experiment, it is highly probable that experiment participants were sufficiently familiar with this dynamic element of the weekly goal since it is an established game mechanic that has remained unchanged since the game went live in September 2015.

iii. Points to Goal Ratio

To assist with the analysis the researcher created a ratio variable, defined as

$$Points\ to\ Goal\ Ratio = \frac{Weekly\ Points\ Earned}{Weekly\ Points\ Goal}$$

Where Points to Goal Ratio ≥ 1 indicates that the individual achieved or exceeded their goal and Points to Goal Ratio < 1 indicates that the goal was not achieved.

There were a few reasons driving the decision to introduce the Points to Goal Ratio variable:

- Considering points earned in isolation does not provide full context for the activity relative to the goal.
- Using a binary indicator for goal achievement does not indicate the magnitude of progress or decline compared to prior weeks.
- The Points to Goal Ratio enables the researcher to compare individuals across different goal levels without needing to fragment the population by placing them in separate groups by game goal.

iv. Action self-efficacy and motivation

The research deploys existing survey instruments to quantify participants' self-efficacy and motivation relating to physical activity. The following section introduces these survey

instruments in greater detail. Participants needed to fully complete these research instruments at the onset of the experiment to be eligible for the field experiment.

v. Goal Framing Content

All experiment participants received additional framed content for the duration of the experiment. Once the researcher allocated an individual to a specific group, either due to direct matching, opposite matching, or randomly according to the earlier explanation, then that was the content the individual received across all 12 weeks of the experiment. The researcher investigates each framing condition separately relative to the unexposed group of similar composition.

vi. Group

During the analysis phase, the researcher classified each participant into a group based on their measured self-efficacy and motivation. Group formation is described in one of the following sections. At the onset of the field experiment the researcher randomly allocated participants to receive framing randomly or based on their initial levels of self-efficacy and motivation (either matched or unmatched), described in Table 5 (see p.54) and Table 6 (see p. 55). The researcher recorded this initial matching and subsequently refined it during the analysis phase, described shortly.

vii. Control variables

The experiment collected various control variables, including demographic features (age and gender) and platform-specific constructs (Vitality status). These control variables were not explicitly used during the analysis phase, however, they were recorded and compared to ensure that each group or population was sufficiently similar. This ensures that findings are less likely to be as a result of underlying differences between the compared populations and more likely as a result of the experimental conditions.

B. Survey instruments

This section describes the survey instruments that the researcher used during the study to quantify participants' levels of self-efficacy and motivation. The full research instruments are reproduced in Appendix G. All participants completed both assessments at the onset of the experiment period. It was essential to measure participants' starting levels of self-efficacy and motivation, since these are two of the target variables.

i. Self-efficacy: Bandura's Self-Efficacy for Exercise Scale

The assessment title implies the aim of this evaluation is to measure an individual's self-efficacy for exercise/physical activity (Bandura, 2006).

This survey includes questions asking the participant to provide a ranking from 0 to 100 for how confident they are that they would exercise when there are other exciting things to do or when there are time constraints (e.g., after a vacation). It is possible to simplify the 100-point scale with a 10-point scale (Everett et al., 2009). Research has shown that the scale has

internal consistency and sufficient validity (Resnick & Jenkins, 2000). This field experiment used the 10-point scale version. The following section presents the full list of survey questions.

ii. Motivation: The Behavioural Regulations in Exercise Questionnaire (BREQ)

The Behavioural Regulations in Exercise Questionnaire (Edmunds et al., 2006) is a survey that provides a score indicating how regulated an individual's motivation to exercise is (as per self-determination theory (Ryan & Deci, 2000)). The BREQ-3 survey uses a 5-point Likert scale (0=not true for me, 4=very true for me) and this version includes a modification adding an amotivation factor (Markland & Tobin, 2004). Examples of questions include "It's important to me to exercise regularly" or "I feel guilty when I don't exercise". There is evidence supporting the construct validity of the questionnaire across a range of use cases (D'Abundo et al., 2014; Murcia et al., 2007; Wilson et al., 2002). The assessment questions are categorised based on the motivation continuum described in the introduction section of this thesis and summarised in Table 1 (see p. 18). The following section presents the full list of survey questions.

C. Tests of factor structure

The research surveys introduce self-efficacy and motivation as multi-item scales. Each survey suggests ways to create composite variables for self-efficacy, amotivation, external, identified, intrinsic and introjected regulation. However, it is necessary to understand how these recommendations compare to a factor analysis of the results in practice for the population in the context of the experiment. The objective of the exploratory factor analysis is to understand if it is possible to create improved composite variables for self-efficacy and motivation for the purposes of the study. The following sections describe these factor analyses and tests of factor structure.

i. Exploratory factor analysis

The research performed separate exploratory factor analyses for self-efficacy and motivation. Both sets of factor analyses deploy principal axis factoring (PAF), that is, common factor analysis, where priors are set to squared multiple correlations and covariance matrices are used as the calculation basis. The researcher used Promax rotations for both factor analyses. The researcher deemed the sample size for the factor analyses adequate since each manifest variable had 2 178 observations, which well exceeds conventional guidelines such as 10-20 per observation (Lee, 2016).

Self-efficacy

Initial fit tests indicate that no variables need to be removed as all have high individual MSA[1] scores (> .90). The overall MSA is good at .92 with no individual item having a low score, and AVE[2] is acceptable at over 70%. Analysis of the scree plot and proportions of variation

[1] Kaiser's Measure of Sampling Adequacy
[2] Average Variance Extracted

explained suggest a final model with two factors. The two-factor model explains a proportion of .87 in total with a third factor adding an insignificant .07. Analysis of factor loadings supports the two-factor model, since the model subsets like variables together on factors, has no high cross-loadings or manifest variables that do not load well on a factor.

Table 9 below shows the major factor loadings for the two-factor solution. The first factor includes items such as "when I am feeling tired" or "when I feel under pressure from work". These items predominately relate to intrinsic, personal experiences. Therefore, the researcher describes Factor 1 as "Self-Efficacy Relating to Intrinsic Pressures" (SEI). The second factor includes items such as "when visitors are present" or "without support from my family or friends". These items predominately relate to external factors. Therefore, the researcher describes Factor 2 as "Self-Efficacy Relating to External Pressures" (SEE).

Table 9 Reporting factor loadings of final model for self-efficacy

	SEI	SEE
When I am feeling anxious or depressed	.88	
When I am feeling tired	.88	
After a vacation	.86	
During or after experiencing personal or family problems	.85	
During bad weather	.85	
When I feel under pressure from work	.82	
After recovering from an injury or illness that caused me to stop exercising	.81	
When I feel physical discomfort when I exercise	.76	
When there are other interesting things to do		.82
When visitors are present		.77
When I have other time commitments		.74
If I don't reach my exercise goals		.70
Without support from my family or friends		.67
During a vacation		.63

Motivation

For the motivational sub-constructs, an initial view of the survey results showed that a majority of individuals responded "0 – not true for me" for the questions relating to amotivation and external motivation, indicating that these variables may not be usable for the analysis. Since the focus of the study is predominately on an individual's levels of

"positive" or more self-determined motivation, the researcher deemed it appropriate to exclude these variables from the factor analysis because they are not germane to positive motivational tendencies.

Initial fit tests indicate that no further variables needed to be removed as all have high individual MSA scores (> 0.71). The overall MSA is good at 0.84 with no individual item having a low score. Again, the AVE is acceptable. Analysis of the scree plot and proportions of variation explained suggest a final model with two factors. The two-factor model explains a proportion of 0.92 in total with a third factor adding a relatively minor 0.07. Analysis of factor loadings supports the two-factor model, as the model subsets like variables together on factors, has no high cross-loadings or manifest variables that do not load well on a factor.

Table 10 shows the major factor loadings for the two-factor solution. The first factor combines Intrinsic and Identified Regulation ($M_{Intrinsic\ and\ Identified}$) questions and the second factor combines Introjected Regulation ($M_{introjected}$) questions. If we refer to the motivation continuum discussed in Paper 1 (see p. 18), these factors are sensible extractions from the data.

Table 10 Reporting factor loadings of final model for motivation

	$\mathbf{M_{Intrinsic\ and\ Identified}}$	$\mathbf{M_{Introjected}}$
I find exercise a pleasurable activity	.86	
I exercise because it's fun	.79	
I get pleasure and satisfaction from participating in exercise	.78	
It's important to me to exercise regularly	.72	
I value the benefits of exercise	.68	
I think it is important to make the effort to exercise regularly	.66	
I feel ashamed when I miss an exercise session		.74
I feel like a failure when I haven't exercised in a while		.73
I feel guilty when I don't exercise		.62

The researcher conducted a previous factor analysis that included all survey questions for comparison purposes. This factor analysis produced a three-factor solution that produced the same factors as above and combined questions relating to Amotivation and External Regulation together into a third factor. This grouping of questions further justifies the decision to exclude those questions from the final analysis and focus on the two-factor solution presented in Table 10.

ii. Confirmatory factor analysis

Once the exploratory factor analyses were completed for self-efficacy and motivation, the researcher performed further confirmatory analyses on each factor. The confirmatory factor analyses were done through structural equation modelling using PROC CALIS in SAS. Confirmatory factor analysis complements the exploratory factor analysis because it tests explicitly for indicator membership in identified factors.

The fit for the resulting models for both self-efficacy and motivation were acceptable, as summarised in Table 11 below.

Table 11 Summary of fit statistics for confirmatory factor analyses conducted

	Self-efficacy	Motivation
Chi-square statistic[3]	< .0001	< .0001
SRMSR[4]	0.03	0.05
RMSEA[5]	0.08	0.09
CFI[6]	0.96	0.97
NNFI[7]	0.95	0.94

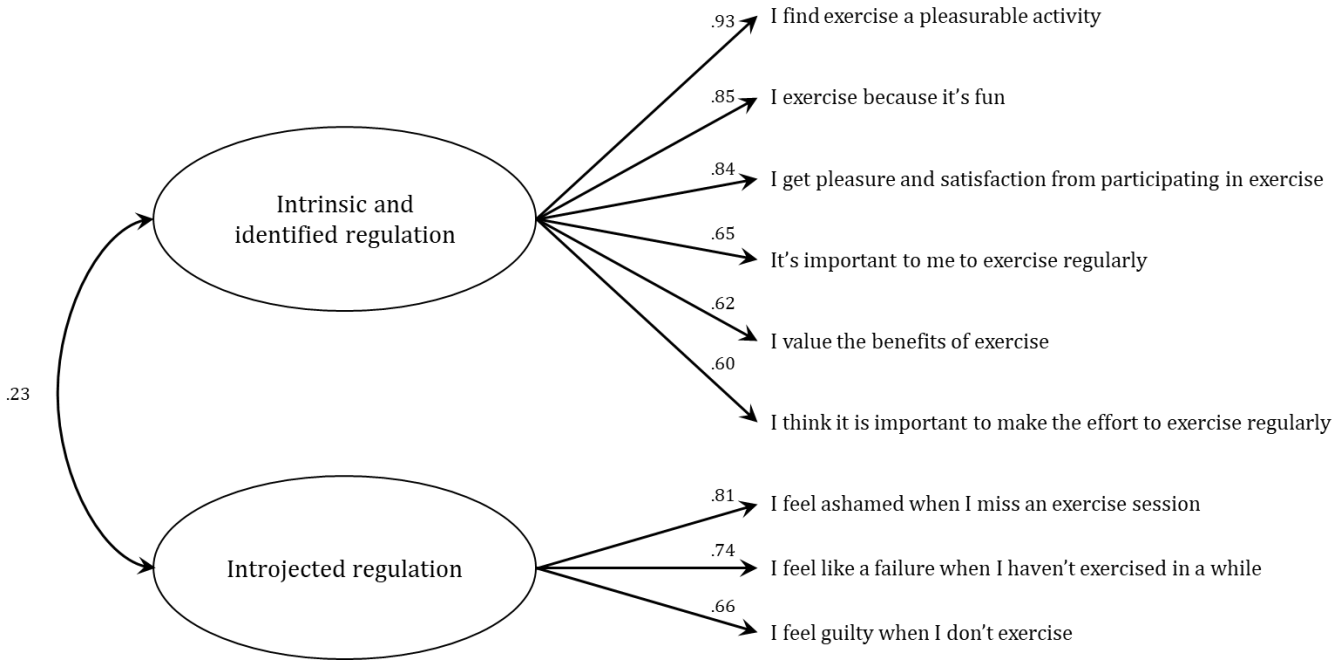
The resulting variables were standardized for the remainder of the analysis. The path diagrams are shown in Figure 22 and Figure 23 below.

[3] Commonly accepted guidelines for good fit indicated by non-significant chi-square (e.g., p > .05), however, in reasonably large samples chi-square will likely be significant.
[4] Commonly accepted guidelines for Standardized Root Mean Square Residual: < .05 is good, < .08 is acceptable.
[5] Commonly accepted guidelines for Root Mean Square Error Approximation: < .05 is good, < .08 is acceptable.
[6] Commonly accepted guidelines for Bentler Comparative Fit index: > .95 is good, > .90 is acceptable.
[7] Commonly accepted guidelines for Non-Normed Fit Index: > .95 is good, .90 is acceptable.

Figure 22 Path diagram for self-efficacy



Figure 23 Path diagram for motivation



iii. Construct reliability

Once the factor analysis was concluded, Cronbach's Alpha was used to measure the internal consistency of the surveys, where a value closer to 1 indicates greater reliability and $\alpha > .70$ is generally deemed to be sufficient (Taber, 2018; Tavakol & Dennick, 2011). Table 12 below summarises the Cronbach's Alpha for each factor. All show acceptable levels for internal consistency. This highlights that the research instruments are fit for purpose.

Table 12 Summary of Cronbach's Alpha for each factor

Factor	α
Self-efficacy relating to Intrinsic Pressures	.95
Self-efficacy relating to Extrinsic Pressures	.87
Intrinsic and Identified Regulation	.89
Introjected Regulation	.78

D. Group formation

At the onset of the field experiment the researcher categorised participants based on higher or lower levels of self-efficacy and motivation based on the population means for these variables. The researcher followed this approach to provide an initial allocation based on ideal matching (see Table 5, p.54) compared to opposite (see Table 6, p. 55) or random matching for the purposes of the experiment, while ensuring that the field experiment could launch promptly following participants' completion of the surveys. The researcher then refined the allocation during the analysis phase by categorising individuals into appropriate groups based on the updated factors for self-efficacy and motivation described in the previous section. The researcher then updated the ideal, or "matched", framing scenario based on the updated group definitions.

The researcher performed an exploratory latent profile analysis using the mclust package in R (Ferguson et al., 2020; Fraley et al., 2023; Wardenaar, 2021) to create the refined groupings based on the updated factors for self-efficacy (Self-Efficacy Relating to Intrinsic Pressures and Self-Efficacy Relating to Extrinsic Pressures) and motivation (Intrinsic and Identified Regulation and Introjected Regulation).

Latent profile analysis is an appropriate analysis technique for this research since it is widely used in vocational behaviour research to group individuals based on psychological constructs including self-efficacy and motivation (Pastor et al., 2007; Spurk et al., 2020; Turner et al., 2022) and is an appropriate methodology for grouping individuals based on continuous variables that are related yet distinct (Spurk et al., 2020; Wardenaar, 2021), as opposed to latent class analysis which is used with discrete variables (Ferguson et al., 2020; Weller et al., 2020). Latent profile analysis focuses on the individuals within a sample as opposed to the variables and therefore has the ability to provide a more nuanced view of groups compared to other clustering techniques (Ferguson et al., 2020).

The research deployed the mclust package in R because it has been shown to be well suited to exploratory analysis (Wardenaar, 2021). The research deemed the sample size (2 178) sufficiently large for latent profile analysis and there were no missing values in the sample. The mclust procedure maximises BIC[8] and therefore the preferred model was the one with the greatest BIC value (Wardenaar, 2021). This was a model with eight groups and a "VVI" model configuration (varying volume, varying shape). The final group sizes are summarised in Table 13 below.

Table 13 Groups identified through latent profile analysis

Group number	1	2	3	4	5	6	7	8
Group size	222	270	276	579	162	305	156	208
% of sample	10%	12%	13%	27%	7%	14%	7%	10%

It is necessary to understand if groups have any significant demographic differences that the analysis needs to consider going forward. Table 14 and Table 15 below summarise the breakdown by gender and age for the groups.

Table 14 Gender breakdown per group identified through latent profile analysis

Group	Frequency		Percentage	
	Females	Males	Females	Males
1	114	108	51%	49%
2	138	132	51%	49%
3	136	140	49%	51%
4	342	237	59%	41%
5	123	39	76%	24%
6	150	155	49%	51%
7	85	71	54%	46%
8	111	97	53%	47%

Group 4 is skewed towards females, but the distribution is still sufficiently close to the overall distribution of individuals completing the surveys (see Table 8, p.62) to be of no concern. Group 5 is heavily skewed towards females, and analysis will take this fact into account.

[8] Bayesian Information Criterion

Table 15 Age breakdown per group identified through latent profile analysis

Group	Frequency					Percentage				
	20-29	30-39	40-49	50-59	60+	20-29	30-39	40-49	50-59	60+
1	17	60	66	44	35	8%	27%	30%	20%	16%
2	29	81	87	44	29	11%	30%	32%	16%	11%
3	22	98	85	45	26	8%	36%	31%	16%	9%
4	92	176	151	97	63	16%	30%	26%	17%	11%
5	26	54	46	23	13	16%	33%	28%	14%	8%
6	32	84	80	71	38	10%	28%	26%	23%	12%
7	14	42	38	42	20	9%	27%	24%	27%	13%
8	33	67	52	38	18	16%	32%	25%	18%	9%

The age distribution per group is reasonably consistent with the overall distribution of the population completing the surveys (see Table 8, p.62).

To confirm that the groups are statistically different, the researcher conducted a multivariate analysis of variance (MANOVA) across the groups for Self-Efficacy Relating to Intrinsic Pressures (SEI), Self-Efficacy Relating to Extrinsic Pressures (SEE), the factor relating to Intrinsic and Identified Regulation ($M_{\text{Intrinsic and Identified}}$) and the factor relating to Introjected Regulation ($M_{\text{Introjected}}$). All four MANOVA fit tests suggest significant differences between the groups, summarised by Table 16 below.

Table 16 MANOVA test criteria and F approximations showing no overall group effect

	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.02	502.28	28	7814.7	<.0001
Pillai's Trace	2.04	321.53	28	8680	< .0001
Hotelling-Lawley Trace	9.28	717.55	28	5407,8	< .0001
Roy's Greatest Root	6.67	2068.54	7	2170	< .0001

The researcher used PROC GLM in SAS using default Tukey multiple comparison analyses to conduct the MANOVA.

The researcher mapped the group mean for each factor relative to the range for that factor to establish if each of the factors is at higher or lower levels. The researcher then used the

results from the MANOVA for each factor to identify which groups are not statistically different.

Table 17 below summarises the range for each factor and Table 18 below summarises the group means for each factor. As an example, the self-efficacy factor relating to intrinsic pressures (SEI) for Group 1 is at 80% relative to the range. This is calculated as:

$$\frac{\overline{SEI} - SEI_{min}}{SEI_{max} - SEI_{min}}$$

$$where\ \overline{SEI}\ is\ the\ group\ mean$$

Table 17 Range per psychological factor

	Minimum	Maximum
SEI	-5.69	3.46
SEE	-6.26	2.69
$M_{intrinsic\ and\ identified}$	-2.66	0.63
$M_{introjected}$	-1.78	1.55

Table 18 Group means per psychological factor

Group	1	2	3	4	5	6	7	8
SEI	1.63	-5.52	1.90	-0.38	-2.77	2.26	1.57	1.81
SEE	0.79	-0.11	1.04	-1.08	-3.10	1.38	0.88	0.90
$M_{intrinsic\ and\ identified}$	-0.23	0.12	0.62	-0.36	-1.06	0.60	0.44	0.01
$M_{introjected}$	-0.78	-0.03	1.10	-0.08	-0.22	-0.63	0.13	0.67

Figure 24, Figure 25, Figure 26 and Figure 27 below show these group mappings for each factor where the similar groups based on the MANOVA results are indicated by the brackets or braces.

Figure 24 Groups mapped relative to each other for SEI

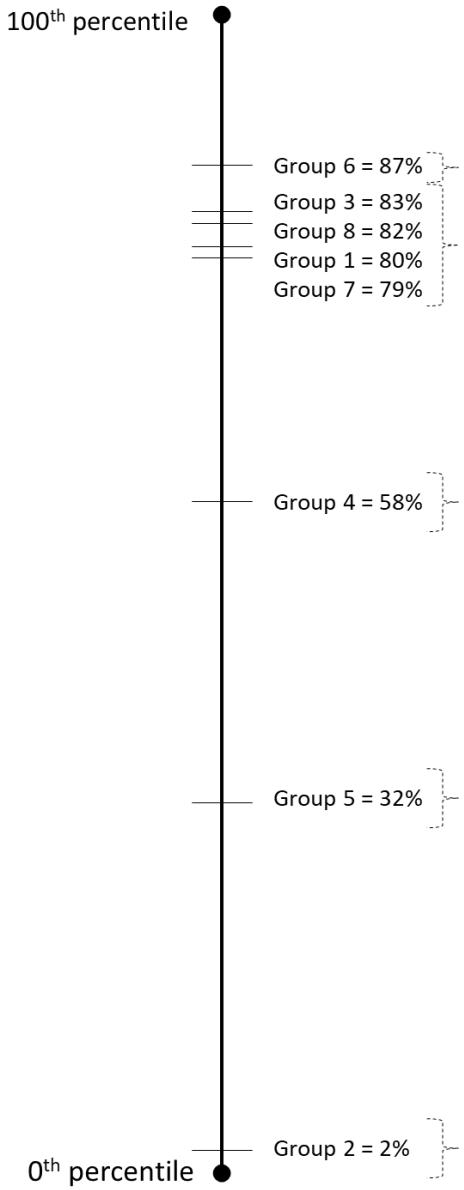


Figure 25 Groups mapped relative to each other for SEE

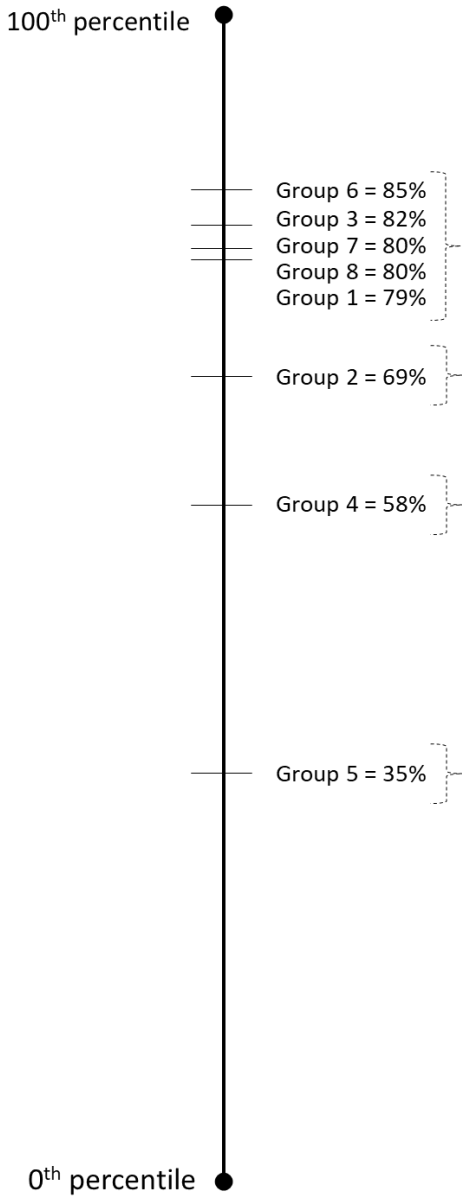


Figure 26 Groups mapped relative to each other for $M_{intrinsic\ and\ identified}$

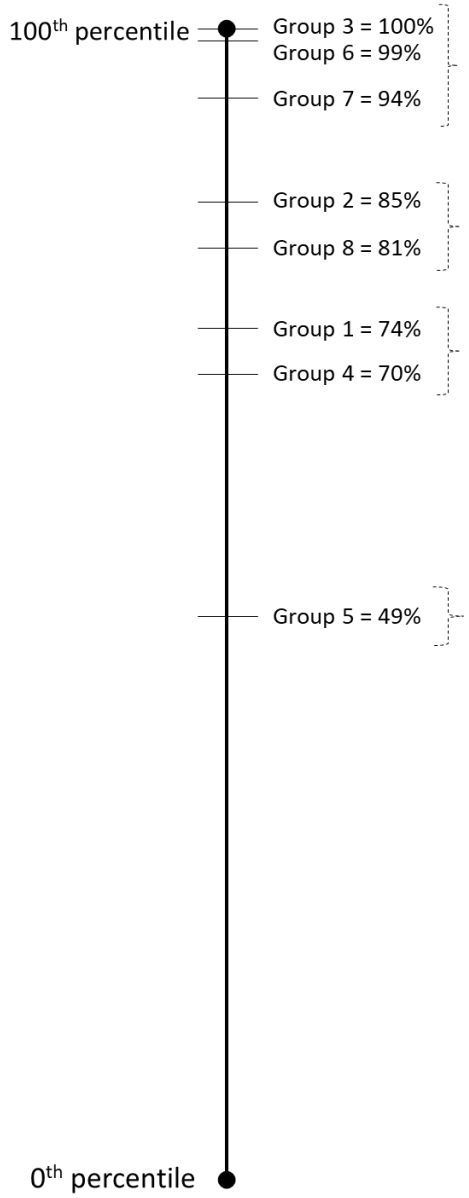


Figure 27 Groups mapped relative to each other for $M_{introjected}$

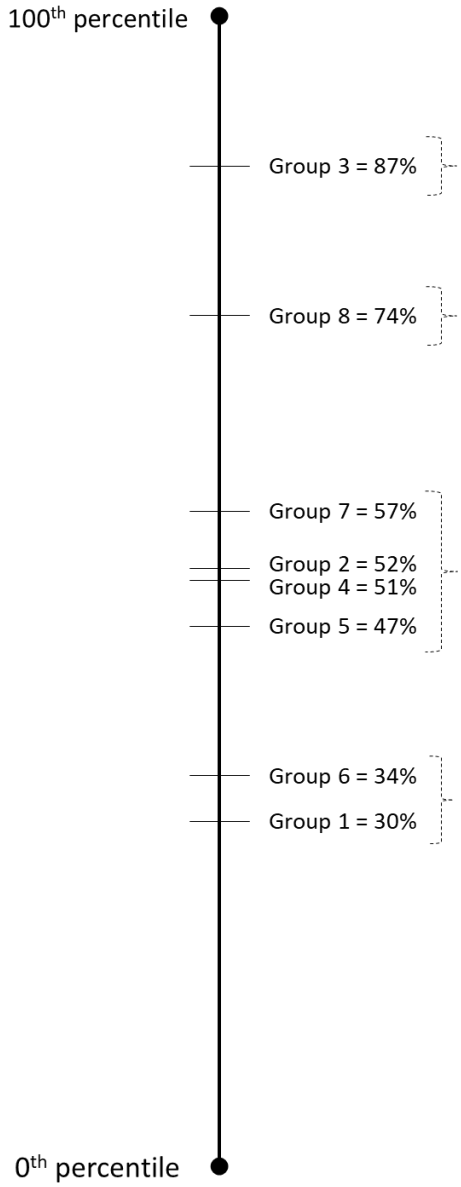


Table 19 below summarises the updated definitions for the psychological factors, including the updated "matched" framing conditions.

Table 19 High and low designations per group

Group	Factors that influence the psychological construct				Overall psychological construct		Updated optimal framing ("matched")
	$M_{Intrinsic\ and\ Identified}$	$M_{Introjected}$	SEI	SEE	Motivation	Self-efficacy	
1	Moderately low	Low	High	High	Low	High	Hybrid: Performance bias
2	Moderately high	Moderately low	Low	Moderately high	High[9]	Low[10]	Hybrid: Learning bias
3	High	High	High	High	High	High	Performance
4	Moderately low	Moderately low	Moderately high	Moderately low	Low	High[11]	Hybrid: Performance bias
5	Low	Moderately low	Moderately low	Low	Low	Low	Learning
6	High	Low	High	High	High	High	Performance
7	High	Moderately low	High	High	High[12]	High	Performance
8	Moderately high	Moderately high	High	High	High	High	Performance

[9] The more intrinsic $M_{Intrinsic\ and\ Identified}$ was initially prioritised and used to classify the overall motivation definition. This may need to be revised following the analysis phase.
[10] The intrinsic SEI was initially prioritised and used to classify the overall self-efficacy definition.
[11] The intrinsic SEI was initially prioritised and used to classify the overall self-efficacy definition. As neither self-efficacy factors are on the extreme end of the spectrum, results may be less straightforward, and the definition may need to be revised following the analysis phase.
[12] The more intrinsic $M_{Intrinsic\ and\ Identified}$ was initially prioritised and used to classify the overall motivation definition.

Table 20 below summarises how the initial definitions, based on the group means, compare to the updated groups following the latent profile analysis based on the definitions for self-efficacy and motivation obtained through factor analysis.

Table 20 Initial allocation compared to updated definitions used during analysis

		Initial psychological states used for group allocation at the onset of the field experiment			
		High self-efficacy High motivation	High self-efficacy Low motivation	Low self-efficacy High motivation	Low self-efficacy Low Motivation
Psychological states following factor analysis	High self-efficacy High motivation	733	158	47	7
	High self-efficacy Low motivation	94	296	82	329
	Low self-efficacy High motivation	0	0	150	120
	Low self-efficacy Low Motivation	0	0	14	148

1 327 participants (61%), indicated by the highlighted cells, had no change in the definition of their starting psychological states. 376 participants only had a change in the definition of their self-efficacy starting state (17%). 386 participants only had a change in the definition of their motivation starting state (18%). 89 participants had a change in the definition of both their self-efficacy and motivation starting states (4%). One can surmise that the factor analysis provides a more nuanced view of participants' starting psychological states, however, the initial definitions are still largely appropriate for the purposes of initial allocations to framing conditions.

For the remainder of the analysis, those individuals who received framing aligning with the optimal framing described in Table 19 are defined as "matched" whereas those who received framing that does not align with the optimal framing are defined as "unmatched" or random.

Before introducing framing conditions, all 8 groups were sufficiently large. However, it is necessary to overlay the framing conditions to understand if there are enough participants in each population to complete satisfactory analysis. Table 21 below summarises the group sizes, once the framing conditions have been considered.

Table 21 Group sizes when framing content is considered

Group	1	2	3	4	5	6	7	8
Performance	21	35	52	117	51	42	25	36
Learning	27	35	57	112	48	54	30	29
Hybrid with a Performance bias	47	45	17	81	15	17	11	32
Hybrid with a Learning bias	26	42	24	77	11	19	16	39

A common rule of thumb used in quantitative analysis is that sample sizes of less than 30 lose their predictive power (Lee, 2016; VanVoorhis & Morgan, 2007). However, in specific circumstances smaller samples may still be of value, depending on the underlying quality of the sample and the datapoints. While the results are reported for smaller samples, it needs to be noted that future research needs to target a larger sample population to accommodate the large number of groups combined with framing conditions to confirm any findings.

2.2.4. Data analysis and interpretation

Once the researcher determined the factors defining self-efficacy and motivation and used these to create groups, the researcher performed analysis to determine if the framing conditions had an impact on any of the identified groups. The research uses a difference-in-differences approach, which is a frequently used technique in quasi-experimental designs that employ an interrupted time series structure, and is appropriate for use with panel data (Donald & Lang, 2007; Gopalan et al., 2020; Roth et al., 2023; Wing et al., 2018). One of the key advantages of this approach is that the results can be interpreted causally. In other words, if there are differences observed between the exposed and unexposed groups these differences are more likely due to the intervention (in this case the framed content) and not as a result of other factors (Roth et al., 2023; Warton, 2020; Warton et al., 2016).

2.3. RELIABILITY AND VALIDITY

This section discusses the reliability and validity of the field experiment.

2.3.1. Reliability

Reliability refers to the repeatability of an experiment and implies that another researcher would get similar results through following the experiment design. Reliability is an indication of consistency rather than accuracy (Armour & Williams, 2022; Hammersley, 1987; Roberts & Priest, 2006).

The field experiment consisted solely of objective, quantitative research with key measures being survey responses or repeated outcome measures over time. The research surveys used to determine starting self-efficacy and motivation are research instruments accepted in the physical activity context and the resulting factor analyses performed displayed high Cronbach's alphas, indicating good internal consistency for the starting states. The measure

relating to outcomes (in other words the Points to Goal Ratio) is based on Vitality physical activity points and the Vitality Active Rewards game goal. Vitality points are an objective measure for physical activity based on measurable, recorded activities, e.g., through wearable devices, and are not self-reported. Both Vitality points and the game goal are external, existing constructs unimpacted by the experiment design. Assuming future research occurred in a similar context utilising such a framework ensures likely repeatability of the experiment.

There is a question around the repeatability of the additional framing content used in the experiment. Assuming another researcher used the same framing approach then the researcher is likely to get similar results. However, if an alternative approach is used for the framing, the question could be raised if it is an entirely different experiment altogether. In this case, it would be necessary to create an objective framework for assessing and comparing framing strategies. In this scenario, it is more reasonable to assume that it is the content strategy being tested, rather than the effects of framing on goal setting.

2.3.2. Internal validity

Internal validity refers to the degree to which differences observed between the experiment and non-experiment populations can be ascribed to the experimental conditions (Slack & Draugalis Jr, 2001), and establishes if the measures accurately represent what the study set out to measure (Armour & Williams, 2022; Roberts & Priest, 2006).

The nature of the experimental design (longitudinal, quasi-experimental) lends itself to high internal validity due to the high level of control throughout the field experiment design. The field experiment leverages an existing game platform in a highly controlled, systemised environment, enabling stringent design implementation. The analysis methodology deployed (difference-in-differences) also enables one to draw conclusions based on causality, indicating that differences observed are more likely due the experimental conditions and not underlying differences between the populations (Warton, 2020; Warton et al., 2016). The researcher chose the population in such a way that participants had sufficient knowledge of the underlying game platform that results are more likely to be ascribed to the experiment condition (i.e., exposure to the additional framed content) rather than the novelty of the game. The unexposed population is not a true control, considering that participants needed to actively select to participate (therefore this is a quasi-experimental design and not a true randomised control trial), however, the difference-in-differences approach balances this element of selection. There were no other observable differences between the exposed and unexposed populations.

With respect to the psychological states, the resulting motivation factors from the factor analysis performed align with self-determination research (Ryan & Deci, 2000) and can therefore be assumed to provide an accurate measure of intrinsic, identified and introjected regulation as required. Similarly, the self-efficacy factors are sensible based on the underlying survey questions and provide an accurate description of the starting self-efficacy states. There is an element of interpretation regarding the “higher” and “lower” definitions of the

factors as these were intuited by the researcher. However, the interpretations were based on reasonable statistical approaches.

The action performance measure and Points to Goal Ratio are based on Vitality physical activity points, which as described previously, are an objective measure for physical activity based on recorded activities and are not self-reported (Porter et al., 2014). Any activity not recorded by participants (for example, if an individual's fitness tracker's battery was flat or the individual forgot their gym card at home) is not of interest in the context of the experiment, since such activity falls outside the game platform and would not contribute to the weekly game goal. The game goal and physical activity points contributing to the goal were unaffected by the experiment design and are therefore a true reflection of both action and game engagement within the Vitality Active Rewards platform.

The final experiment sample consisted of 2 178 individuals. In general, this is a reasonable sample size. However, once groups based on self-efficacy and motivation were created using latent profile analysis and framing conditions were overlaid some of the subsamples were too small to make a definitive conclusion regarding observations. These were explicitly noted in the results section, and future studies should address this shortcoming.

2.3.3. External validity

External validity is the ability to demonstrate that research findings may be generalised beyond the context of the experiment (Findley et al., 2021; Steckler & McLeroy, 2008).

The broad applicability of goal setting across a range of contexts and behaviours is widely documented (Locke & Latham, 1979, 2002, 2019), so although the experiment focuses on physical activity within a wellness platform, the findings can likely be translated to other behaviours. Physical activity is a behaviour frequently associated with goal setting, traditionally focusing on performance as opposed to learning. Testing the effects of framing on goal setting in this context provides valuable insights into the impact of framing on goal setting in general since an alternative approach in this context is particularly novel. It would be of value to extend this type of experiment to other behaviours to understand if employing learning or hybrid framing is successful at driving positive outcomes. Extending this research to other behaviours will likely require context-specific adjustments to ensure that the goal framing, and overall approach, remains relevant.

The experiment focuses on Vitality Active Rewards as the underlying game chassis and the Discovery Vitality programme in South Africa as the case site. 40 markets to date implement Vitality principles successfully (Vitality Group, 2023) with a global member base of 30 million people and some of these markets have a version of the Vitality Active Rewards game platform (most notably UK and USA). The Discovery Vitality programme has illustrated that many behavioural tenets are translatable and applicable beyond South Africa. One may assume with confidence that this generalisability would extend to the results of this research experiment.

2.4. LIMITATIONS OF THE FIELD EXPERIMENT

Participants opted-in and provided consent to be part of the experiment, therefore, they were aware that they were being observed and that the framing conditions were part of an experiment (even though they were not explicitly aware of which group they belonged to or what the purpose of the framed content was). Furthermore, there was an element of selection, and a true control is not possible in this experiment. The analysis approach (difference-in-differences) controls for the differences between the exposed and unexposed populations and is well suited to a quasi-experimental design such as this where a true control is unavailable. The group formation also ensured that exposed and populations were as similar as possible within the groups for more accurate comparisons.

The underlying game mechanic of Vitality Active Rewards may very likely influence behaviour change. Since the underlying theme of this research is goal setting within a gamification context, this is not a concerning outcome. The research only considered participants with sufficient base-line exposure to the gamification platform to ensure that results were more likely due to the additional framing conditions than due to the novelty of the game elements or the individual re-engaging with the game. There was no change to the Vitality Active Rewards game elements during the field experiment which could have influenced behaviour further.

The research classifies participants based on their starting self-efficacy and motivation. The field study deployed existing research instruments that are commonly used when assessing psychological states in a physical activity context. However, these instruments do not necessarily address the broader gamification context or the more specific Vitality Active Rewards context. Furthermore, these research instruments are lengthy and requiring individuals to complete both could possibly lead to drop-off or fatigue resulting in poor responses. Only individuals who completed all questions of both research instruments were included in the experiment, which also largely reduced the need to deal with missing values during the analysis. The factor analyses conducted and construct reliability confirm that the research surveys are appropriate despite the limitations. Future research needs to consider alternative approaches to assessing self-efficacy and motivation, particularly in an organisational context where these measures need to be operationalised and in a gamification context where there are very likely additional game states that need to be measured.

As part of the underlying Vitality Active Rewards game structure goal difficulty increases as individuals increase their physical activity and achieve their goals. The intention of the framed content was to improve performance and engagement; therefore, it can be argued that the field experiment may have had an impact on individual's goal achievement which in turn influenced future goal setting as part of the underlying game. In other words, engagement with the field experiment indirectly influenced the underlying Vitality Active Rewards game experience. Goals increasing due to engagement is a fundamental game mechanic that hasn't changed since the introduction of Vitality Active Rewards and this mechanic was unaffected during the experiment period. Since participants were individuals who had enough experience with the game, it is unlikely that this dynamic would be

surprising to participants and thereby influence the results. The participants' goal level was allowed for in the analysis through the Points to Goal Ratio variable introduced previously. Since this experiment occurs within a gamification context, this dynamic is again not of too much concern.

It is reasonable to assume that there is a seasonal aspect to physical activity and that Vitality Active Rewards exhibits an autoregressive structure (each week is likely influenced by the previous week). All participants participated in the field experiment over the same period (i.e., there were no additional timing elements that could exacerbate the seasonality impact) and the intervention occurred at the same time point for all participants. Any seasonality effects were further controlled for during the analysis through using structures in the models that accommodate an autoregressive time series.

2.5. ETHICAL CONSIDERATIONS

The researcher obtained ethical approval for the field experiment from the Human Research Ethics Committee (non-medical) of the University of the Witwatersrand, clearance certificate number H20/10/21 (see Appendix B). The Discovery Vitality legal and compliance teams also approved the field experiment in the context of an external member-facing campaign.

Participation in the field experiment was entirely voluntary and prior to the commencement of the field experiment all participants needed to provide explicit consent to participate in the experiment. Participants were provided with detailed information regarding the scope of the experiment, and they were able to withdraw at any stage during the experiment period.

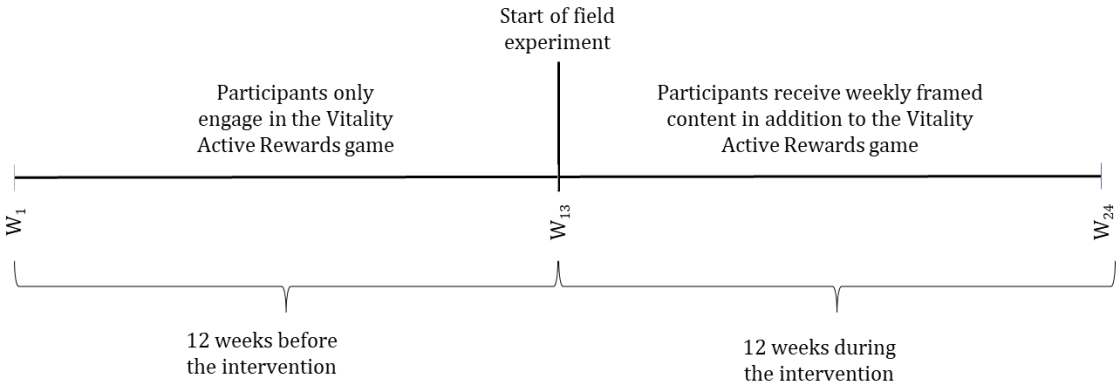
All data collected during the experiment was anonymised to safeguard the privacy of participants and data was aggregated wherever possible. No personally identifiable data was collected or stored, and participants were only identifiable through an anonymised entity number. In other words, it is not possible to trace data back to an individual based on the data collected during the experiment.

Every effort was made to minimise potential inconveniences and participants could refer any queries regarding the field experiment directly to the researcher via email. Any benefits or rewards that a member was eligible for through the Vitality programme was unaffected by the field experiment and participation in the field experiment was additive to the member experience for the duration of the experiment.

2.6. RESULTS

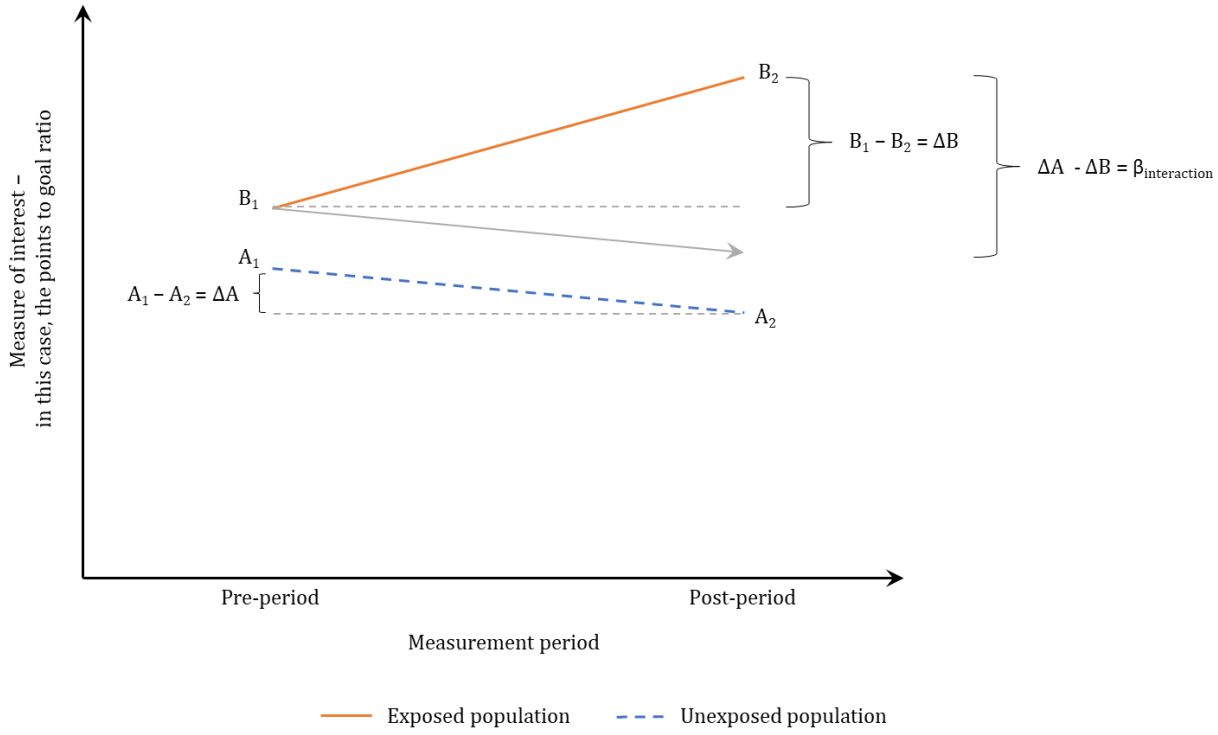
Described previously, the data generated during the experiment consisted of data points for each participant in the 12 weeks before the research experiment and for the 12 weeks of the experiment, illustrated in Figure 28 below.

Figure 28 Graphical representation of field experiment timelines



Therefore, the data meets the requirements for a difference-in-differences experiment design, namely a longitudinal time series with an immediate interruption (i.e., the framed content) that occurs at a known time point (Warton, 2020; Warton et al., 2016). A difference-in-differences design compares the outcome before vs after the intervention (or the interruption). The approach measures the change in an outcome (in this case, the Points to Goal Ratio) for the exposed group compared to the unexposed group and then measures the "difference in the differences". This design approach is used to determine if the amount of change between the two groups was significant. Graphically, the difference-in-differences analysis is represented by Figure 29 adjusted from Warton et al. (2016), below.

Figure 29 Graphic representation of the D-I-D design



If the $\beta_{interaction}$ coefficient is statistically significant, then it is likely that the slopes are not parallel, and the intervention or interruption influenced the exposed population compared to the unexposed population.

Propensity score matching can be used to further ensure groups are sufficiently similar for comparison (Warton, 2020; Warton et al., 2016). The researcher did not deem this necessary since the group definitions described previously matched participants rigorously based on starting psychological states and groups were reasonably representative of the underlying sample (with the exception of Group 5, which was dealt with separately).

The analysis was conducted in SAS using PROC MIXED, because this allows for repeated measures (Warton, 2020; Warton et al., 2016). A Toeplitz covariance structure was chosen due to its similarity to the autoregressive (1) structure (which is appropriate given that each week is likely dependent on the previous week due to the underlying game dynamic), and provided the lowest BIC[13] compared to other appropriate covariance structures (Kincaid, 2005).

The difference-in-differences analysis considers the full 12-week experiment period as well as reduced periods to understand if the effects varied over time. The analysis adjusts the "before" period each time to align with the experiment period considered. For example, if the analysis considers the first 4 weeks of the intervention, then the "before" period used in the analysis is the 4 weeks immediately before the intervention. The researcher investigated all group-framing permutations.

Table 22 below summarises the results for each group where an effect was seen. Where the cell is blank, it indicates that there were no statistically significant results observed.

Where an effect is described as "weak" it indicates that the result was significant at the $\alpha = .15$ level and needs to be reevaluated in a larger sample.

Effects are described as long-term, medium-term, or short-term. Long-term indicates that the effect was seen in the period 10-12 weeks before and after the intervention. Medium-term indicates that the effect was seen in the period 7-9 weeks before and after the intervention. Short-term indicates that the effect was seen in the period 4-6 weeks before and after the intervention. Shorter than 4 weeks before and after the intervention was not considered because such an immediate, short-lived intervention is of less value in practice.

[13] Bayesian Information Criterion – lower is better in mixed model analysis.

Table 22 Summary of results per group

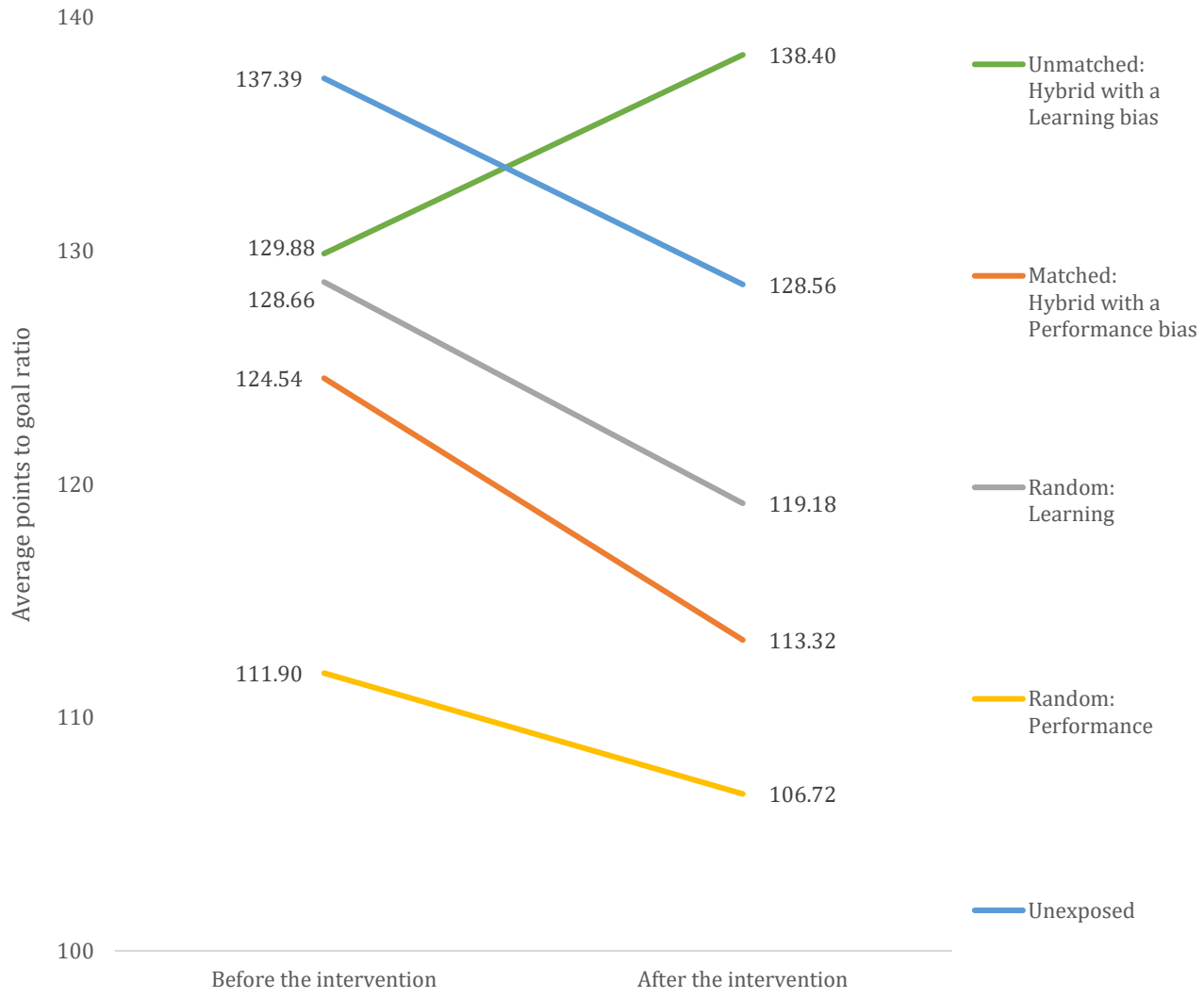
Group	Psychological States		Expected Matched Framing condition	Results per Framing Condition			
	Self-efficacy	Motivation		Performance	Learning	Hybrid with a Performance bias	Hybrid with a Learning bias
1	High	Low	Hybrid with a Performance bias				Weak, long-term positive effect seen
2	Low	High	Hybrid with a Learning bias		Short-term positive effect seen	Weak, long-term positive effect seen	
3	High	High	Performance	Long-term positive effect seen			Long-term negative effect seen
4	High	Low	Hybrid with a Performance bias	Medium-term positive effect seen		Medium-term positive effect seen	Medium-term positive effect seen
5	Low	Low	Learning	Weak, medium-term negative effect seen	Medium-term negative effect seen	Medium-term negative effect seen	
6	High	High	Performance				
7	High	High	Performance				
8	High	High	Performance		Short-term negative effect seen		

2.6.1. Group 1: Higher Self-Efficacy & Lower Motivation

Group 1 participants were those with higher levels of self-efficacy and lower levels of motivation; therefore, the normative theory guiding the field study predicts the best results for a Hybrid Framed content with a Performance Bias.

Figure 30 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control, or unexposed, population.

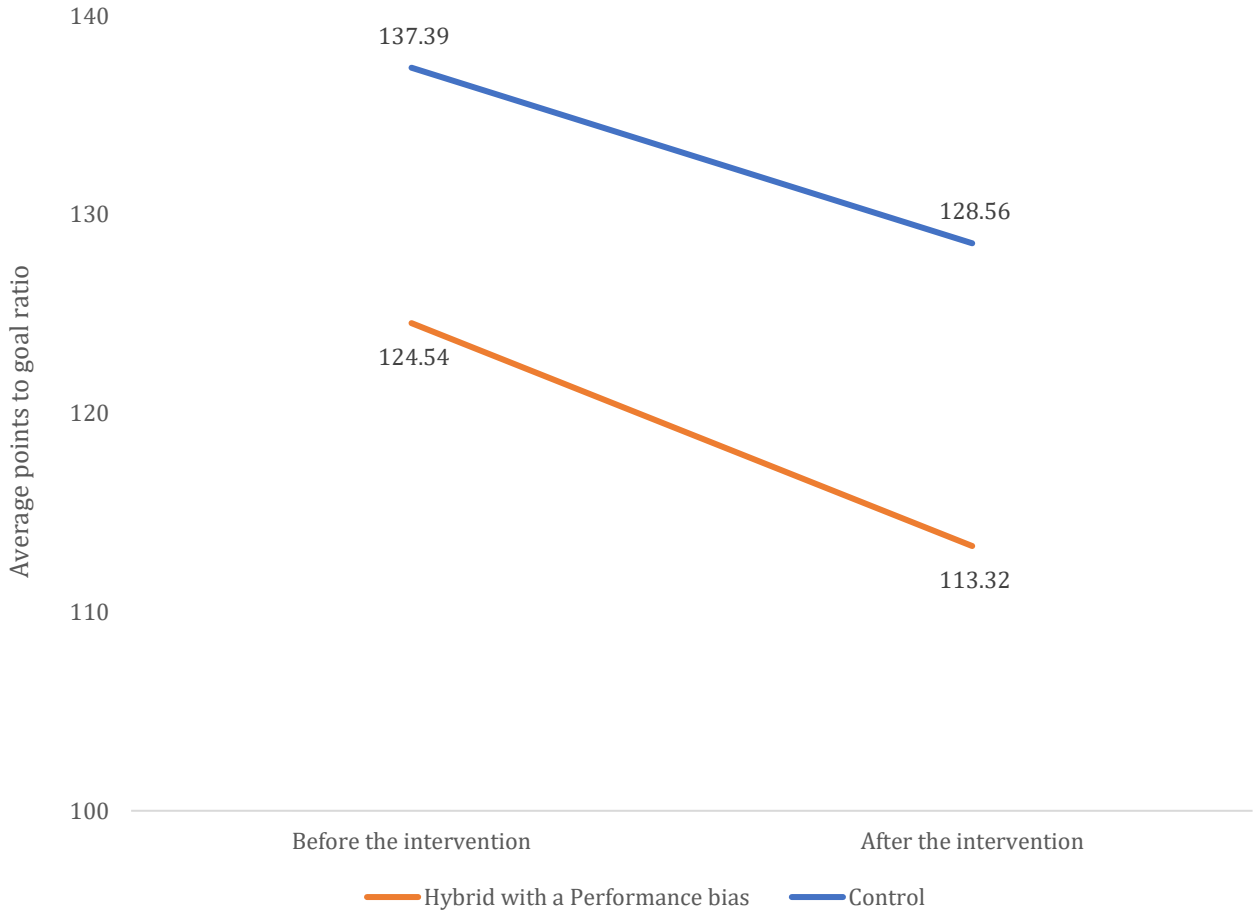
Figure 30 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 1 under all framing conditions



Graphically, all populations show a similar decline in the Points to Goal Ratio with the exception of the population receiving Hybrid Framed content with a Learning Bias, which shows an increase.

Figure 31 below shows the average Points to Goal Ratio in the period before compared to after the intervention in the "matched", Hybrid with a Performance Bias, scenario.

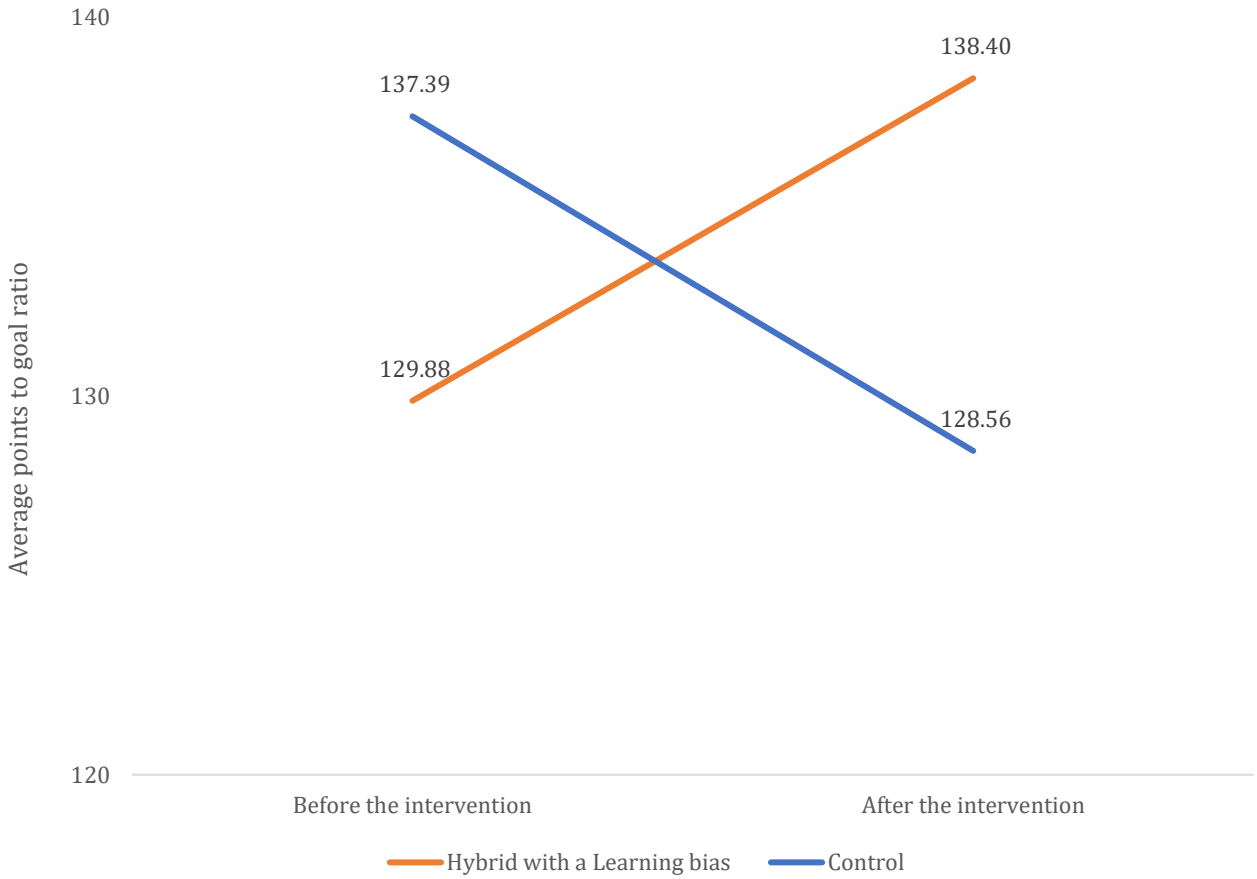
Figure 31 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 1 under Hybrid Framing with a Performance Bias



The magnitude of the D-I-D coefficient is -2.38 and is not significant (p =.79), indicating that it is unlikely that the exposure to the additional Hybrid content with a Performance Bias affected the outcome of the exposed population any differently than the underlying background trend, captured by the control, or unexposed, population. Varying the time period evaluated did not provide different results in this population. Based on the coefficients from the linear model, exposure to the Hybrid content with a Performance Bias decreased the average Points to Goal Ratio in the exposed population by 11.22% (not significant, p = .14) compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 8.84% (significant, p = .09).

The "unmatched" framing condition was Hybrid Framed content with a Learning Bias. The sample size (n = 26) is below the optimal threshold for research, and it is necessary to reevaluate with a larger sample. Figure 32 below shows the average Points to Goal Ratio in the period before compared to after the intervention in the "unmatched" scenario.

Figure 32 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 1 under Hybrid Framing with a Learning Bias



The magnitude of the D-I-D coefficient is 17.35 and it is weakly statistically significant at the $\alpha = 0.15$ level ($p = .14$), indicating that the slopes of the two groups are likely not parallel and that exposure to the additional learning framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the learning framing increased the average Points to Goal Ratio by 8.52% (not significant, $p = .41$) compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 8.84% (significant , $p = .09$).

The randomly allocated population consisted of participants in Group 1 who received Pure framed content (i.e., Performance or Learning). Both populations are small ($n = 21$ for Performance framed content and $n = 27$ for Learning framed content) and should be reevaluated with a larger sample. Neither of these framing conditions showed any statistically significant results.

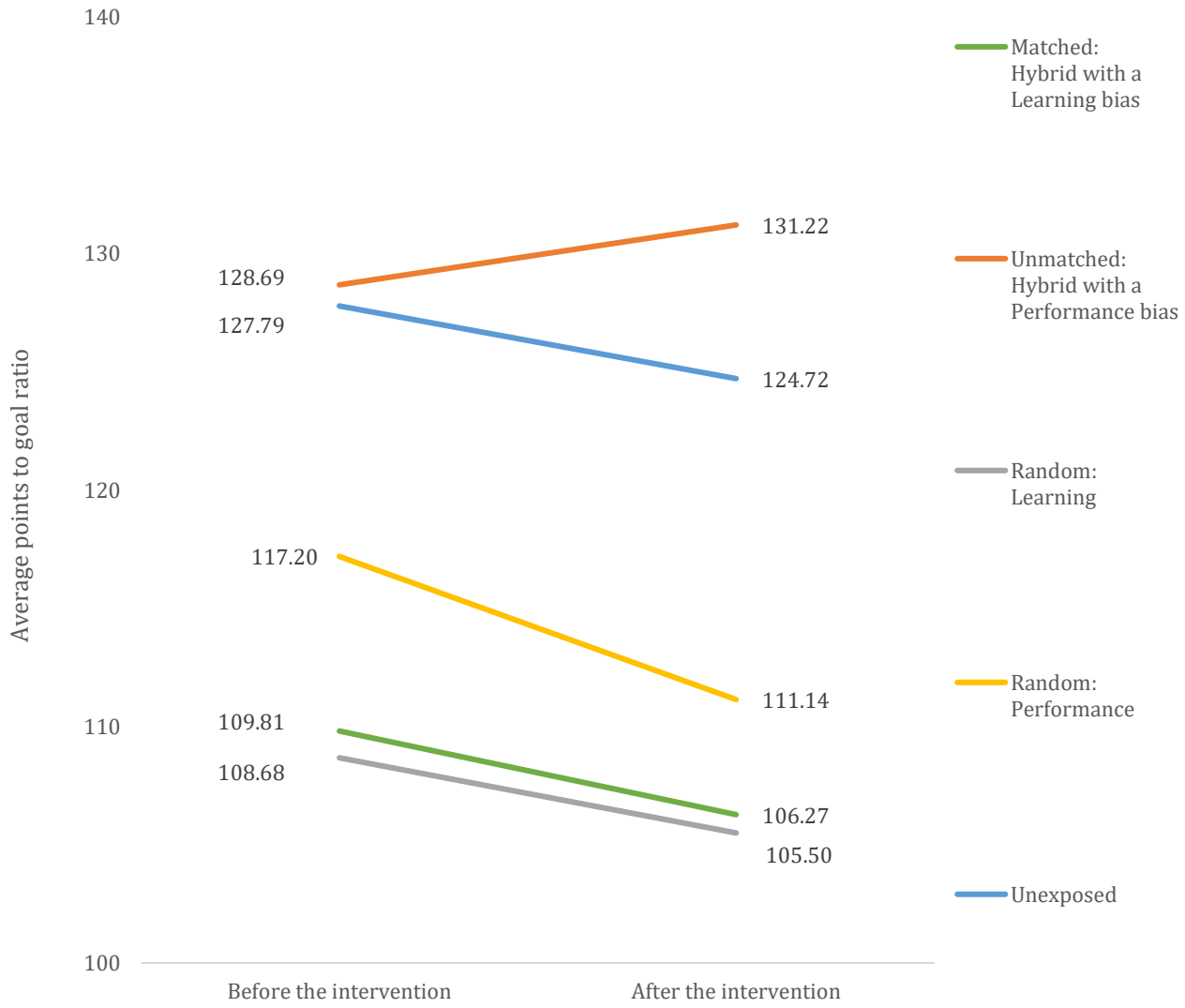
2.6.2. Group 2: Lower Self-Efficacy & Higher Motivation

Group 2 participants were those with lower levels of self-efficacy and higher levels of motivation; therefore, the normative theory guiding the field study predicts the best results

for a Hybrid Framed content with a Learning Bias. It needs to be noted that the Intrinsic and Identified motivation factor was moderately high and was prioritised over a moderately low Introjected motivation factor (as summarised in Table 19 on p. 77).

Figure 33 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control, or unexposed, population.

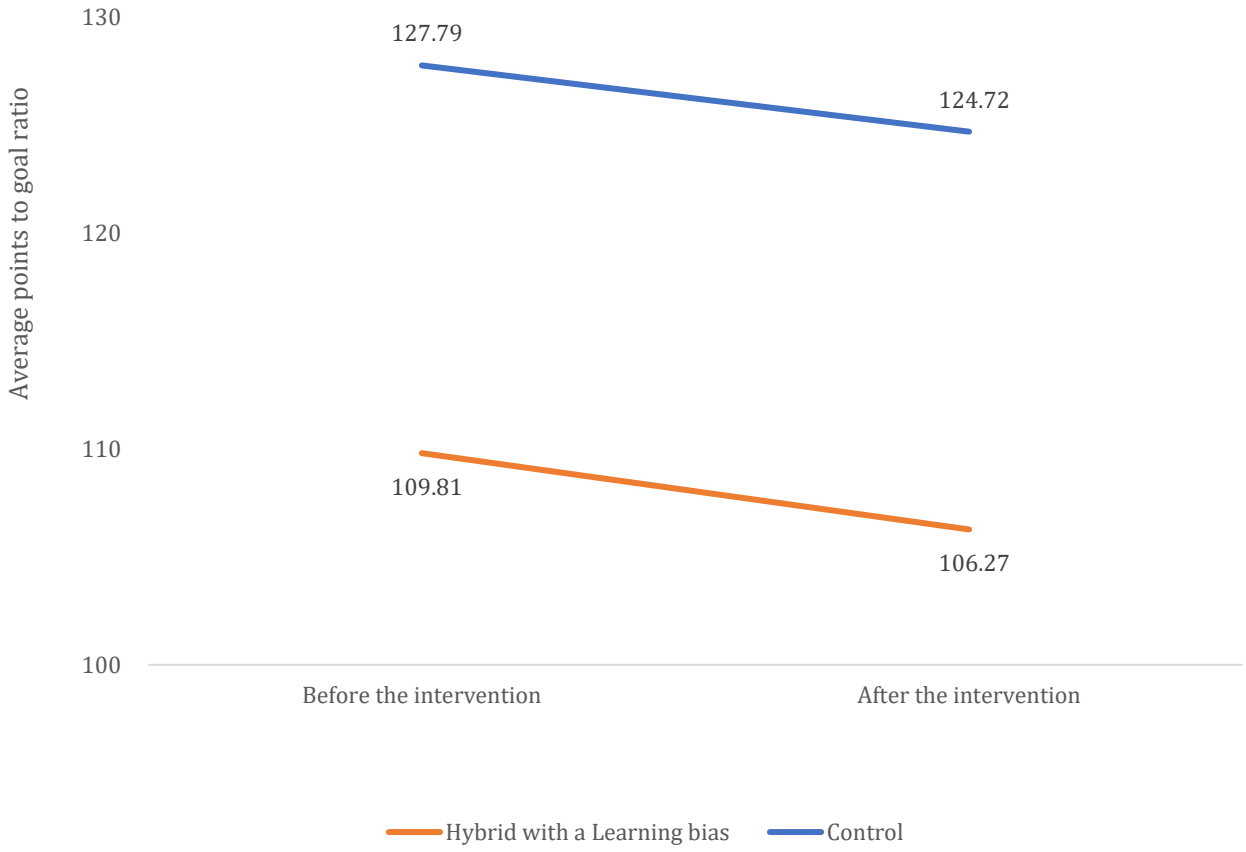
Figure 33 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 2 under all framing conditions



Graphically, all populations show a similar decline in the Points to Goal Ratio with the exception of the population receiving Hybrid Framed content with a Performance Bias, which shows an increase.

Figure 34 below shows the average Points to Goal Ratio in the period before compared to after the intervention in the "matched", Hybrid with a Learning Bias, scenario.

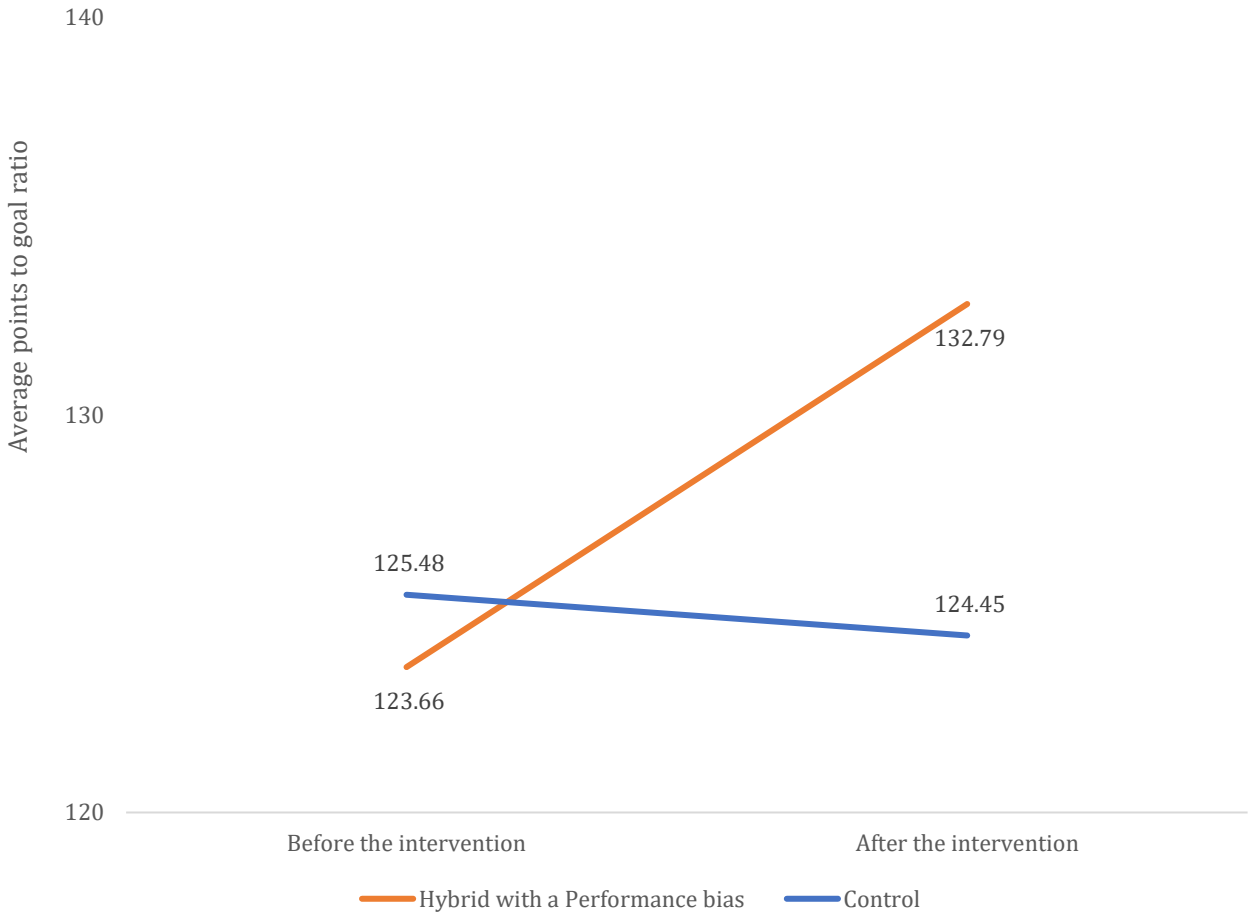
Figure 34 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 2 under Hybrid Framing with a Learning Bias



The magnitude of the D-I-D coefficient is -0.47 and is not significant (p = .95), indicating that it is unlikely that the exposure to the additional Hybrid content with a Learning Bias affected the outcome of the exposed population any differently than the underlying background trend, captured by the control, or unexposed, population. Varying the time period considered did not provide different results in this population. Based on the coefficients from the linear model, exposure to the Hybrid content with a Learning Bias decreased the average Points to Goal Ratio in the exposed population by 3.54% (not significant, p = .60), compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 3.07% (not significant, p = .46).

The "unmatched" framing condition was Hybrid Framed content with a Performance Bias. Figure 35 below shows the average Points to Goal Ratio in the period 10 weeks before compared to 10 weeks after the intervention in the "unmatched" scenario.

Figure 35 Average Points to Goal Ratio in the 10 weeks before the intervention compared to the 10 weeks after the intervention for Group 2 under Hybrid Framing with a Performance Bias

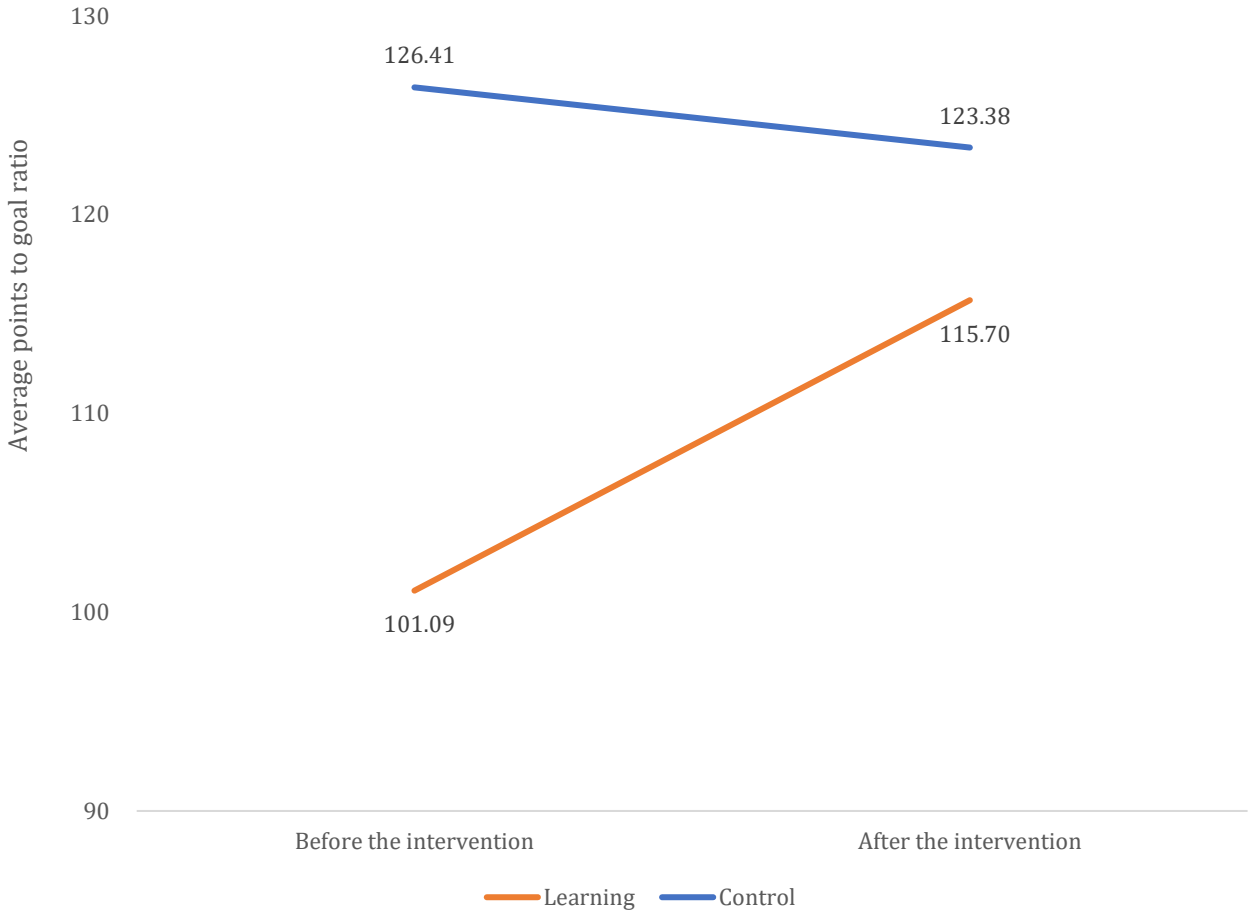


The magnitude of the D-I-D coefficient is 10.16 and it is weakly statistically significant at the $\alpha = 0.15$ level ($p = .12$), indicating that the slopes of the two groups are likely not parallel and that exposure to the additional Hybrid Framed content with a Learning Bias affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the learning framing increased the average Points to Goal Ratio by 9.14 (significant, $p = .10$) compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 1.03% (not significant, $p = .77$).

The randomly allocated population consisted of participants in Group 2 who received Pure framed content (i.e., Performance or Learning). The researcher did not observe a significant effect for the population randomly exposed to Pure Performance framed content. However, there is a difference between the unexposed population and those who received Pure Learning framed content in the period immediately following the intervention.

Figure 36 below shows the average Points to Goal Ratio in the period 4 weeks before compared to 4 weeks after the intervention.

Figure 36 Average Points to Goal Ratio in the 4 weeks before the intervention compared to the 4 weeks after the intervention for Group2 under Learning framing



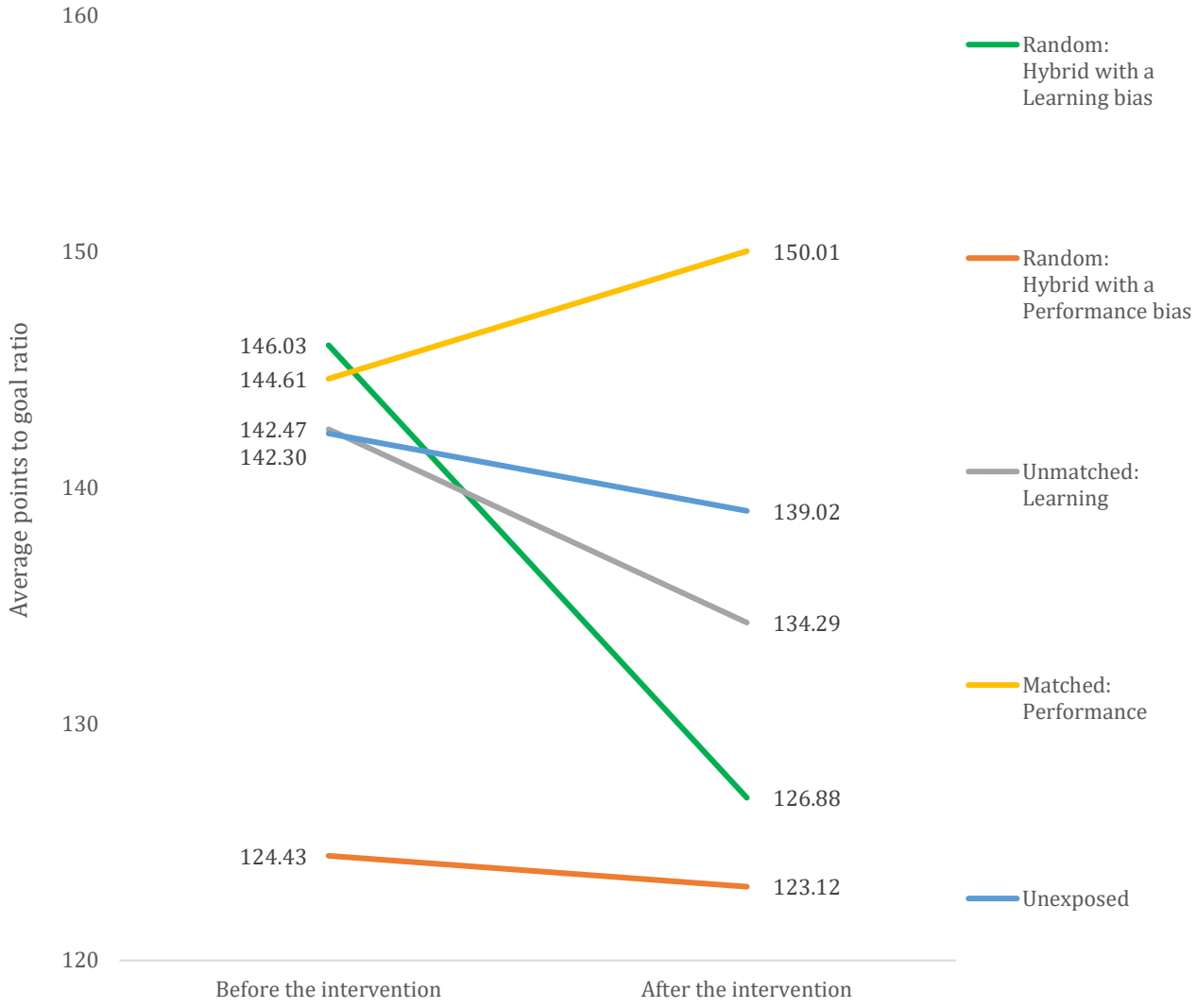
The magnitude of the D-I-D coefficient is 17.64 and is significant at the $\alpha = 0.1$ level ($p = .09$), indicating that the slopes of the two groups are not parallel and that exposure to the additional Learning framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the Learning framing increased the average Points to Goal Ratio by 14.61% (significant, $p = .10$), compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 3.03% (not significant, $p = .55$).

2.6.3. Group 3: Higher Self-Efficacy & Higher Motivation

Group 3 participants were those with higher levels of self-efficacy and higher levels of motivation; therefore, the normative theory guiding the field study predicts the best results for Pure Performance framed content.

Figure 37 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control, or unexposed, population.

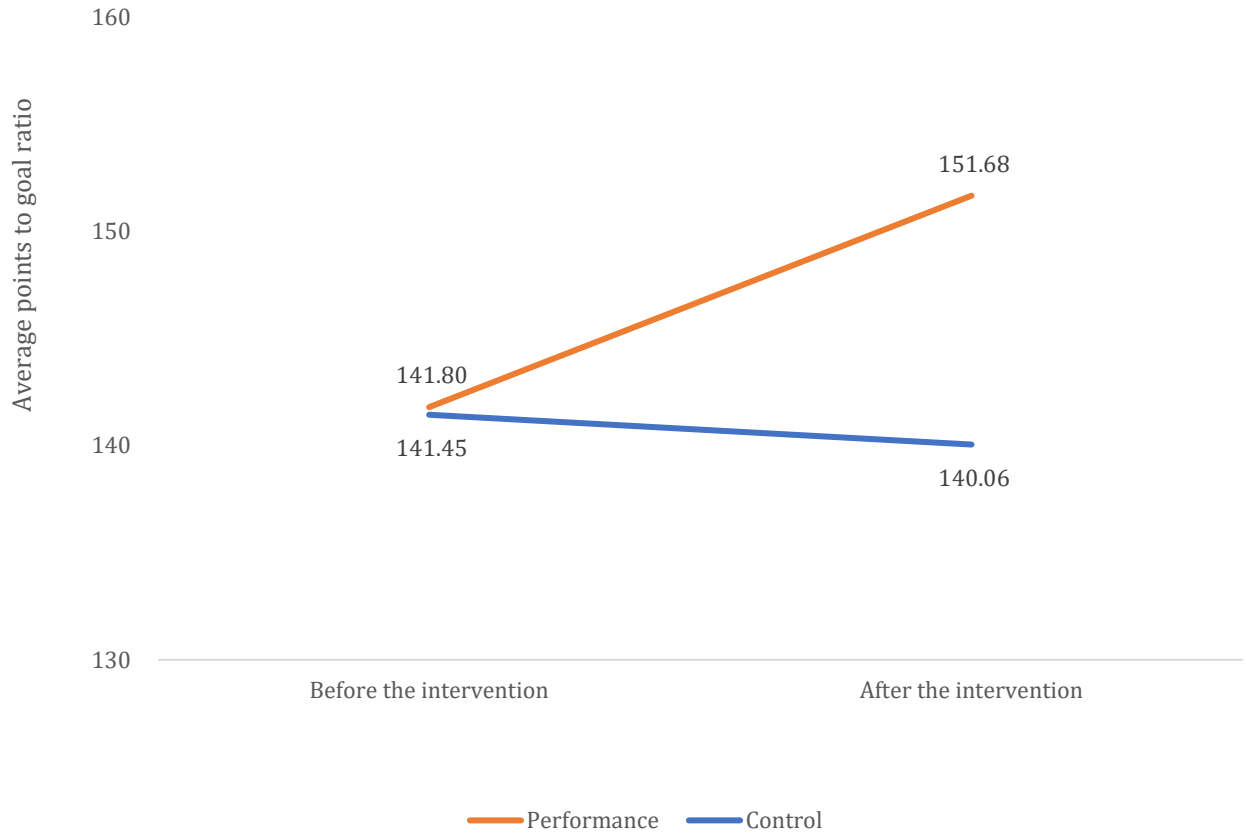
Figure 37 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 3 under all framing conditions



Graphically, all populations show varying levels of decline in the Points to Goal Ratio with the exception of the population receiving Pure Performance framed content, which shows an increase.

Figure 38 below shows the average Points to Goal Ratio in the period 10 weeks before compared to 10 weeks after the intervention in the "matched", Performance, scenario.

Figure 38 Average Points to Goal Ratio in the 10 weeks before the intervention compared to the 10 weeks after the intervention for Group 3 under Performance framing



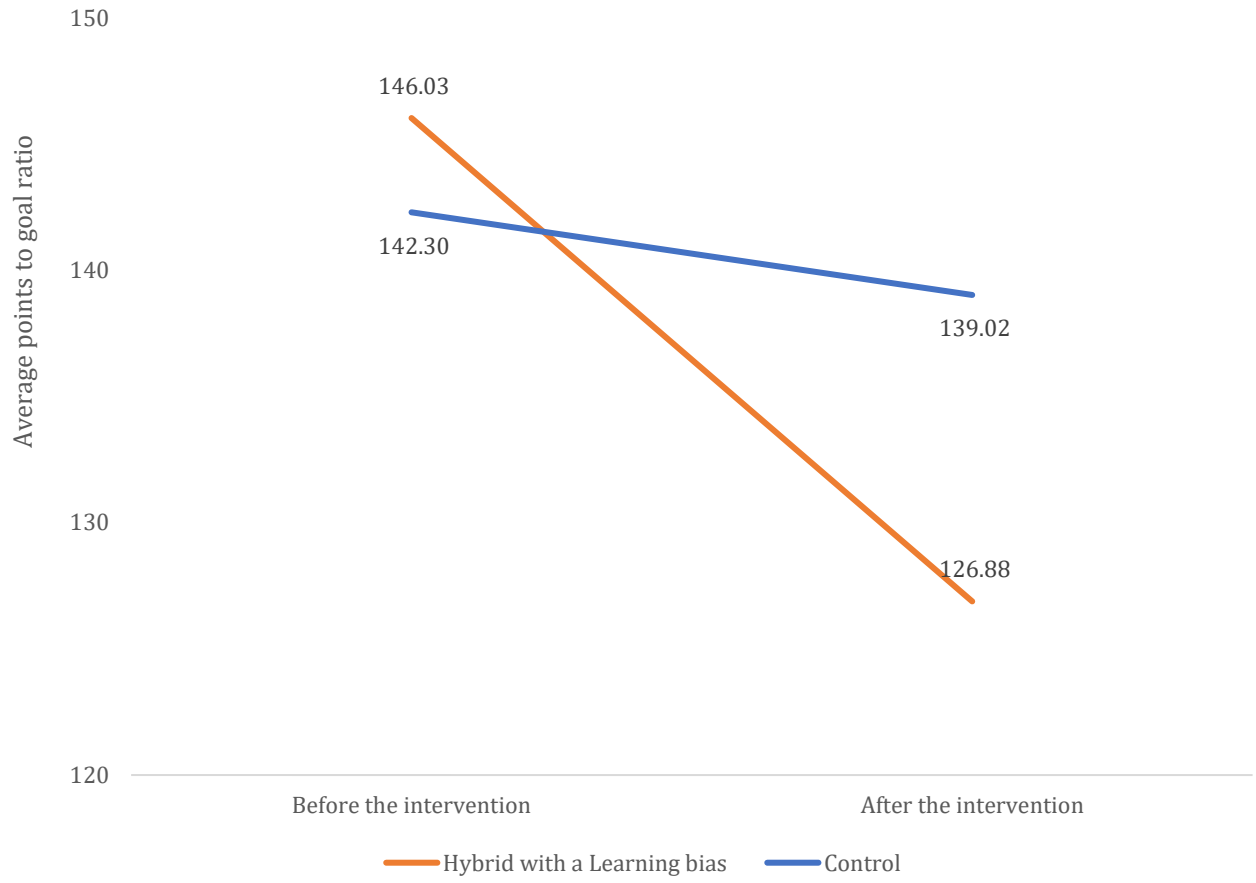
The magnitude of the D-I-D coefficient is 11.27 and is significant at the $\alpha = 0.1$ level ($p = .08$), indicating that the slopes of the two groups are not parallel and that exposure to the additional Performance framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. This positive effect becomes even stronger as the time period reduces. Based on the coefficients from the linear model, exposure to the performance framing increased the average Points to Goal Ratio by 9.88% (significant, $p = .07$), compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 1.39% (not significant, $p = .69$).

The researcher did not observe a significant effect for the "unmatched" population exposed to Pure Learning framed content over any time period.

The randomly allocated population consisted of participants in Group 3 who received Hybrid Framed content (i.e., with a Performance or Learning Bias). Both populations are small ($n = 17$ for Hybrid with a Performance Bias and $n = 24$ for Hybrid with a Learning Bias) and should be reevaluated with a larger sample. The researcher did not observe a significant effect for the random population exposed to Hybrid Framed content with a Performance Bias, over any period. The population exposed to Hybrid Framed content with a Learning Bias showed a

statistically significant **negative** effect. Figure 39 below shows the average Points to Goal Ratio in the period before compared to after the intervention.

Figure 39 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 3 under Hybrid Framing with a Learning Bias



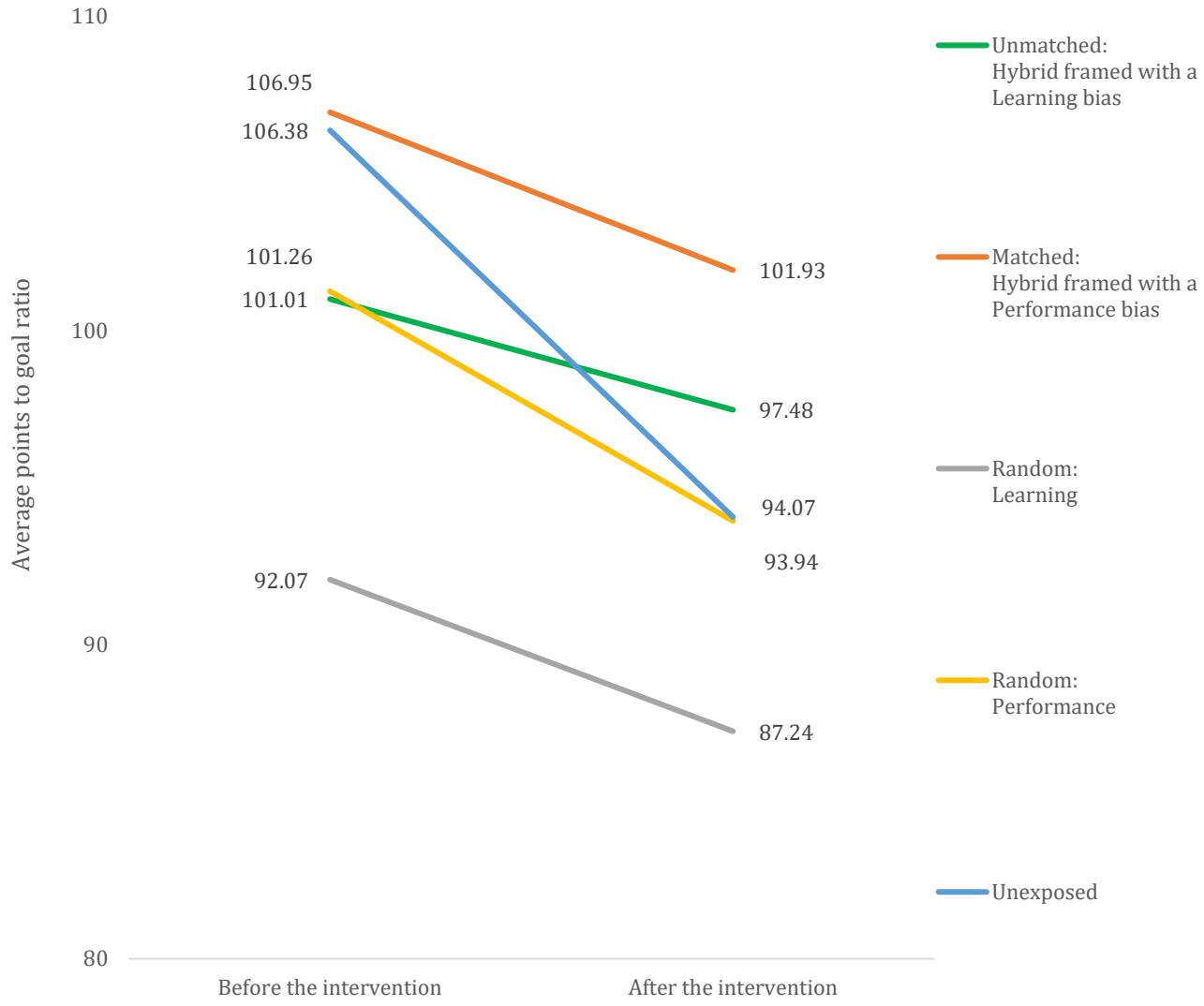
The magnitude of the D-I-D coefficient is -15.88 and is significant at the $\alpha = 0.1$ level ($p = .10$), indicating that the slopes of the two groups are not parallel and that exposure to the additional Hybrid Framed content with a Learning Bias affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the Hybrid Framing with a Learning Bias decreased the average Points to Goal Ratio by 19.15% (significant, $p = .03$), compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 3.27% (not significant, $p = .40$).

2.6.4. Group 4: Higher Self-Efficacy & Lower Motivation

Group 4 participants were those with higher levels of self-efficacy and lower levels of motivation; therefore, the normative theory guiding the field study predicts the best results for Hybrid Framed content with a Performance Bias. It is noteworthy that the underlying self-efficacy and motivation factors were all at moderate levels rather than on the extreme ends of the spectrum (as summarised in Table 19 on p. 77).

Figure 40 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control, or unexposed, population.

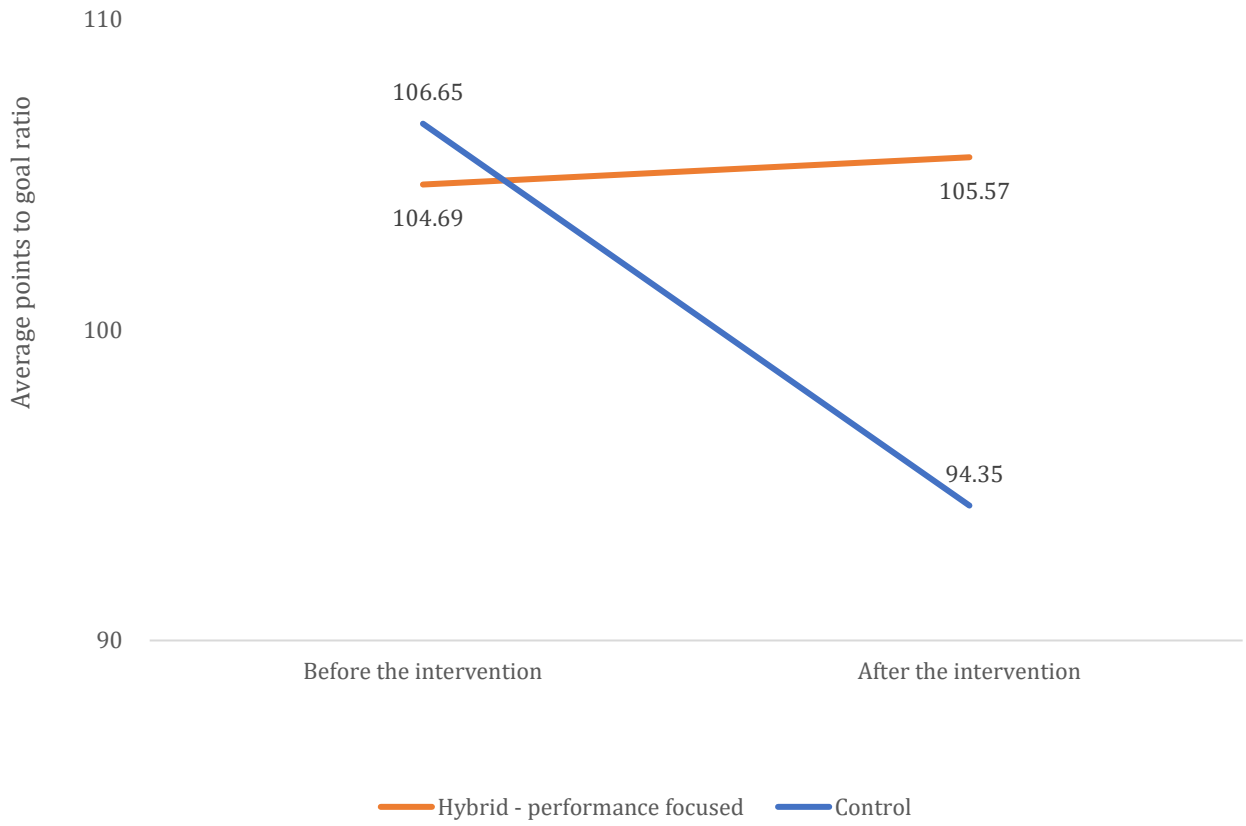
Figure 40 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 4 under all framing conditions



Graphically, all populations show a decline in the Points to Goal Ratio at varying rates. The populations receiving Hybrid Framed content appear to show a less sharp decline compared to the unexposed population.

Figure 41 below shows the average Points to Goal Ratio in the period 9 weeks before compared to 9 weeks after the intervention in the "matched", Hybrid with a Performance Bias, scenario.

Figure 41 Average Points to Goal Ratio in the 9 weeks before the intervention compared to the 9 weeks after the intervention for Group 4 under Hybrid Framing with a Performance Bias

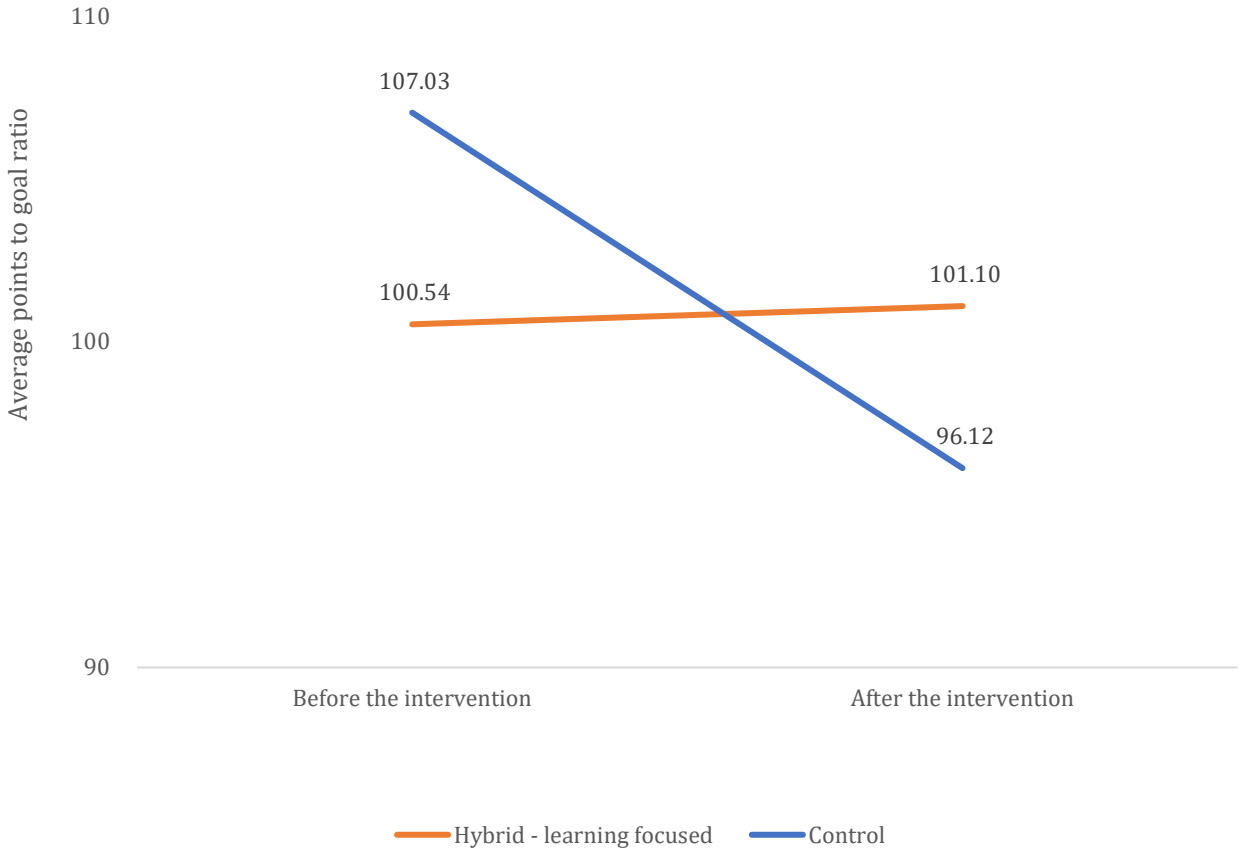


The magnitude of the D-I-D coefficient is 13.18 and is significant at the α = .01 level (p = .06), indicating that the slopes of the two groups are not parallel and that exposure to the additional Hybrid Framed content with a Performance Bias affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. This positive effect becomes even stronger as the time period reduces. Based on the coefficients from the linear model, exposure to the Hybrid Framing increased the average Points to Goal Ratio by 0.88% (not significant, p = .88), compared to the unexposed group which had a decrease in the average Points to Goal Ratio of 12.30% (significant, p = .00).

The "unmatched" framing condition for Group 4 was Hybrid Framing with a Learning Bias and the researcher also observed a positive effect under this framing condition.

Figure 42 below shows the average Points to Goal Ratio for the population receiving Hybrid Framing with a Learning Bias in the period 7 weeks before compared to 7 weeks after the intervention.

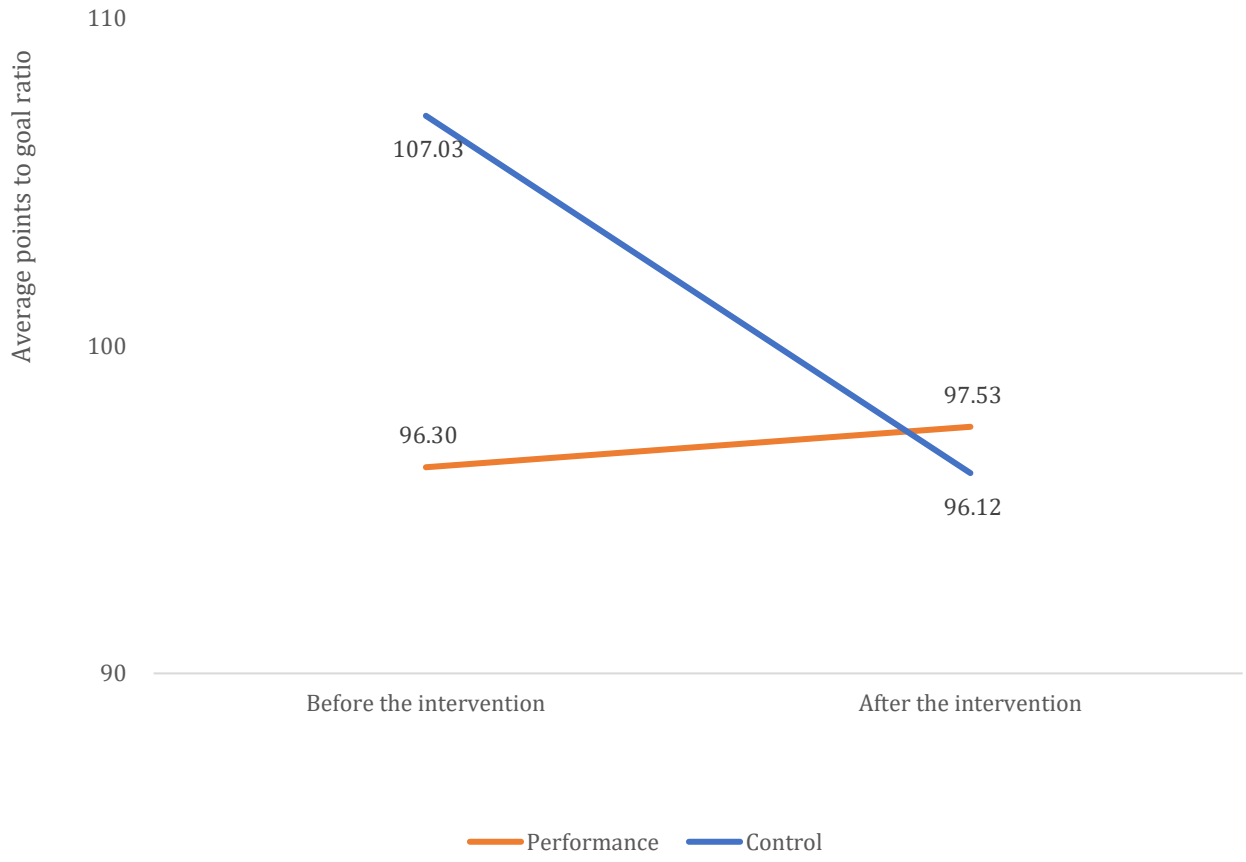
Figure 42 Average Points to Goal Ratio in the 7 weeks before the intervention compared to the 7 weeks after the intervention for Group 4 under Hybrid Framing with a Learning Bias



The magnitude of the D-I-D coefficient is 11.47 and is significant at the $\alpha = 0.1$ level ($p = .10$), indicating that the slopes of the two groups are not parallel and that exposure to the additional Hybrid Framed content with a Learning Bias affected the outcome of the exposed group differently than the underlying background trend, captured by the control, or unexposed, population. Based on the coefficients from the linear model, exposure to the Hybrid framing increased the average Points to Goal Ratio by 0.56% (not significant, $p = .92$), compared to the unexposed group which had a decrease in the average Points to Goal Ratio of 10.92% (significant, $p = .00$).

The random framing conditions for Group 4 were those receiving Pure Performance or Learning framed content. The researcher observed a positive effect in the population exposed to Pure Performance framing. Figure 43 below shows the average Points to Goal Ratio for the population receiving Performance framed content in the period 7 weeks before compared to 7 weeks after the intervention.

Figure 43 Average Points to Goal Ratio in the 7 weeks before the intervention compared to the 7 weeks after the intervention for Group 4 under Performance framing



The magnitude of the D-I-D coefficient is 11.72 and is significant at the α = 0.1 level (p = .06), indicating that the slopes of the two groups are not parallel and that exposure to the additional Performance framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control, or unexposed, group. This positive effect becomes even stronger as the time period reduces. Based on the coefficients from the linear model, exposure to the Performance framing increased the average Points to Goal Ratio by 0.81% (not significant, p =.87), compared to the unexposed group which had a decrease in the average Points to Goal Ratio of 10.92% (significant, p =.00).

The researcher did not observe a significant effect for the random population exposed to Pure Learning framed content across any time period.

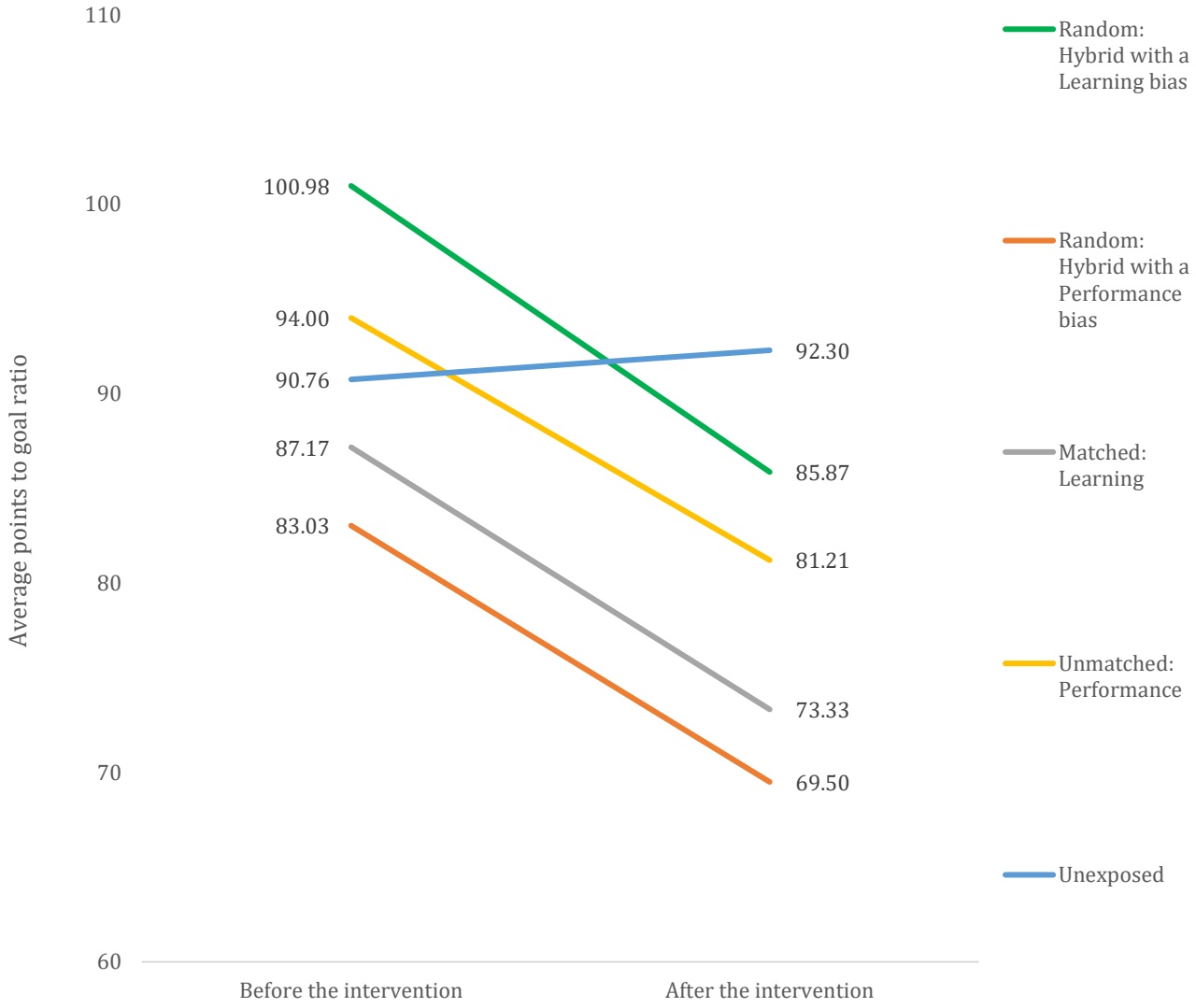
2.6.5. Group 5: Lower Self-Efficacy & Lower Motivation

Group 5 participants were those with lower levels of motivation and lower levels of self-efficacy; therefore, the normative theory guiding the field study predicts the best results for

Pure Learning framed content. Group 5 was heavily skewed towards females, and this was controlled for in the analysis.

Figure 44 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control, or unexposed, population.

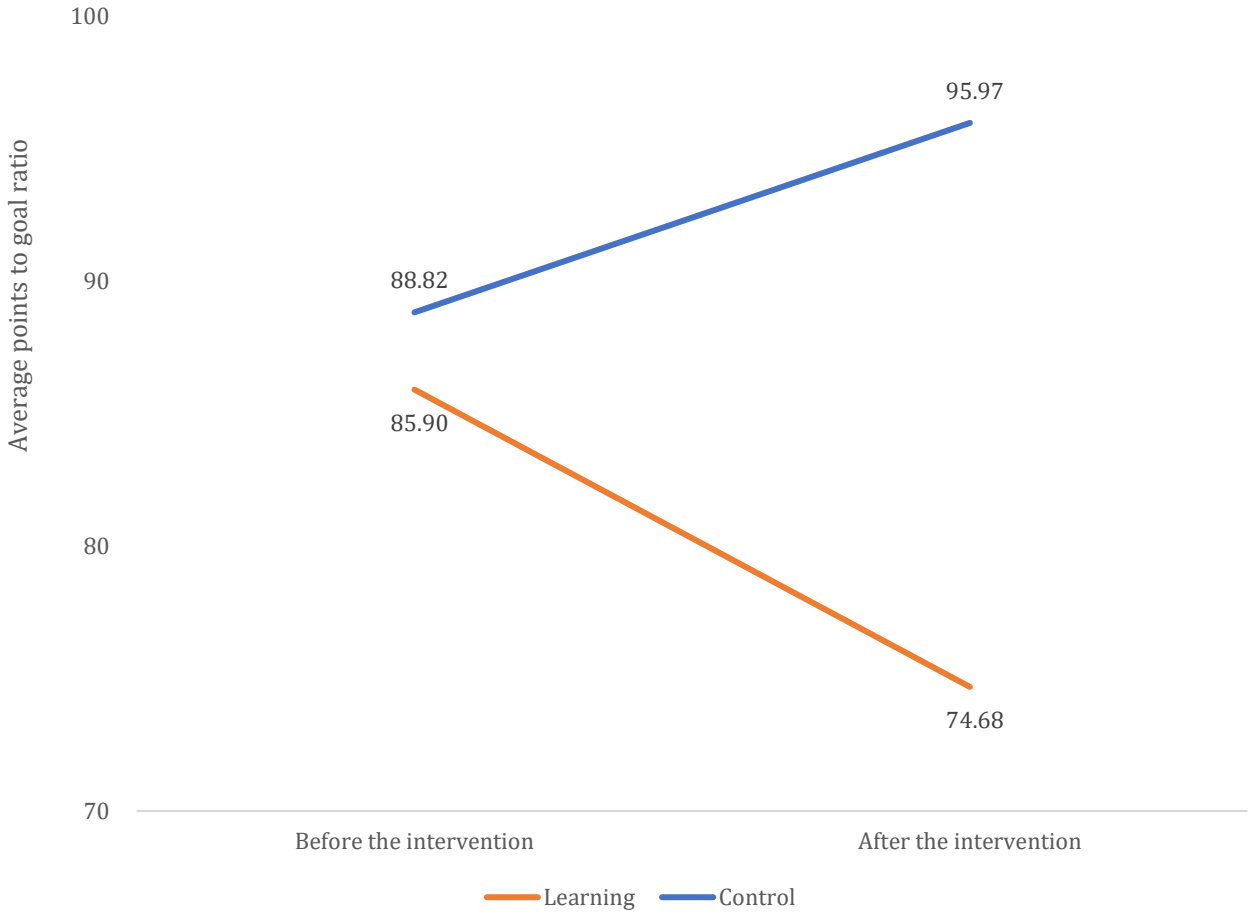
Figure 44 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 5 under all framing conditions



Graphically, all exposed populations show a similar decline in the Points to Goal Ratio compared to the unexposed population.

Figure 45 below shows the average Points to Goal Ratio in the period 9 weeks before compared to 9 weeks after the intervention in the "matched", Learning, scenario.

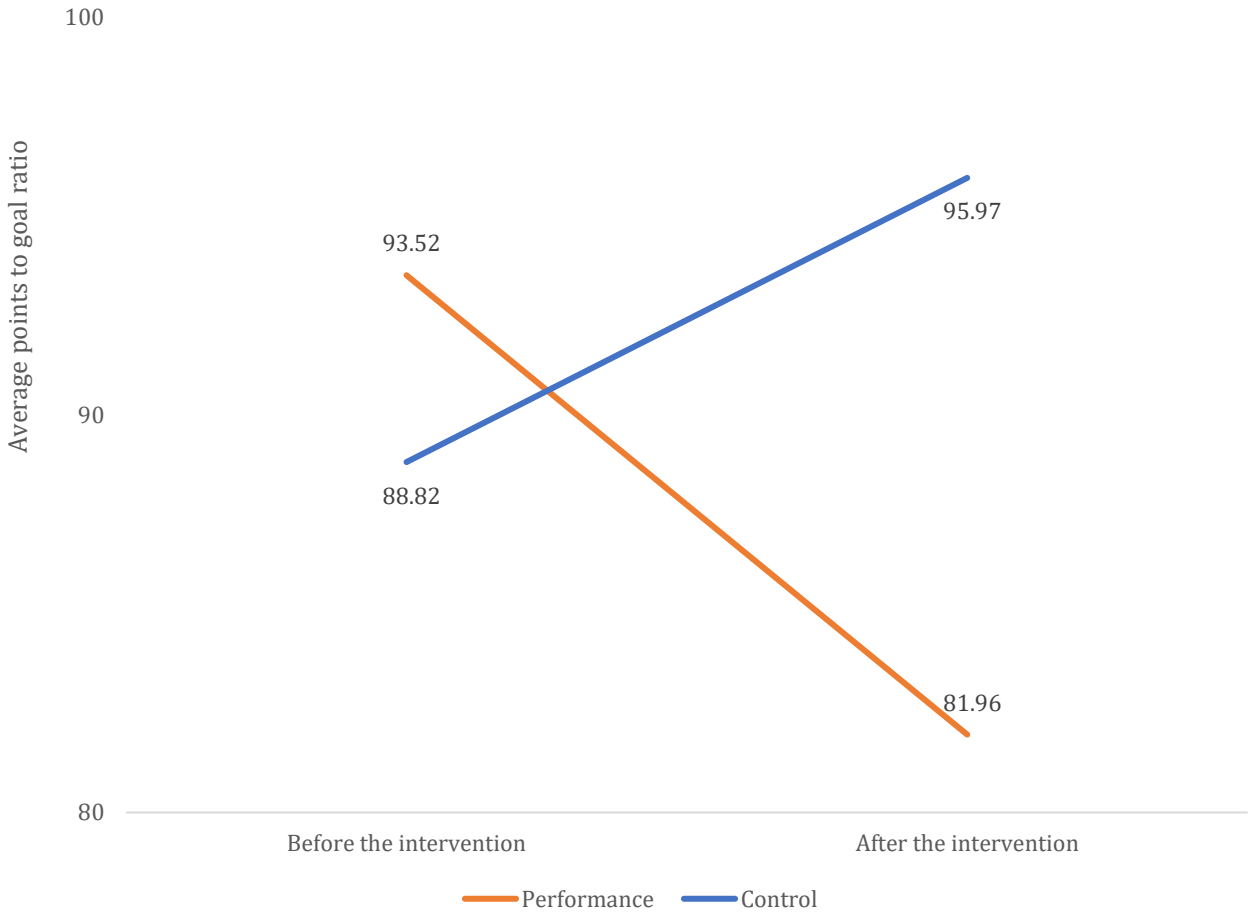
Figure 45 Average Points to Goal Ratio in the 9 weeks before the intervention compared to the 9 weeks after the intervention for Group 5 under Learning framing



The magnitude of the D-I-D coefficient is -18.37 and is significant at the $\alpha = 0.1$ level ($p = .10$), indicating that the slopes of the two groups are not parallel and that exposure to the additional learning framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the Learning framing decreased the average Points to Goal Ratio by 11.22% (not significant, $p = .13$), compared to the unexposed group which had an increase in the average Points to Goal Ratio of 7.15% (not significant, $p = .39$).

The "unmatched" framing condition for Group 5 was Pure Performance framing. Figure 46 below shows the average Points to Goal Ratio in the population receiving Pure Performance framing in the period 9 weeks before compared to 9 weeks after the intervention.

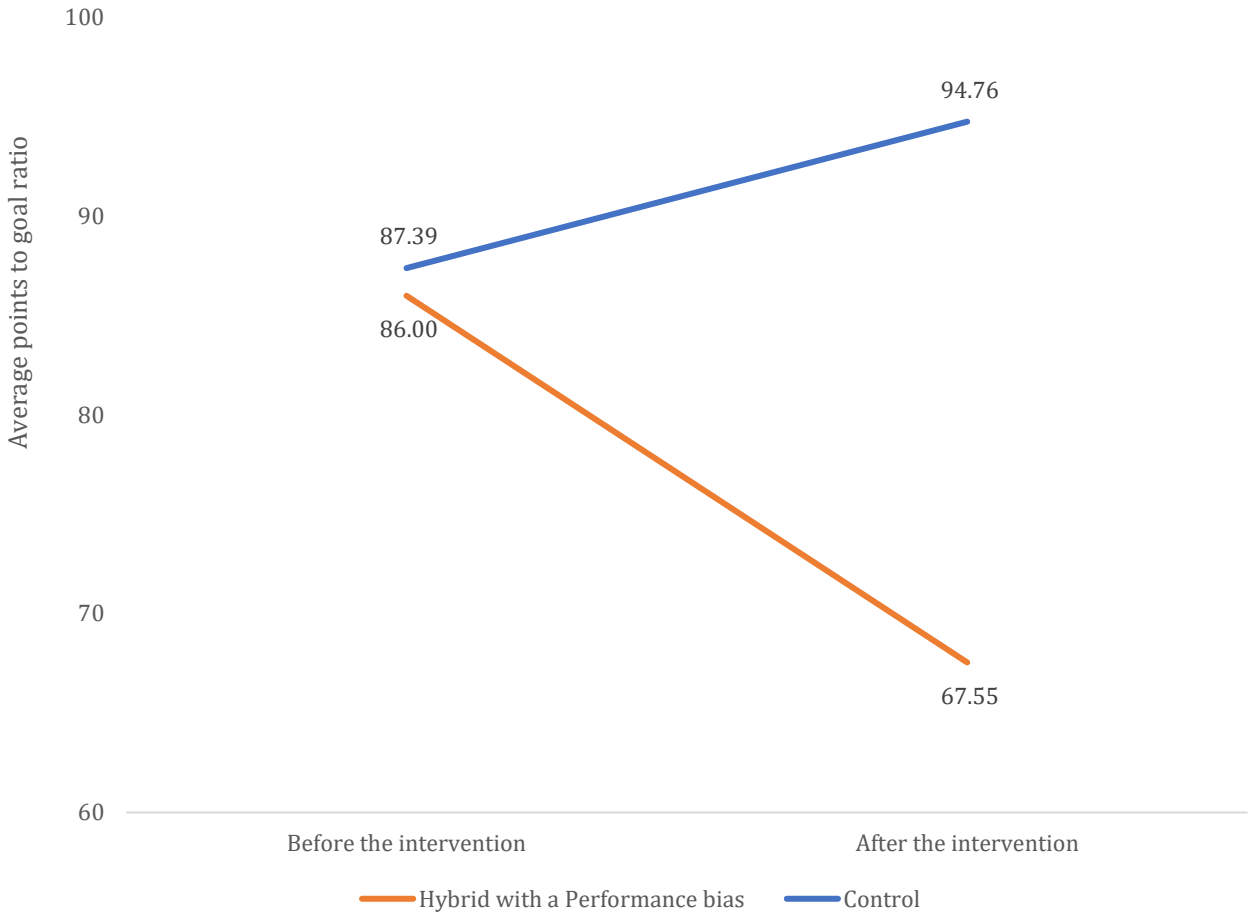
Figure 46 Average Points to Goal Ratio in the 9 weeks before the intervention compared to the 9 weeks after the intervention for Group 5 under Performance framing



The magnitude of the D-I-D coefficient is -18.71 and is marginally significant at the $\alpha = 0.15$ level ($p = .11$), indicating that the slopes of the two groups are not parallel and that exposure to the additional Performance framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the Performance framing decreased the average Points to Goal Ratio by 11.56% (not significant, $p = .12$), compared to the unexposed group which had an increase in the average Points to Goal Ratio of 7.15% (not significant, $p = .41$).

The randomly allocated population consisted of participants in Group 5 who received Hybrid Framed content (i.e., with a Performance or Learning Bias). Both populations are small ($n = 15$ for Hybrid Framing with a Performance Bias and $n = 11$ for Hybrid Framing with a Learning Bias) and should be reevaluated with a larger sample. Figure 47 below shows the average Points to Goal Ratio in the population receiving Hybrid Framed content with a Performance Bias in the period 8 weeks before compared to 8 weeks after the intervention.

Figure 47 Average Points to Goal Ratio in the 8 weeks before the intervention compared to the 8 weeks after the intervention for Group 5 under Hybrid framing with a Performance bias



The magnitude of the D-I-D coefficient is -25.82 and is significant at the α = .10 level (p = .10), indicating that the slopes of the two groups are not parallel and that exposure to the additional Hybrid Framed content with a Performance Bias affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the Hybrid Framed content with a Performance Bias decreased the average Points to Goal Ratio by 18.45% (not significant, p =.16), compared to the unexposed group which had an increase in the average Points to Goal Ratio of 7.37% (not significant, p =.37).

The researcher did not observe any significant effects for the population randomly exposed to Hybrid Framed content with a Learning Bias.

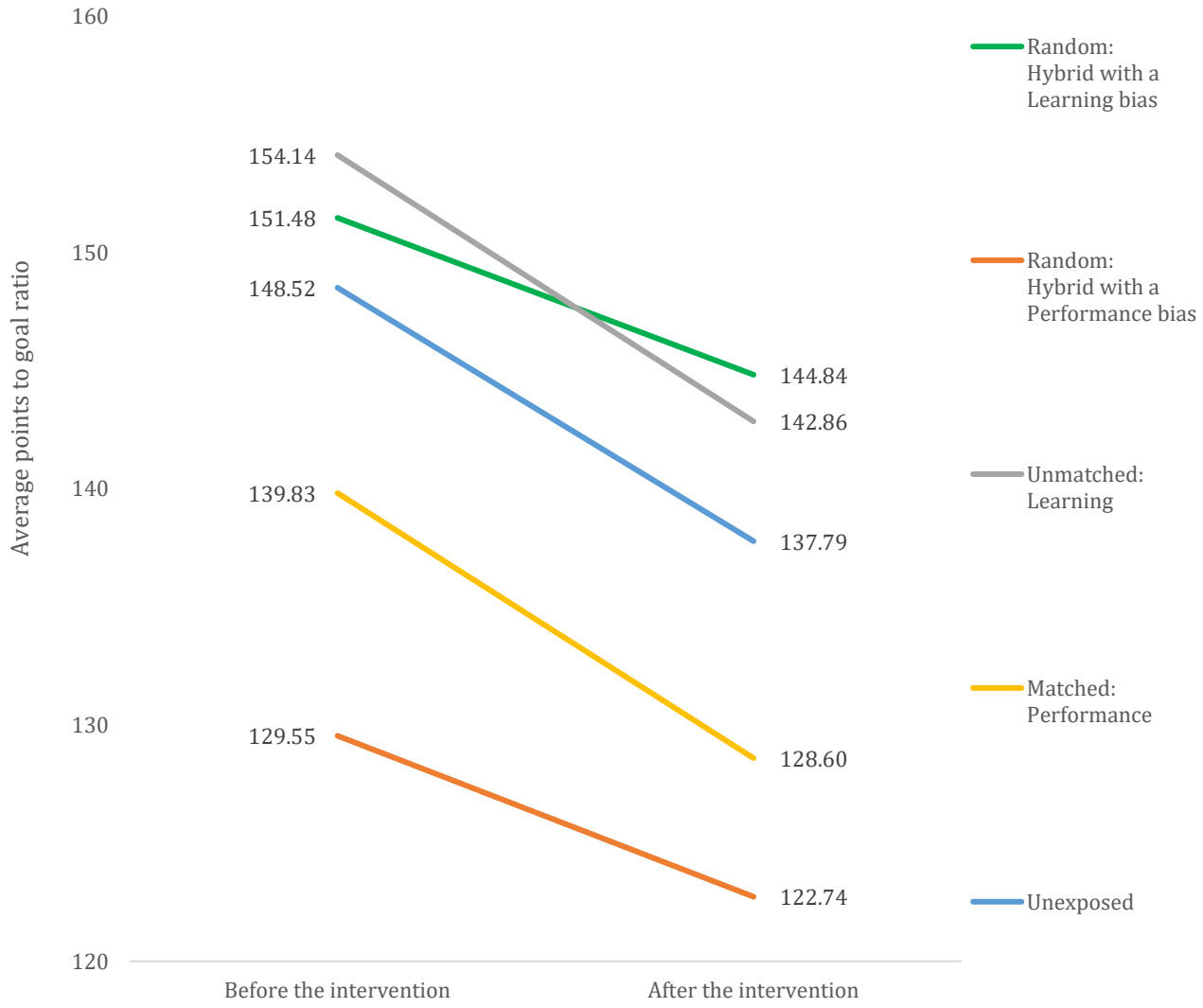
The researcher noted previously that Group 5 is heavily skewed towards females. The analysis was repeated, controlling for gender as a variable, however, there was no change in the outcomes of the results.

2.6.6. Group 6: Higher Self-Efficacy & Higher Motivation

Group 6 participants were those with higher levels of self-efficacy and higher levels of motivation; therefore, the normative theory guiding the field study predicts the best results for Pure Performance framing.

Figure 48 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control, or unexposed, population.

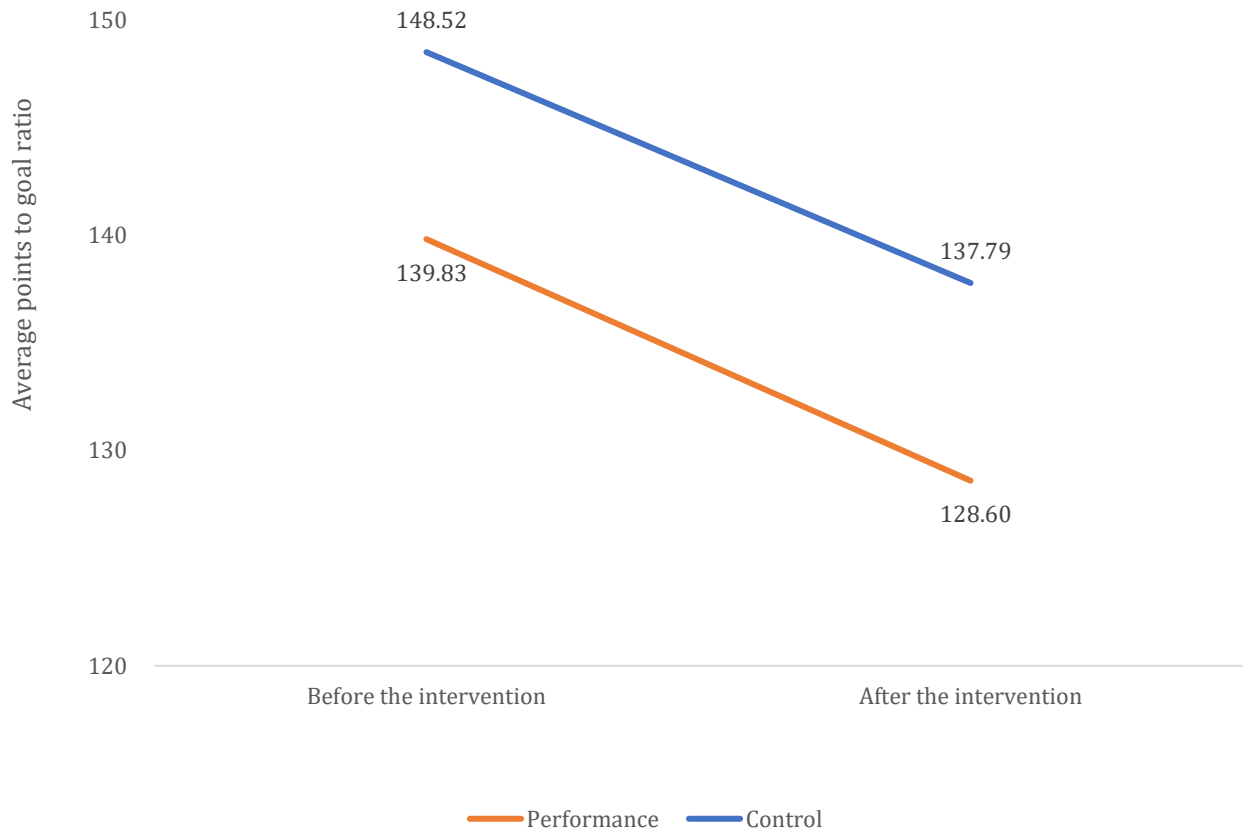
Figure 48 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 6 under all framing conditions



Graphically, all populations show varying levels of decline in the Points to Goal Ratio.

Figure 49 below shows the average Points to Goal Ratio in the period before compared to after the intervention in the "matched", Performance, scenario.

Figure 49 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 6 under Performance framing



The magnitude of the D-I-D coefficient is -0.49 and is not significant (p = .96), indicating that it is unlikely that the exposure to the additional Performance framed content affected the outcome of the exposed group any differently than the underlying background trend, captured by the control group. Varying the time period considered did not provide different results in this population. Based on the coefficients from the linear model, exposure to the Performance framed content decreased the average Points to Goal Ratio by 11.22% (not significant, p =.19), compared to the unexposed group which had a decrease in the average Points to Goal Ratio of 10.73% (significant, p =.01).

The "unmatched" framing condition was Pure Learning framed content. The researcher did not observe a significant effect for the "unmatched" population, and varying the time period considered did not provide different results in this population.

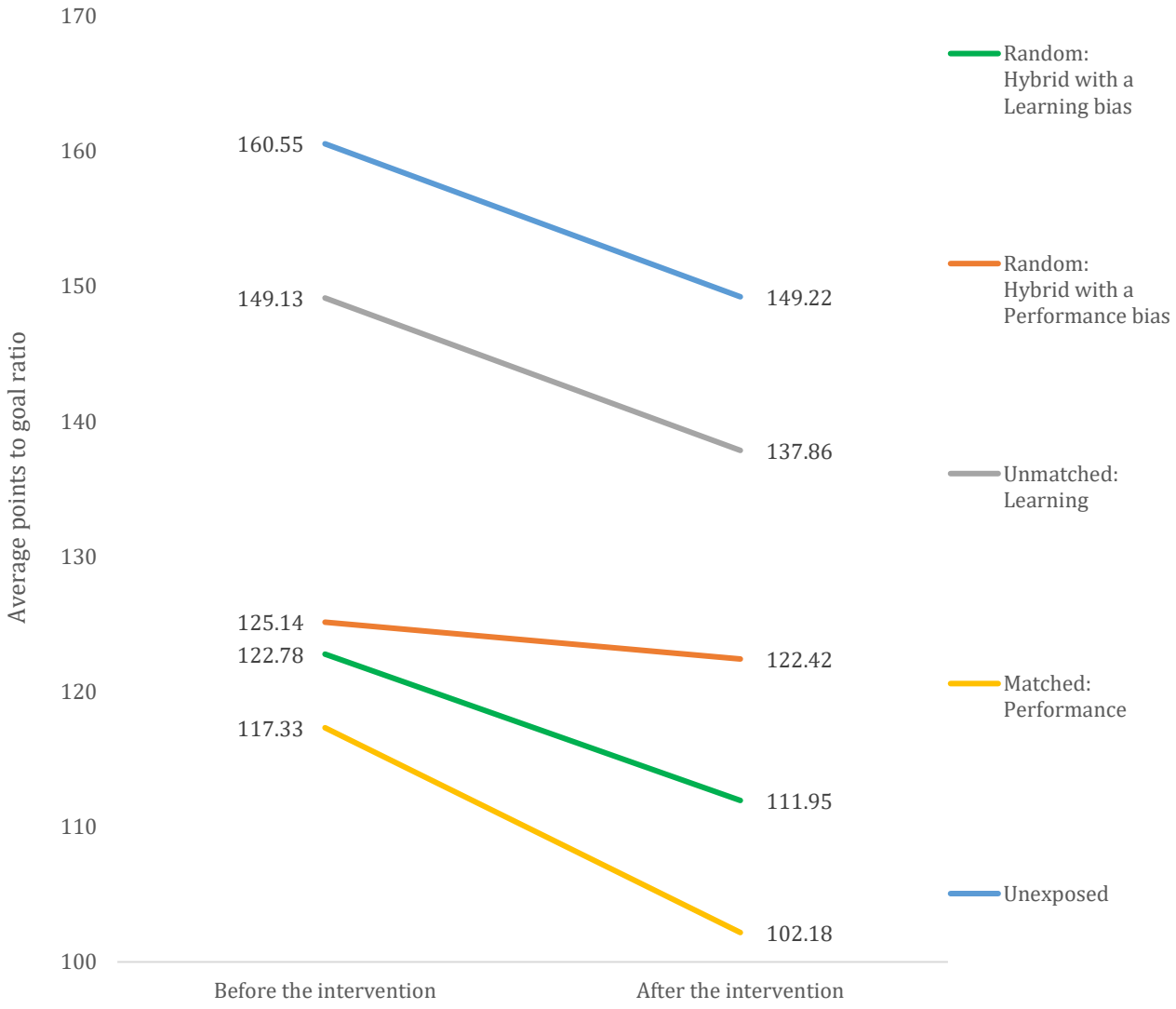
The randomly allocated population consisted of participants in Group 6 who received Hybrid Framed content (i.e., Hybrid with a Performance or Learning Bias). Both populations are small (n = 17 for Hybrid with a Performance Bias and n = 19 for Hybrid with a Learning Bias) and should be reevaluated with a larger sample. Neither of these framing conditions showed any statistically significant results, over any time period.

2.6.7. Group 7: Higher Self-Efficacy & Higher Motivation

Group 7 participants were those with higher levels of self-efficacy and higher levels of motivation; therefore, the normative theory guiding the field study predicts the best results for Pure Performance framing. The sample size in the "matched" condition (n = 25) is below the optimal threshold for research, and it is necessary to reevaluate with a larger sample.

Figure 50 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control population.

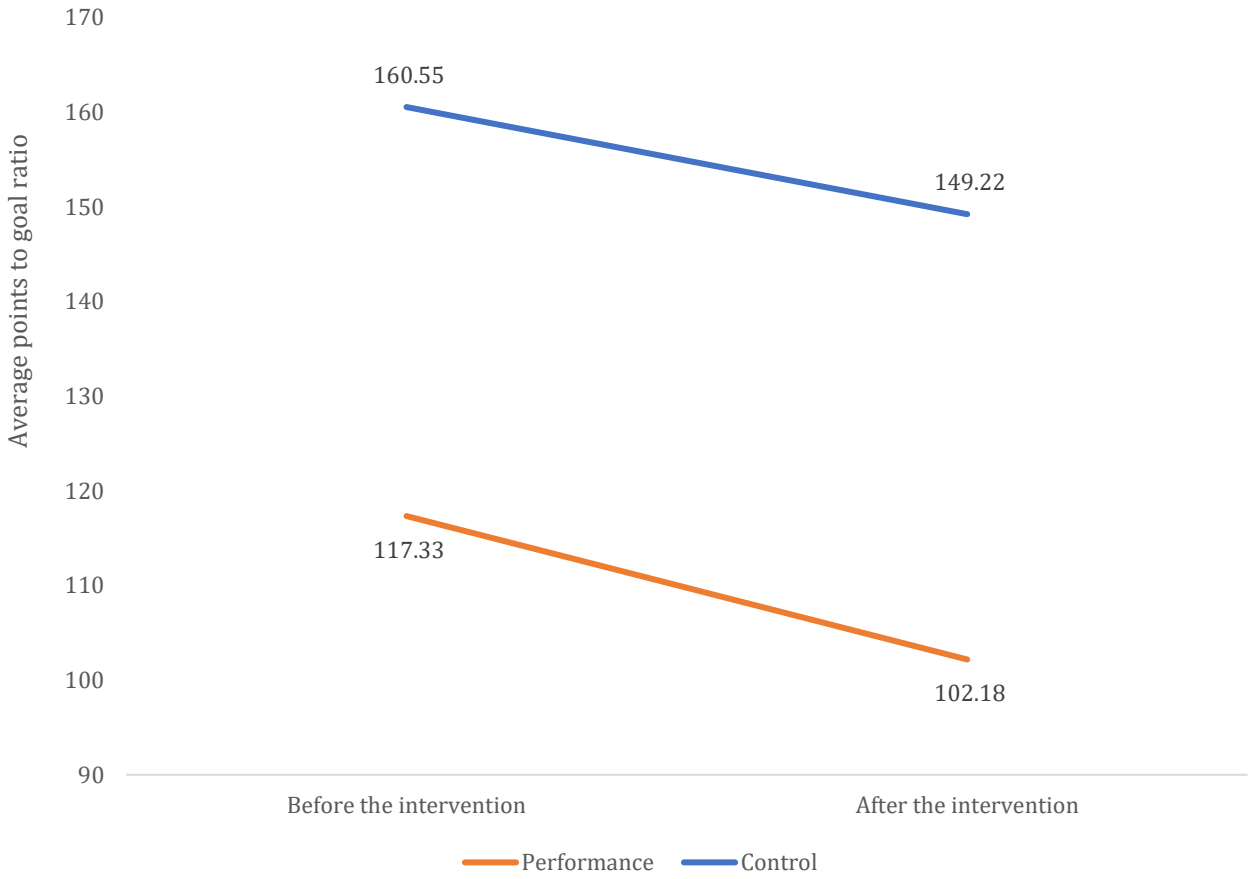
Figure 50 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 7 under all framing conditions



Graphically, all populations show varying levels of decline in the Points to Goal Ratio.

Figure 51 below shows the average Points to Goal Ratio in the period before compared to after the intervention in the "matched", Performance, scenario.

Figure 51 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 7 under Performance framing



The magnitude of the D-I-D coefficient is -5.56 and is not significant (p = .60), indicating that it is unlikely that the exposure to the additional Performance framed content affected the outcome of the exposed group any differently than the underlying background trend, captured by the control, or unexposed, population. Varying the time period considered did not provide different results in this population. Based on the coefficients from the linear model, exposure to the Performance framed content decreased the average Points to Goal Ratio by 16.88% (significant, p =.07), compared to the unexposed group which had a decrease in the average Points to Goal Ratio of 11.32% (significant, p =.03).

The "unmatched" framing condition was Pure Learning framed content. The researcher did not observe a significant effect for the "unmatched" population, and varying the time period considered did not provide different results in this population.

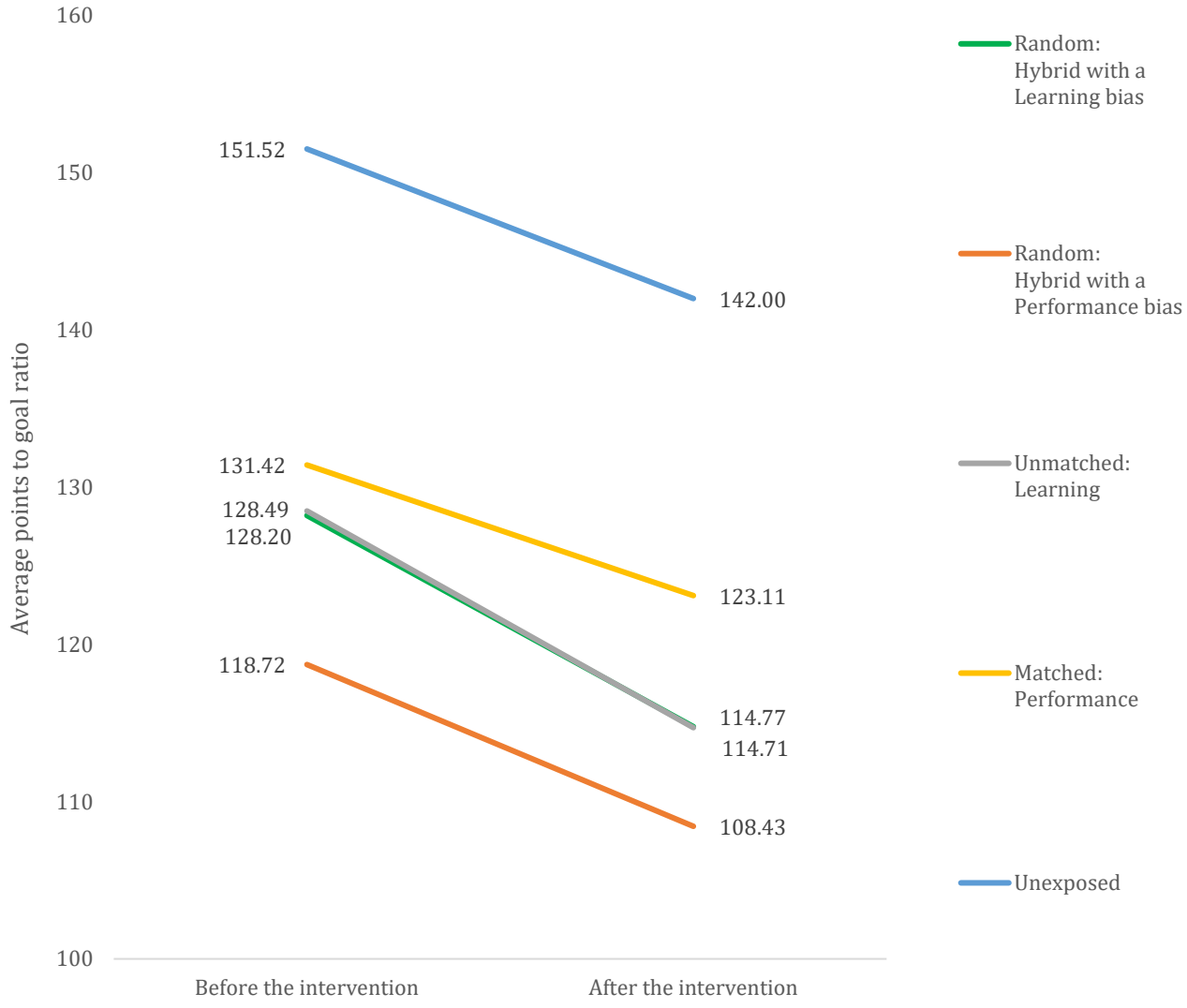
The randomly allocated population consisted of participants in Group 7 who received Hybrid Framed content (i.e., Hybrid with a Performance or Learning Bias). Both populations are small (n = 11 for Hybrid with a Performance Bias and n = 16 for Hybrid with a Learning Bias) and should be reevaluated with a larger sample. Neither of these framing conditions showed any statistically significant results, over any time period.

2.6.8. Group 8: Higher Self-Efficacy & Higher Motivation

Group 8 participants were those with higher levels of self-efficacy and higher levels of motivation; therefore, the normative theory guiding the field study predicts the best results for Pure Performance framing.

Figure 52 below shows the average Points to Goal Ratio in the period before compared to after the intervention for each of the framing conditions and the control population.

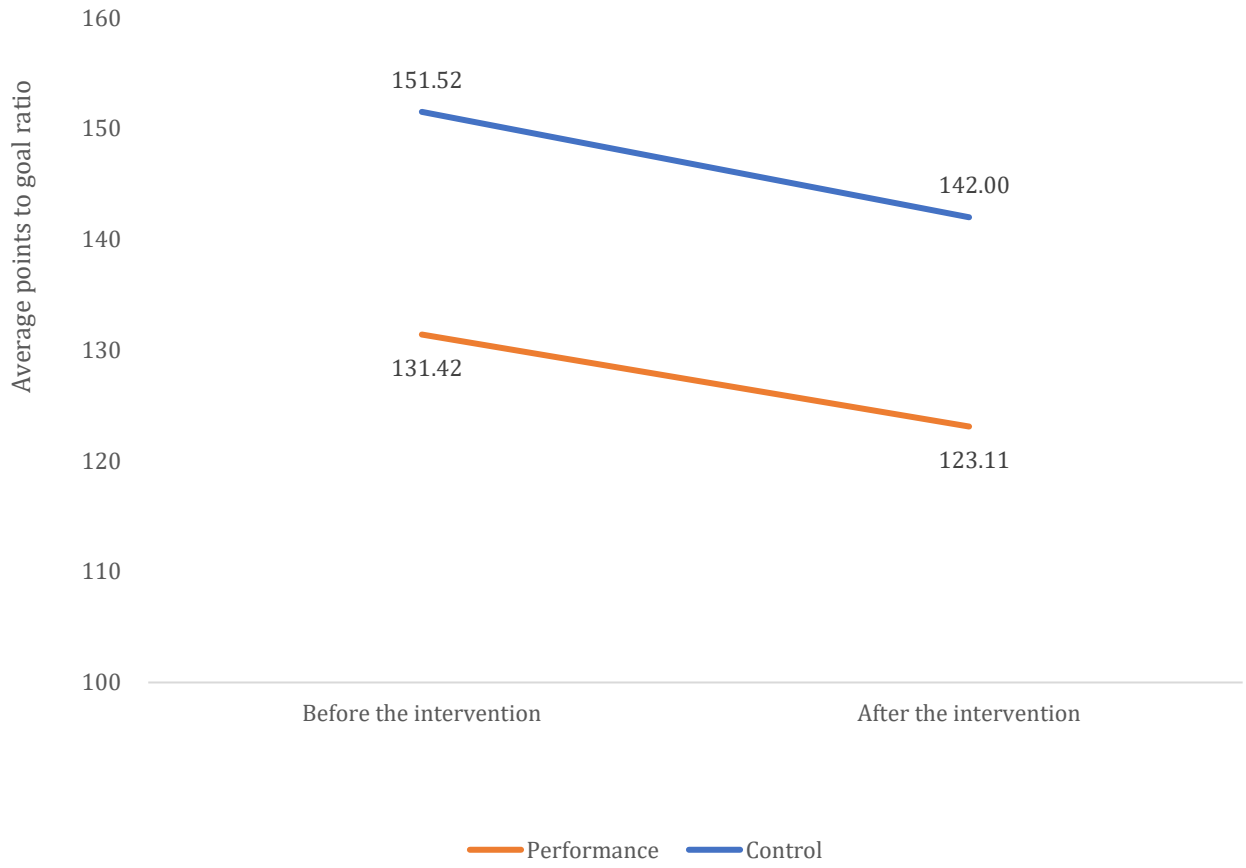
Figure 52 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 8 under all framing conditions



Graphically, all populations show a similar or slightly worse decline in the Points to Goal Ratio compared to the unexposed population.

Figure 53 below shows the average Points to Goal Ratio in the period before compared to after the intervention in the "matched", Performance, scenario.

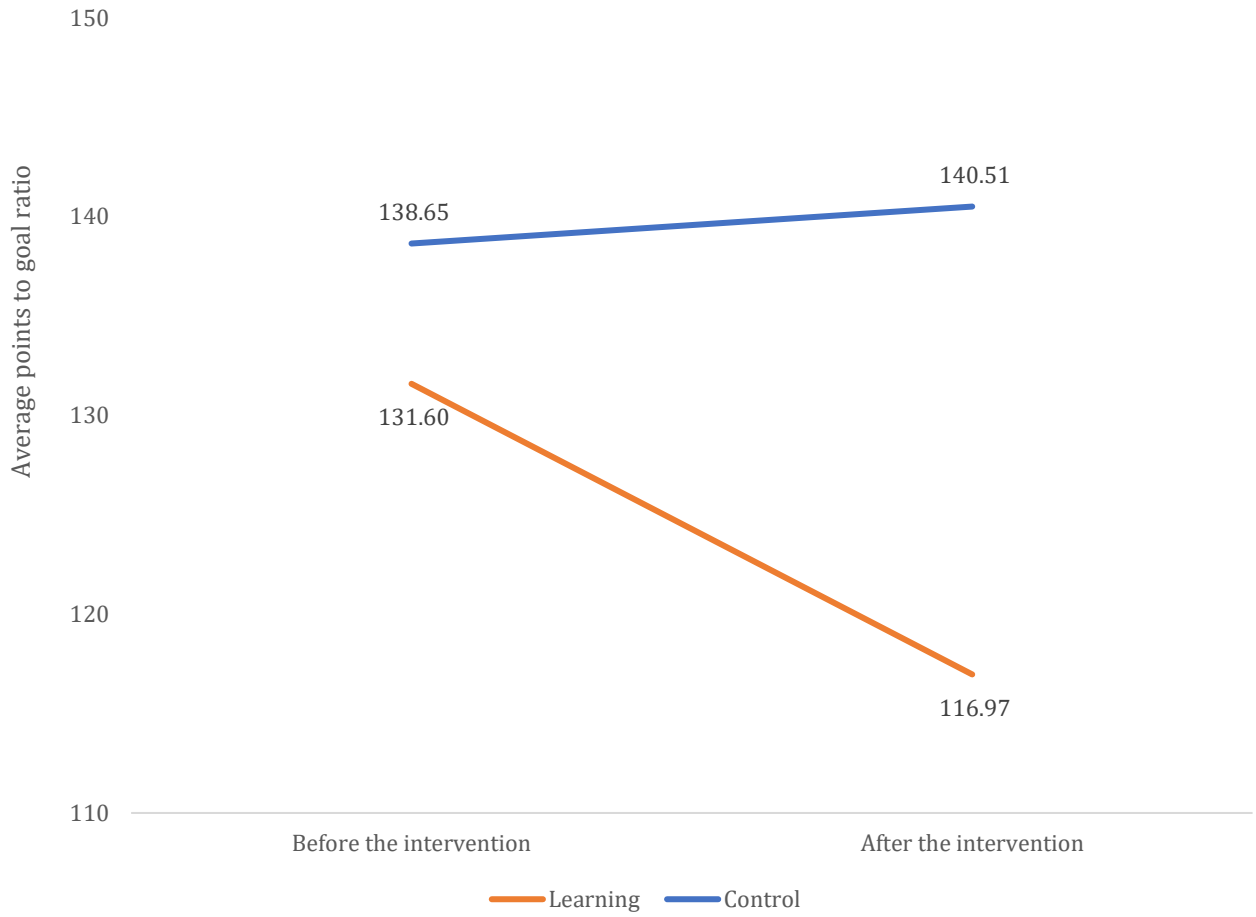
Figure 53 Average Points to Goal Ratio in the 12 weeks before the intervention compared to the 12 weeks after the intervention for Group 8 under Performance framing



The magnitude of the D-I-D coefficient is 1.21 and is not significant (p = .90), indicating that it is unlikely that the exposure to the additional Performance framed content affected the outcome of the exposed group any differently than the underlying background trend, captured by the control group. Varying the time period considered did not provide different results in this population. Based on the coefficients from the linear model, exposure to the Performance framed content decreased the average Points to Goal Ratio by 8.31% (not significant, p =.31), compared to the unexposed group which had a decrease in the average Points to Goal Ratio of 9.52% (significant, p =.01).

The "unmatched" framing condition was Pure Learning framed content. The sample size (n = 29) is below the optimal threshold for research, and it is necessary to reevaluate with a larger sample. Figure 54 below shows the average Points to Goal Ratio in the period 6 weeks before compared to 6 weeks after the intervention.

Figure 54 Average Points to Goal Ratio in the 6 weeks before the intervention compared to the 6 weeks after the intervention for Group 8 under Learning framing



The magnitude of the D-I-D coefficient is -16.48 and is significant at the α = 0.05 level (p = .04), indicating that the slopes of the two groups are not parallel and that exposure to the additional Learning framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the Learning framing decreased the average Points to Goal Ratio by 14.63% (significant, p = .03), compared to the unexposed group which had an increase in the average Points to Goal Ratio of 1.86% (not significant, p =.66).

The randomly allocated population consisted of participants in Group 8 who received Hybrid Framed content (i.e., Hybrid with a Performance or Learning Bias). Neither of these framing conditions showed any statistically significant results, over any time period.

2.7. DISCUSSION

The following sections present an in-depth discussion of the field experiment results. Table 23 below summarises the results from the field experiment and Figure 55 below presents an updated view of the normative framework presented in Paper 1 based on the observations from the field study. The discussion below will expand on these updated optimal framing conditions.

Table 23 Summary of field experiment results per group

Group	Psychological States		Expected Matched Framing	Results per Framing Condition			
	Self-efficacy	Motivation		Performance	Learning	Hybrid with a Performance Bias	Hybrid with a Learning Bias
1	High	Low	Hybrid with a Performance Bias			Expected, not seen	Weak, long-term positive effect seen
2	Low	High	Hybrid with a Learning Bias		Short-term positive effect seen	Weak, long-term positive effect seen	Expected, not seen
3	High	High	Performance	Long-term positive effect seen			Long-term negative effect seen
4	High	Low	Hybrid with a Performance Bias	Medium-term positive effect seen		Medium-term positive effect seen	Medium-term positive effect seen
5	Low	Low	Learning	Weak, medium-term negative effect seen	Medium-term **negative** effect seen	Medium-term negative effect seen	
6	High	High	Performance	Expected, not seen			
7	High	High	Performance	Expected, not seen			
8	High	High	Performance	Expected, not seen	Short-term negative effect seen		

Notes:

- A weak effect indicates that the result was significant at the $\alpha = .15$ level and needs to be reevaluated in a larger sample.
- Long-term indicates that the effect was seen in the period 10-12 weeks before and after the intervention.
- Medium-term indicates that the effect was seen in the period 7-9 weeks before and after the intervention.
- Short-term indicates that the effect was seen in the period 4-6 weeks before and after the intervention.

Shorter than 4 weeks before and after the intervention was not considered since such an immediate, short-lived intervention is of less value in practice.

Figure 55 Updated normative model for goal framing based on starting self-efficacy and motivation

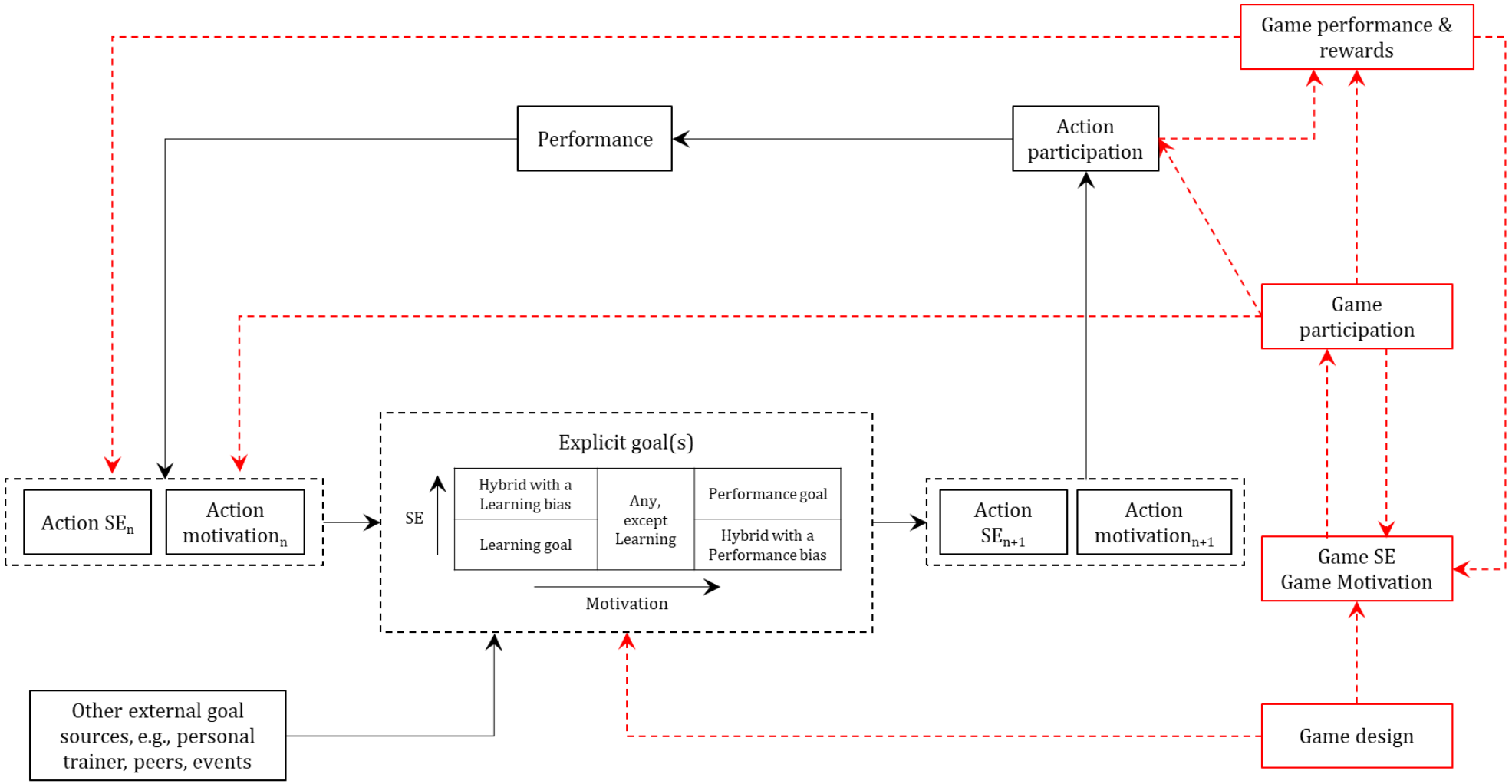


Table 24 below summarises the results for each hypothesis.

Table 24 Summary of results per hypothesis

Hypothesis	Detailed description	Results
1a	Individuals with simultaneously higher/lower self-efficacy and motivation will respond to greater/less performance content with greater subsequent action participation and performance.	Partially supported
1b	For individuals with higher self-efficacy but lower motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a "hybrid" goal composed of greater performance and lesser learning content leads to the best outcomes and deviations from this reduces outcomes.	Further investigation is required
1c	For individuals with lower self-efficacy but higher motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a "hybrid" goal composed of greater learning and lesser performance content leads to the best outcomes and deviations from this reduces outcomes.	Further investigation is required

2.7.1. Pure framing conditions

Pure framing conditions refer to traditionally framed content that is based on a performance or learning focus alone. It is expected that these framing conditions are satisfactory in cases where the individual's self-efficacy and motivation factors are at the same level. In other words, both factors are at high levels or both factors are at lower levels.

A. Populations with higher self-efficacy & motivation

Performance framing is the most frequently used framing approach, particularly in gamification and physical activity contexts (Swann et al., 2023; Swann et al., 2021; Tondello et al., 2018). It was expected that pure performance framing would be the most successful in populations with higher levels of both self-efficacy and motivation. Research in goal setting theory suggests that performance framing is most appropriate when an increase in effort is sufficient to improve outcomes and this is most commonly the case when a task is simple or when the individual has high self-efficacy (Locke & Latham, 2002, 2019; Seijts & Latham, 2005). In the case where both self-efficacy and motivation are at higher levels it is not necessary to introduce techniques to build motivation or improve goal attainment strategies, since these individuals have both psychological states in place (in particular, self-efficacy is in place).

During the field experiment the researcher identified four groups where the expectation was that performance framing would be successful. Table 25 below summarises these groups.

Table 25 Groups with higher levels of self-efficacy and motivation

Group	Factors that influence the psychological construct				Overall psychological construct	
	$M_{intrinsic\ and\ identified}$	$M_{introjected}$	SEI	SEE	Motivation	Self-efficacy
3	High	High	High	High	High	High
6	High	Low	High	High	High	High
7	High	Moderately low	High	High	High	High
8	Moderately high	Moderately high	High	High	High	High

Of these four groups only Group 3 displays higher levels across all the underlying factors. For the remaining groups the motivation factor that is more closely related to intrinsic regulation was prioritised, since intrinsic motivation has been shown to be superior (Ryan & Deci, 2000).

The researcher observed the expected positive effect (D-I-D coefficient = 11.27, p = .08) in Group 3 under the Performance framing condition (n = 52) for the period 10 weeks before compared to 10 weeks after the intervention. Exposure to the Performance framing condition increased the average Points to Goal Ratio by 9.88% (p = .07) compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 1.39% (p = .69). A significant positive effect indicates that the pure Performance framing condition is successful in the medium-to-long-term in Group 3.

The researcher observed a negative effect (D-I-D coefficient = -15.88, p = .10) in the Group 3 population exposed to Hybrid Framed content with a Learning Bias (n = 24) for the period 12 weeks before compared to 12 weeks after the intervention. Exposure to the Hybrid framed content with a Learning bias decreased the average Points to Goal Ratio by 19.15% (p = .03), compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 3.27% (p = .40). The population size is below the typical acceptable range for quantitative analysis and future analysis should target larger samples to ensure that the statistically significant negative effect is not due to other underlying factors.

The negative effect observed in the cohort exposed to Hybrid Framed content with a Learning Bias emphasises the importance of appropriately drafted goal content. It is apparent that despite the higher levels of self-efficacy and motivation in Group 3, the additional framed content negatively affected outcomes. Since this population had high levels of self-efficacy one can reasonably conclude that they were comfortable with the underlying game behaviour (physical activity), and they may very likely have reasonable goal attainment strategies in place. In other words, the researcher did not expect that it is necessary for this population to adopt new strategies to improve their outcomes. The introduction of a learning bias in this population may have encouraged these individuals to adjust their existing

strategies or try to learn new skills which did not align with their existing strategies in place, which led to declining outcomes.

The researcher did not observe any statistically significant effects for any of the framing conditions in both Groups 6 and 7. Both of these groups have lower levels for the motivation factor relating to introjected regulation. It may be that the motivation factor would more accurately be described as "low" or that a moderate layer needs to be introduced to accommodate this scenario; both of these approaches imply that a hybrid framing condition may be more appropriate than pure performance. The hybrid populations in Group 6 were below the typical acceptable range for quantitative analysis (n = 17 for Hybrid with a Performance Bias and n = 19 for Hybrid with a Learning Bias) as were the hybrid populations in Group 7 (n = 11 for Hybrid with a Performance bias and n = 16 for Hybrid with a Learning bias). Future research needs to target larger samples to establish if either of the hybrid framing conditions can be successful in these groups.

The researcher observed a medium-to-short-term negative effect (D-I-D coefficient = -16.48, p = .04) in the Group 8 population exposed to Pure Learning framed content (n = 29) for the period 6 weeks before and 6 weeks after the intervention. Exposure to the Learning framed content decreased the average Points to Goal Ratio by 14.63% (p = .03), compared to the unexposed population which experienced an increase in the average Points to Goal Ratio of 1.86% (p =.66). This negative result is not unexpected since a learning approach is directly opposite to the performance framing approach posited in the normative model from Paper 1. The short-term negative effect is likely from the participants reverting to previous behaviours or strategies that they are more familiar with (based on the high self-efficacy of the population) or the participants become comfortable with the additional framed content and outcomes improve once more. The researcher did not observe positive effects for any of the framing conditions in Group 8. The factors relating to motivation for group 8 were at moderate levels, and it may be that the motivation factor would more accurately be described as "low" or that a moderate layer needs to be introduced to accommodate this scenario.

When only self-efficacy is considered to classify individuals and the four groups are combined into a single group then the research observes a positive effect (D-I-D coefficient = 8.34, p = .06) for the combined group exposed to Performance framed content in the period 5 weeks before and 5 weeks after the intervention. Exposure to the Performance framed content increases the average Points to Goal Ratio by 3.88% (p = .31), compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 4.67% (p =.05). These results are presented in more detail in Appendix I. The focus of this research is on goal framing based on the interaction between the starting states, and the combined view only serves to highlight that, in general, performance framing is appropriate in populations with high self-efficacy (Locke & Latham, 2002, 2019; Seijts & Latham, 2005), but the short-term nature of the positive result highlights that this could be improved further by expanding the framing approach.

H_{1a}, introducing that individuals with simultaneously higher self-efficacy and motivation will respond to greater performance content with greater subsequent action participation and performance, is supported in cases where both psychological factors score at higher levels (as in Group 3). Further research is needed to understand cases where the self-efficacy factors are high, but the motivation factors are opposite (as in Groups 6 and 7) or moderate (as in Group 8). These scenarios may be better suited to a hybrid framed approach, which needs to be evaluated in a larger sample.

B. Populations with lower self-efficacy & motivation

The framing condition that is expected to be most successful in populations with lower levels of both self-efficacy and motivation is learning framing. Research in goal setting theory suggests that learning framing is most successful when an individual needs to acquire new skills or develop new strategies to improve outcomes. This is most commonly the case when a task is complicated or when the individual has low self-efficacy (Locke & Latham, 2002, 2019; Seijts & Latham, 2005). Where an individual has low self-efficacy, it is necessary to introduce techniques to build motivation or improve goal attainment strategies. Despite the change in focus from performance to learning the goals still need to align with the requirements set out by goal setting theory: they still need to be specific and challenging (Locke & Latham, 2002; Seijts & Latham, 2005).

During the field experiment the researcher identified one group where the expectation was that learning framing would be successful. Table 26 below summarises this group.

Table 26 Group with lower levels of self-efficacy and motivation

Group	Factors that influence the psychological construct				Overall psychological construct	
	$M_{intrinsic\ and\ identified}$	$M_{introjected}$	SEI	SEE	Motivation	Self-efficacy
5	Low	Moderately low	Moderately low	Low	Low	Low

All factors were at lower levels; however, they were not all at the extreme ends (seen in Group 3 in the previous section).

The researcher did not observe any framing condition that had a positive effect on this population, however, the researcher did observe significant negative effects for Pure Performance framing, Pure Learning framing and Hybrid Framing with a Performance Bias.

The researcher observed an unexpected negative effect (D-I-D coefficient = -18.37, p = .10) in the Group 5 population exposed to Learning content (n = 48) for the period 9 weeks before compared to 9 weeks after the intervention. Exposure to the Learning content decreased the average Points to Goal Ratio by 11.22% (p = .13), compared to the unexposed population which experienced an increase in the average Points to Goal Ratio of 7.15% (p = .39).

It is apparent that the population with lower levels of self-efficacy and lower levels of motivation were sensitive to the additional framing, however, the additional framed content

may have exacerbated the participants' low starting states by highlighting to the participants that there is a gap in their abilities compared to their weekly goal rather than supporting the participants in developing the required positive strategies to achieve their goals. The shorter period over which the effect is seen could indicate that individuals abandoned the learning framing content and reverted to more traditional strategies, or it took 9 weeks before they adapted to the new learning approach.

The researcher observed an expected negative effect (D-I-D coefficient = -18.71, p = .11) in the Group 5 population exposed to Performance content (n = 51) for the period 9 weeks before compared to 9 weeks after the intervention. Exposure to the Performance content decreased the average Points to Goal Ratio by 11.56% (p = .12), compared to the unexposed population which experienced an increase in the average Points to Goal Ratio of 7.15% (p = .41). Since the individuals in Group 5 have low levels of self-efficacy and motivation one would not expect performance framing to be successful: these individuals do not have the required skills or goal attainment strategies in place and need more than just an increase in effort to attain their goals.

The researcher observed a negative effect (D-I-D coefficient = -25.82, p = .10) in the Group 5 population exposed to Hybrid Framed content with a Performance Bias (n = 15) for the period 8 weeks before compared to 8 weeks after the intervention. Exposure to the Hybrid framed content with a Performance bias decreased the average Points to Goal Ratio by 18.45% (p = .16), compared to the unexposed population which experienced an increase in the average Points to Goal Ratio of 7.37% (p = .37). The population size is below the typical acceptable range for quantitative analysis and future analysis should target larger samples to ensure that the statistically significant negative effect is not due to other underlying factors. Similar to the scenario with Pure Performance framed content, the negative result in the population exposed to Hybrid Framed content with a Performance Bias is not unexpected. Since these individuals have lower levels of self-efficacy, the greater focus on performance is unlikely to be beneficial.

The sample size of the population exposed to Hybrid Framed content with a Learning Bias (n = 11) is below the typical acceptable range for quantitative analysis and future analysis should target larger samples to understand if this framing condition could have a positive effect in participants similar to Group 5.

In both gamification and physical activity contexts the status quo is performance framed content and alternative approaches to framing in these contexts are not well understood (Swann et al., 2020; Swann et al., 2023; Swann et al., 2021; Tondello et al., 2018). Very little practical guidelines could be found at the time of the field experiment regarding the approach to drafting specific, challenging learning goals outside of an education or work-place context (Buchanan et al., 2022; Schippers et al., 2020). Due to the novelty of the alternative framing approach (i.e., learning as opposed to the traditional performance framing approach) in a gamification platform focusing on physical activity, it may likely be that individuals participating in the platform are more familiar with traditional performance framing and did not perceive the learning framed content as true goals that can support improved outcomes.

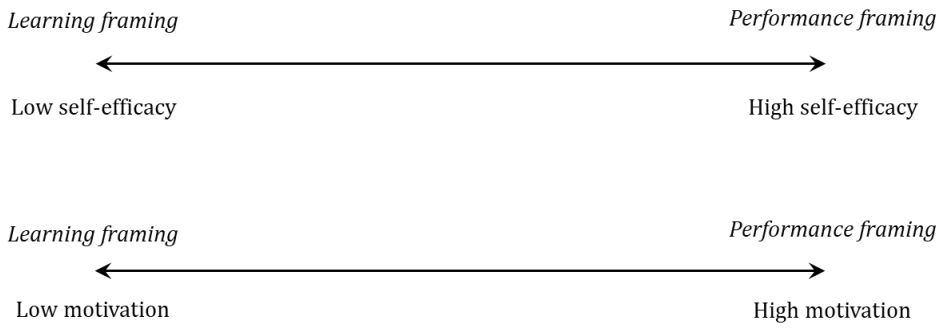
Future research would benefit from focused efforts to determine the optimal approach for operationalising and implementing learning framed content in a way that aligns with goal setting theory requirements and supports the underlying psychological states.

H_{1a}, introducing that individuals with simultaneously lower self-efficacy and motivation will respond to less performance content with greater subsequent action participation and performance, is not supported in the population with lower levels of self-efficacy and motivation. Future research needs to consider larger sample sizes and improved approaches of introducing the alternative framing to assess if learning, or some other, framing condition can be effective at increasing engagement in the population with lower levels of self-efficacy and motivation.

2.7.2. Hybrid framing conditions

Paper 1 proposed optimal framing based on the interaction between self-efficacy and motivation. Extant literature is clear on which approach to follow when considering the states independently or when the underlying psychological states are aligned, discussed in the previous section (Locke & Latham, 2002, 2006, 2019; Seijts & Latham, 2005). Figure 56 below highlights the optimal framing when considering the underlying psychological states independently.

Figure 56 Optimal framing approach based on self-efficacy and motivation



Literature is not clear on which approach to employ when starting states are opposite. In other words, no guidelines could be found based on the interaction between starting states. The researcher proposed the introduction of hybrid framed content with either a performance or learning bias to support the lower psychological state while still fostering the psychological state that is already in place. In both scenarios the hybrid content deploys a performance layer to provide the requisite increase in effort under which the learning layer may succeed in developing new skills to improve outcomes. One may think of the performance layer as providing energy and the learning layer providing direction or guiding the energy. The extent to which each layer is applied in the hybrid framing depends on the underlying psychological states.

A. Populations with higher self-efficacy & lower motivation

The expectation is that populations with higher self-efficacy and lower motivation would respond favourably to Hybrid Framed content with a Performance Bias. Since self-efficacy is in place, the expectation is that it is not necessary to focus on assisting the individual with developing new skills or strategies for goal attainment. Research indicates that performance framing is best suited when an individual has high self-efficacy (Locke & Latham, 2002, 2006, 2019; Seijts & Latham, 2005). The expectation is that the performance bias leverages the individual's existing high self-efficacy while introducing supporting learning content to improve motivation by encouraging the individual to investigate new goal attainment strategies in the context of the performance goal.

To satisfy the underlying requirements of goal setting theory hybrid framing should still be specific and challenging, while maintaining the perception that the goal is achievable.

During the field experiment the researcher identified two groups where the expectation was that Hybrid Framed content with a Performance Bias would be successful. Table 27 below summarises these groups.

Table 27 Groups with higher levels of self-efficacy and lower levels of motivation

Group	Factors that influence the psychological construct				Overall psychological construct	
	$M_{intrinsic\ and\ identified}$	$M_{introjected}$	SEI	SEE	Motivation	Self-efficacy
1	Moderately low	Low	High	High	Low	High
4	Moderately low	Moderately low	Moderately high	Moderately low	Low	High

Of these two groups only Group 1 clearly has the two states at opposite levels (i.e., self-efficacy at higher levels and motivation at lower levels). Group 4 has all four underlying factors at moderate levels rather than clearly at higher or lower levels. The Self-Efficacy factor relating to Intrinsic Pressures (SEI) was given a higher priority and used to define Group 4 as having higher levels of self-efficacy and lower levels of motivation.

The researcher observed a weak positive effect (D-I-D coefficient = 17.35) for the Group 1 population exposed to Hybrid Framed content with a Learning Bias ($n = 26$) at the $\alpha = .15$ significance level ($p = .14$) for the period 12 weeks before compared to 12 weeks after the intervention. Exposure to the Hybrid framed content with a Learning bias increased the average Points to Goal Ratio by 8.52% ($p = .41$) compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 8.84% ($p = .09$). A weakly significant positive effect indicates that the Hybrid framed content with a Learning Bias is likely successful in the long-term in Group 1. The sample size is below the generally accepted threshold for quantitative analysis and future research needs to target larger samples to understand if a stronger result may be observed and to ensure that the positive effects are not as a result of other underlying factors not identified.

The expected positive effect was not observed in the population exposed to Hybrid framed content with a Performance bias. The initial expectation was that a predominate learning bias would be of less value since self-efficacy is already in place and therefore skills development is not required. However, it could be that even though this population has the required ability (i.e., high self-efficacy) to complete the underlying task (in this case, physical activity) they do not have the necessary goal strategies in place to attain the goal, which may be what is driving the low motivation to engage. A lesser focus on performance framing may be sufficient to encourage an increase in effort which is then targeted further through the greater focus on learning.

The Group 4 population consists of individuals who exhibited moderate levels across all four underlying factors of the starting states. The researcher observed positive effects under all framing conditions except for the Pure Learning condition.

The Group 4 population exposed to Hybrid Framed content with a Performance Bias (n = 81) showed the expected positive effect (D-I-D coefficient = 13.18, p = .06) for the period 9 weeks before compared to 9 weeks after the intervention. Exposure to the Hybrid Framed content with a Performance Bias increased the average Points to Goal Ratio by 0.88% (p = .88), compared to the unexposed population which had a decrease of 12.30% (p = .00). It is valuable to note that in this scenario the exposure to the Hybrid Framed content with a Performance Bias did not have a marked effect on increasing the Points to Goal Ratio, but rather avoided the significant decline observed in the unexposed population. In other words, in this scenario, the positive outcome was avoiding a decline in performance as opposed to increasing performance. Practically, both outcomes are of value.

The reduced period in which the intervention was successful indicates that the positive impact will likely dissipate as time progresses. In other words, it is unlikely to remain effective over extended periods following the intervention. This is an important consideration in a gamification context where the game layer and goal are repeated weekly. There is an element of novelty in gamification that drives immediate outcomes but is not necessarily sustained (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015). It may be that the goal framing layer inherits similar shortcomings to the overarching game platform: once the individual becomes accustomed to the hybrid framing it loses its potency.

Furthermore, the expectation is that once the participant improves their outcomes it is likely that they may transition into another Group due to their underlying psychological states improving (or declining) over time. The positive effects may also reduce over time because the individual's psychological states shift over time and the initial framing condition is no longer optimal. This implies that goal framing should ideally be more dynamic to ensure that optimal framing is applied for each goal cycle to adapt to the individual's underlying psychological state. The underlying platform needs to accommodate both positive and negative movements in psychological states over time.

The researcher observed an unexpected positive effect (D-I-D coefficient = 11.47, p = .10) in the Group 4 population exposed to Hybrid Framed content with a Learning Bias (n = 77) for

the period 7 weeks before compared to 7 weeks after the intervention. Exposure to Hybrid Framed content with a Learning Bias increased the average Points to Goal Ratio by 0.56% (p = .92), compared to the unexposed population which had a decrease of 10.92% (p = .00). Furthermore, the researcher observed a positive effect (D-I-D coefficient = 11.72, p = .06) in the Group 4 population exposed to Pure Performance framing (n = 117) in the period 7 weeks before compared to 7 weeks after the intervention. Exposure to the Performance content increased the average Points to Goal Ratio by 0.81% (p = .87), compared to the unexposed population which had a decrease of 10.92% (p = .00).

Similar to what has been described previously, the short-term nature of the positive effects can likely be ascribed to the novelty wearing off in the gamification context and to changes in the underlying psychological states requiring a more iterative framing approach. The Group 4 population displayed moderate levels of self-efficacy and moderate levels of motivation. It may likely be that the self-efficacy levels were on the threshold where Hybrid Framing with a Learning Bias provided sufficient additional learning content that was effective at directing the increase in effort, promoted by the supporting performance layer, into investigating more effective goal attainment strategies which led to improved outcomes. Furthermore, the Pure Performance framing condition was likely effective at encouraging an increase in effort that was successful at improving outcomes in the short term, but the moderate nature of the factors let to this dissipating once the increase in effort alone became insufficient to sustain the positive effects. In the population with moderate levels of self-efficacy and motivation it is unlikely that Pure Learning framed content would be sufficient since this approach would be lacking in encouraging an increase in effort, which is appropriate given that self-efficacy is not entirely lacking.

A combined group with Groups 1 and 4 was not considered since the underlying psychological states are sufficiently distinct.

H_{1b} states that for individuals with higher self-efficacy but lower motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a “hybrid” goal composed of greater performance and lesser learning content leads to the best outcomes and deviations from this reduces outcomes. This hypothesis cannot be accepted or rejected, and further investigation is required.

There is evidence to suggest that a more appropriate condition for this population is Hybrid Framing with a Learning Bias and that an additional definition needs to be introduced for individuals with moderate levels of self-efficacy and motivation that may respond to Performance or Hybrid framing with either bias. Future research needs to consider larger sample sizes and interrogate the thresholds for the starting states in more detail.

B. Populations with lower self-efficacy & higher motivation

The expectation is that populations with lower self-efficacy and higher motivation would respond favourably to Hybrid Framed content with a Learning Bias. Since self-efficacy is not in place the expectation is that it is necessary to introduce content that would assist the individual with developing new skills or strategies for goal attainment through learning

content. Literature suggests that learning framing is most appropriate when self-efficacy is low (Locke & Latham, 2002, 2006, 2019; Seijts & Latham, 2005). The expectation is that the learning bias builds the requisite skills and goal attainment strategy to improve the low levels of self-efficacy. Since motivations levels are high, introducing supporting performance content encourages the necessary increase in effort to implement the newly acquired skills.

To satisfy the underlying requirements of goal setting theory hybrid framing should still be specific and challenging, while still being perceived as achievable.

During the field experiment the researcher identified one group where the expectation was that Hybrid Framed content with a Learning Bias would be successful. Table 28 below summarises this group.

Table 28 Group with lower levels of self-efficacy and higher levels of motivation

Group	Factors that influence the psychological construct				Overall psychological construct	
	$M_{intrinsic\ and\ identified}$	$M_{introjected}$	SEI	SEE	Motivation	Self-efficacy
2	Moderately high	Moderately low	Low	Moderately high	High	Low

The Self-Efficacy factor relating to Intrinsic Pressures (SEI) was prioritised over the factor relating to Extrinsic Pressures (SEE) and, therefore, self-efficacy was defined as being at lower levels. Similarly, the motivation factor relating to Intrinsic and Identified Regulation was prioritised. The underlying motivation factors are both at moderate levels and it may be more appropriate to describe the motivation factor as “moderate” or “low”.

The researcher did not observe the expected positive effect in the Group 2 population exposed to Hybrid Framing with a Learning Bias. However, the researcher did observe positive effects for the populations exposed to Hybrid Framed content with a Performance Bias and to Pure Learning content.

The Group 2 population exposed to Hybrid Framed content with a Performance Bias ($n = 45$) had a weak positive effect (D-I-D coefficient = 10.16) at the $\alpha = .15$ level ($p = .12$) for the period 10 weeks before compared to 10 weeks after the intervention. Exposure to the Hybrid Framed content with a Performance Bias increased the average Points to Goal Ratio by 9.14% ($p = .10$) compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 1.03% ($p = .77$).

The expected positive effect was not observed in the population exposed to Hybrid Framed content with a Learning Bias. The initial expectation was that a predominate performance bias would be of less value since self-efficacy is low and the assumption was that skills development needs to be prioritised. However, it could be that since this population has high levels of motivation in place, they have a greater tolerance for performance framing compared to a population where motivation is not in place. A slight learning framing may be

sufficient to provide the required guidance to develop the necessary goal attainment strategies while the predominate performance framing ensures that a sufficient increase in effort is achieved to deploy these strategies. The weaker result needs to be interrogated further in a larger sample to understand if Hybrid Framed content with a Performance Bias is the more appropriate condition for Group 2.

The Group 2 population exposed to the Pure Learning condition (n = 35) had a positive effect (D-I-D coefficient = 17.64, p = .09) for the period 4 weeks before compared to 4 weeks after the intervention. Exposure to the Learning content increased the average Points to Goal Ratio by 14.61% (p = .10) compared to the unexposed population which experienced a decrease in the average Points to Goal Ratio of 3.03% (p = .55).

A significant effect over the reduced period indicates that the additional Learning framed content was successful in the short term, however, the effects are unlikely to persist over prolonged periods. Discussed previously, a shorter-term effect is not too surprising, both in a gamification context and in a goal setting context. It is unclear if the positive effect is due to an incorrect designation of the starting states (i.e., if Group 2 should rather have been described as having lower levels of self-efficacy and lower levels of motivation), in which case the result is as expected, and further research is required with larger sample sizes.

H_{1c} states that for individuals with lower levels of self-efficacy but higher levels of motivation, there exists an inverse curvilinear relationship between goal content and subsequent action participation and performance such that a "hybrid" goal composed of greater learning and lesser performance content leads to the best outcomes and deviations from this reduces outcomes. This hypothesis cannot be accepted for the scenario with low levels of self-efficacy and high levels of motivation, and it is uncertain if Group 2 adequately describes this population.

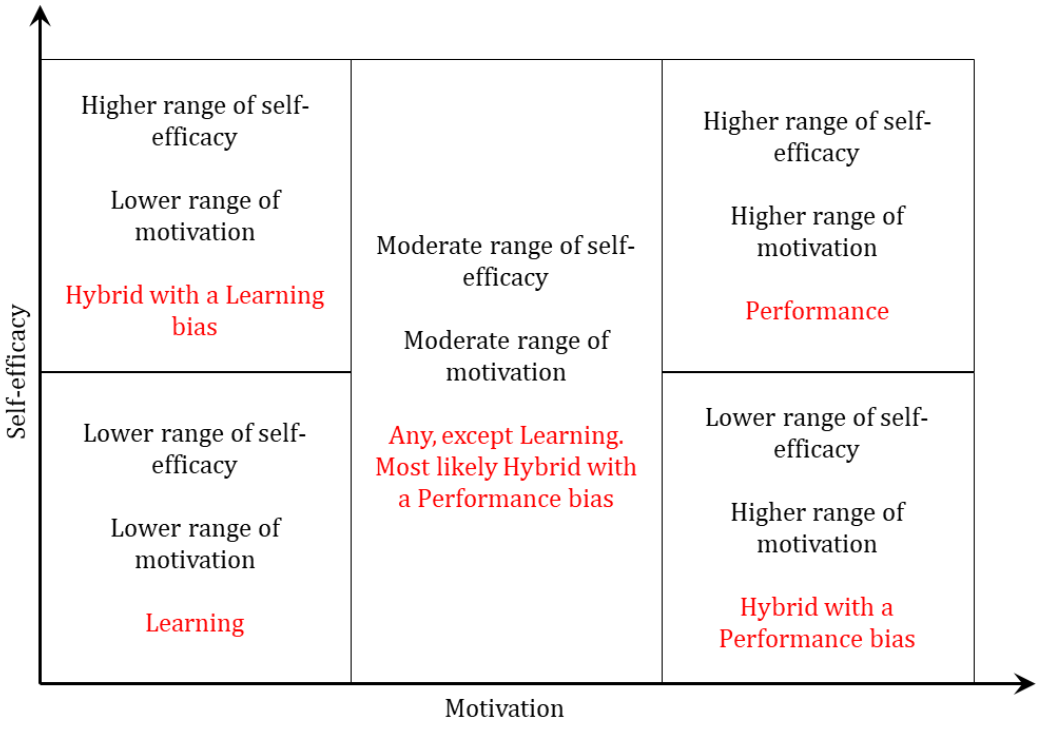
In the event that the Group 2 description is correct, results indicate that Hybrid Framing with a Performance Bias is more appropriate for the population with lower levels of self-efficacy and higher levels of motivation. Future research needs to consider larger sample sizes and interrogate the thresholds for the starting states further to determine if the proposed framing condition needs to be redefined or of if the starting states need to be redefined.

2.7.3. Implications for future research

It is noteworthy that each of the framing conditions was successful in at least one of the groups, highlighting that there is merit in alternative approaches to goal framing outside of the traditional performance framed focus seen in gamification platforms and in physical activity interventions (Swann et al., 2023; Tondello et al., 2018). There is opportunity for future research to refine the scenarios under which each condition would be most appropriate and to develop a more structured approach to crafting goal framing content to align with the underlying requirements of goal setting theory (Locke & Latham, 1979, 2019; Seijts & Latham, 2005). Future research needs to ensure that sample sizes are sufficiently large to accommodate many groups split across the four identified framing conditions.

This study used existing, accepted survey instruments to determine the starting self-efficacy and motivation (Edmunds et al., 2006; Everett et al., 2009). However, these instruments are not necessarily reflective of the gamification context in which the study was conducted and did not provide a measure for the game states (i.e., self-efficacy related to the game and motivation to engage in the game). This study accommodated for the lack of game states by ensuring that the sample is sufficiently familiar with the game (therefore indicating self-efficacy is likely in place, as the participants are familiar with all elements) and that participants actively play the gameboard (therefore indicating that motivation to engage exists). Future research would benefit from interrogating the starting psychological states in more detail and determining if it is possible to measure the interaction between the game-specific psychological states and the action states. Alternatively, a measure that combines action and game states needs to be investigated. Furthermore, from this research, it appears that the initial 2 × 2 framework introduced may not be sufficient and that a "moderate" or interim state needs to be introduced, illustrated in Figure 57.

Figure 57 Updated 2 ×3 framework plotting the interaction between self-efficacy and motivation with updated framing conditions



There are limited resources providing a practical approach to learning framed content outside of education (Buchanan et al., 2022; Schippers et al., 2020) and no literature could be found on a hybrid framed approach in either a physical activity or gamification setting. There is an opportunity to improve the approach to drafting appropriate framed content to drive the intended changes. It was observed in the research that some of the framing conditions had a negative effect to the additional framed content – it needs to be understood if this can be avoided through the correct use of linguistics and a focus on behavioural

positioning. Future research needs to investigate optimal approaches to implementing these framing conditions and ensure that the goal framing still aligns to the underlying requirements of goal setting theory (Locke & Latham, 1979, 2019; Seijts & Latham, 2005). In other words, goals need to be specific and challenging regardless of which framing approach is deployed.

Due to the cyclical, or iterative, nature of goal setting in a gamification context, future research needs to implement the goal framing conditions iteratively to allow for changes in psychological states based on outcomes.

Future research may very likely need to make appropriate adjustments based on the underlying context and behaviour to ensure successful outcomes.

2.7.4. Implications for practice

Gamification design, in practice, can be described as easily operationalised particularly since these platforms are frequently app-based (Research and Markets, 2024). Similarly, a "one-size-fits-all" performance approach to goal setting in the gamification context can be seen as easy to implement. From the results of this study, it is possible to improve performance through appropriate framing based on psychological states. In practice it is unlikely feasible to require participants or clients to complete lengthy surveys to establish initial psychological states. Furthermore, it is necessary to understand if individuals' states change without needing to repeat surveys or similar assessments. Therefore, an appropriate proxy needs to be developed or defined per platform. Such a proxy needs to be rigorously assessed to ensure that it aligns with research and is not developed in isolation. Similarly, an optimised approach to iterative goal framing needs to be investigated.

2.8. CONCLUSION

The objective of the field experiment was to understand if framed content can be matched appropriately based on an individual's starting levels of self-efficacy and motivation to improve a participant's performance outcomes in a gamification platform leveraging goal setting theory. In the context of the field experiment, improved performance manifested as an increase in the weekly Points to Goal Ratio during the field experiment period compared to the period before the experiment. The experiment population was compared to a control group that received no framed content during the period. A difference-in-differences approach was used to compare the exposed and unexposed populations.

During the survey phase of the field experiment 2 178 participants completed the research surveys. The researcher used factor analysis to obtain measures for self-efficacy and motivation, followed by latent profile analysis to group similar individuals together based on their starting psychological states. The researcher identified eight distinct groups using this methodology.

The research showed that each framing condition was successful in at least one group, highlighting that there is merit in adjusting the framing in a goal setting context based on

underlying psychological states, rather than using the current “one size fits all” performance approach across all individuals.

From these results one can conclude that it is possible to improve performance in goal setting through appropriate framing. However, the exact matching based on psychological states and the correct way to draft the framed content needs to be interrogated further. In practice, a more succinct approach is needed to determine starting psychological states and the method may need to differ depending on the underlying context. Similarly, the framing approach needs to be interrogated further to determine the optimal strategy for drafting learning and hybrid framed content in a behaviour that has historically always relied on performance framing.

There is an opportunity to improve these results in future studies. In particular, it is necessary to have larger sample sizes across all framing conditions and it is necessary to identify the optimal approach to crafting framing conditions not typically associated with gamification, in particular, learning and hybrid framing approaches.

Having looked at the effects of framing on goal setting in a gamification context, another frontier to explore is the temporal effects in a gamification platform, which will be discussed in Paper 3.

Paper 3.
A Theory of the Temporal Unfolding of Gamification

The objective of Paper 3 is to conduct a comprehensive review of gamification literature, serving as a foundation to inform the propositions introduced within the Paper. These propositions will subsequently be tested through a case study, the results of which will be presented in Paper 4.

Gamification is most frequently defined as the "use of game design elements in non-game contexts" (Deterding et al., 2011, p. 9). Despite the widespread implementation of gamification across a range of use cases (Deterding et al., 2011; Hamari et al., 2014; Landers, 2019; Landers et al., 2018), the long-term effects of gamification are not well understood, with results often being anecdotal (Cugelman, 2013; Warsinsky et al., 2021). Furthermore, it appears that recent empirical studies focus largely on gamification within education as opposed to broader applications (Lampropoulos et al., 2022; Zainuddin et al., 2020). There is the perception that gamification design may be less effective at driving long-term behaviour change, since the positive effects are more likely due to the novelty of the intervention (Cardador et al., 2017; Floryan et al., 2019; Hamari et al., 2014; Landers et al., 2018; Raftopoulos, 2020; Richter et al., 2015; Seaborn & Fels, 2015).

This research investigates a novel approach to gamification design within an intervention that increases the likelihood that the platform will remain relevant over extended periods.

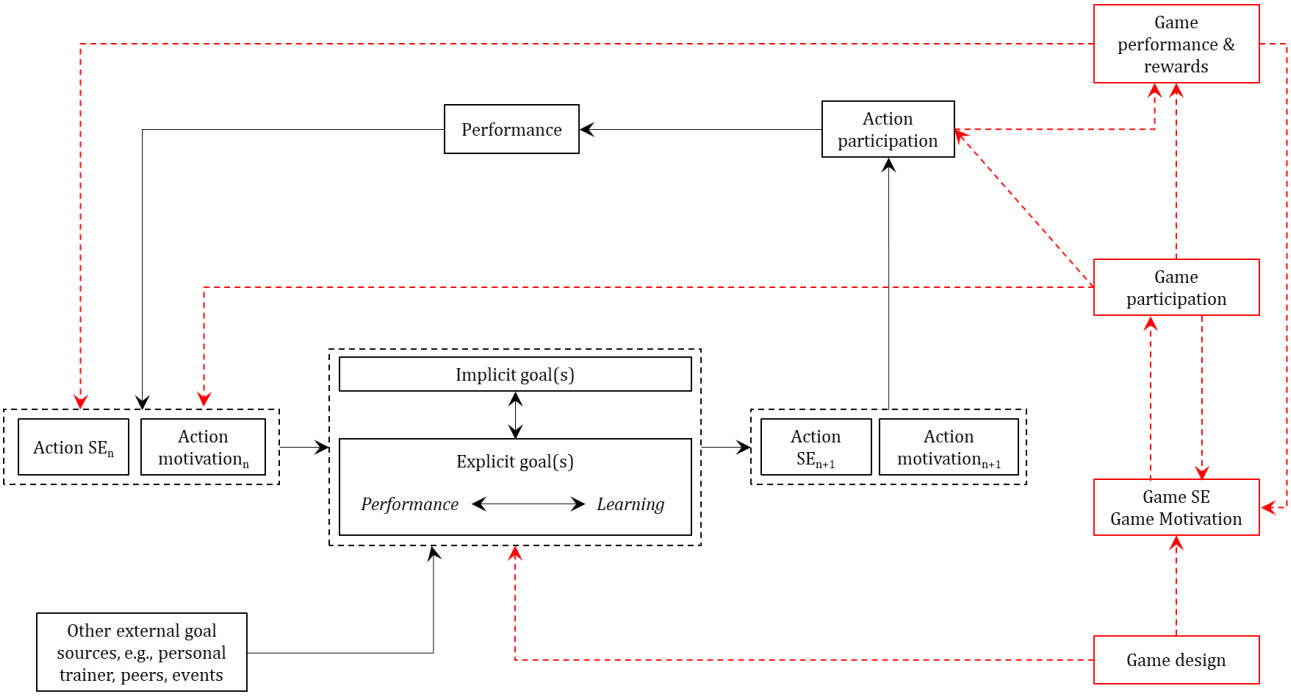
3.1. BASE THEORY OF GAMIFICATION

Paper 1 introduced a model for implementing an enhanced approach to goal setting within a gamification design context, with the summary view illustrated in Figure 58 below. Paper 3 extends on this model, focusing on the gamification elements, illustrated in red, and introduces a strategy to implement gamification design over extended periods, while maintaining the overall effectiveness on the platform.

Discussed in Paper 1, one of the key innovations introduced by the model is the clear separation of the game elements/process (seen in red) from that of the actual underlying action (seen in black). For instance, if we consider the gamification of exercise (e.g., through the Vitality Active Rewards game) it is important to separate the individual's actual motivation to exercise and journey through 'cycles' of exercise (such as each week) compared to the individual's experience of the gamification elements themselves. Gamification usually only acts to augment an individual's innate motivations and actions regarding the focal behaviour, and game-focused behaviours such as opening the game, claiming rewards and so on are definitionally different from core behaviours like actually exercising. This is a critical

separation, since too many descriptions of gamification have failed to make these distinctions.

Figure 58 Positivist model for goal framing in a gamification design context



3.2. THE STATE OF UNDERSTANDING TIME IN GAMIFICATION

The focus of Paper 3 is to develop a temporal theory of gamification design, with the intention of presenting a novel approach to ensuring the long-term applicability of platforms implementing gamification design strategies. The following sections examine the effects of time in a gamification context when goal setting is one of the key game mechanics as well as how time is considered in gamification literature.

3.2.1. The effects of time on goals in a gamification context

A frequently used strategy in goal setting theory is that of breaking up long term, or distal, goals into short term, or proximal, goals since this frequently leads to improved results by making the goal more achievable (Donovan & Williams, 2003; Latham, 2016; Locke & Latham, 1985). This is a dynamic that is similarly used in gamification design, for example in Vitality Active Rewards, the case site for this research, which breaks down becoming physically active into a series of weekly goals. This concept of breaking long-term goals into smaller, short-term goals and rewarding players in increments (e.g., with badges, points, virtual goods, etc.) in a gamification context introduces an element of time and potentially repetition. It is, therefore, essential to understand the effects of time (and repetition) in both goal setting and gamification.

Based on Bandura's social cognitive theory, Donovan and Williams (2003) investigated how time, goal-performance distance (i.e. the delta between the goal and performance achieved – which may be attaining or missing the goal) and perceived causes for missing a goal impacted goal revision. While their focus was on athletes, the observations may be generalised to a broader goal setting context due to the generalisability of goal setting theory (Locke & Latham, 1979, 2002, 2006, 2019). Furthermore, the research is relevant in a gamification context where long-term objectives may be broken up into short-term goals or "missions". The authors reiterated the importance of breaking up long term goals into more attainable short-term goals – the observation made was that repeated failure to attain a goal might lead to individuals becoming demotivated and disengaging with the goal entirely. Such repeated failure may be indicative of a goal that is beyond the individual's abilities or due to incorrect framing, based on the discussions in Paper 1. In a gamification context, repeated failure would be seen as "losing" to the game. Although multiple factors can impact self-efficacy, for self-efficacy to be sustained an individual needs to experience positive outcomes (i.e., "win" in the gamification context), which includes achieving goals with a reasonable frequency – this links to the cyclical nature of self-regulation and the fact that past experiences feed into expected results which in turn impacts self-efficacy (Schunk & DiBenedetto, 2020). When the perceived cause (attribution) for missing a goal is due to factors outside the individual's control, this lowers levels of self-efficacy due to the negative impact on autonomy (Donovan & Williams, 2003) but if the causes are perceived to be in an individual's control, then it may keep motivation to achieve the next goal intact (Schunk & DiBenedetto, 2020). It is essential to keep this relationship in mind when using gamification design strategies where goal setting may not always be in the participant's control and where goal setting may be cyclical as in the case of Vitality Active Rewards.

In terms of the repetition element of some gamification platforms, Fried and Slowik (2004) observed that repetitive goals may become less potent at driving performance when the number of repetitions increases. This is likely because when the goal repeats, the individual's proficiency increases and task complexity decreases, assuming that the individual is achieving the goals and that the underlying goal is not changing fundamentally with repetition. One of the critical aspects of goal setting theory is that goals need to be challenging to increase performance. When repetition of the goal increases, the underlying task may no longer be sufficiently difficult, and the individual is more likely to disengage, because motivation declines. This is a critical consideration in repetitive activities or interventions that span over a prolonged period, including gamification platforms.

Furthermore, time plays a role in perceptions of goal achievement and on revising future goals (Donovan & Williams, 2003). When goal setting introduces time deadlines (which is one of the criteria of so-called "SMART"[14] goals (Doran, 1981)), individuals are more likely to revise a goal towards the second half of the period if they perceive that goal achievement is unlikely. If the individual cannot review the goal or the reasons for not attaining the goal are perceived to be outside the individual's control, they are more likely to disengage with the goal activity. In a gamification context, it may be more likely that the goals are set by the

[14] Specific, Measurable, Achievable, Relevant, Time-bound

underlying gamification platform and that goal revision is less feasible. When the individual perceives the time to achieve a goal as too short to realistically achieve the goal, performance can also decrease (Fried & Slowik, 2004). It is therefore essential to ensure that goals set as part of a gamification platform, which likely repeat over time, are done so appropriately to ensure the longevity and continued relevance of the platform.

3.2.2. The understanding of time in gamification literature and design

Despite broad applicability and usage of gamification, the temporal impact of games on engagement is not well-researched.

Discussed in the introduction section of this thesis (see p. 31), there is a vast amount of systematic reviews on whether gamification works (Hamari et al., 2014; Johnson et al., 2016; Sardi et al., 2017; Seaborn & Fels, 2015); literature mapping app-based interventions to behaviour or motivation principles (Cotton & Patel, 2019; Cowan et al., 2013; Edwards et al., 2016; Lister et al., 2014); some research investigating how gamification impacts motivation (Johnson et al., 2016; Sailer et al., 2017; Tondello et al., 2018) and studies using gamification methods as a tool to drive behaviour change (Harrison et al., 2019; Lowensteyn et al., 2019; Patel et al., 2017). While this body of research presents some evidence for positive effects of games on behaviour, there is also inconclusive evidence (Floryan et al., 2019; Hamari et al., 2014; Johnson et al., 2016; Seaborn & Fels, 2015). Most of this research is done at the time of the initial game introduction or over shorter periods (Hamari et al., 2014; Lowensteyn et al., 2019; Patel et al., 2017; Seaborn & Fels, 2015; Swann et al., 2020). There is uncertainty if some of the positive results are simply due to the novelty of the interventions (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Seaborn & Fels, 2015), or whether inconclusive results are due to poor implementation of the intervention, poor experimental design, or a combination of both, especially since there are few comparative or longitudinal designs available (Seaborn & Fels, 2015).

A more thorough treatment of games over time would not just address the above gap but has the potential to be an important contribution to the field. Such a contribution should lead to a better theoretical understanding of gamification, since temporal models are more able to address mechanisms of change. A methodological contribution of such a model would also exist since future field and lab experiments would be able to rely on temporal modelling as their basis. Finally, a normative temporal model would be of enormous potential value to practitioners, who typically design games with the beginning in mind without considering subsequent iterations in any detail.

The rest of Paper 3, therefore, presents the researcher's theory regarding the long-term effect of a gamified intervention (Nortje & Lee, 2022). The output of this study is an alternative methodology for implementing gamification design that reduces the effects of time on performance. The theory includes normative elements which, as noted above, may have practical implications. The temporal theory rests on the base theory developed in Paper 1, and briefly summarised above.

3.3. TEMPORAL THEORY OF GAMIFICATION

Gamification provides a scalable and cost-effective way of translating the motivational nature of games into other behaviours, largely due to the prevalence of smartphone technology and app-based interventions (Cugelman, 2013; Johnson et al., 2016; Lister et al., 2014; Research and Markets, 2024). Despite the extensive use of gamification across contexts to enhance motivation and improve engagement and persistency (Ciuchita et al., 2023; Cugelman, 2013; Hammedi et al., 2021; Harrison et al., 2019; Lowensteyn et al., 2019; Patel et al., 2017; Research and Markets, 2024; Richter et al., 2015), the introduction section of this thesis showed that there is no conclusive evidence that gamification works (see p. 31), and that this is especially the case in long-term interventions. There is concern that positive impacts of gamification that are recorded may primarily be due to the novelty of the design (Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Seaborn & Fels, 2015) and that once this novelty wears off, there is a risk that the positive behaviour change and engagement will no longer persist (Cardador et al., 2017; Floryan et al., 2019; Hamari et al., 2014; Landers et al., 2018; Richter et al., 2015; Seaborn & Fels, 2015). These observations lead to the first proposition of Paper 3 that while gamification initially has a positive effect on behaviour, this effect may decline over time without intervention:

> **Proposition 1a: Gamification has an initial positive and substantive impact on the targeted behaviour.**
>
> **Proposition 1b: The magnitude of the positive impact on the targeted behaviour reduces over time without intervention.**

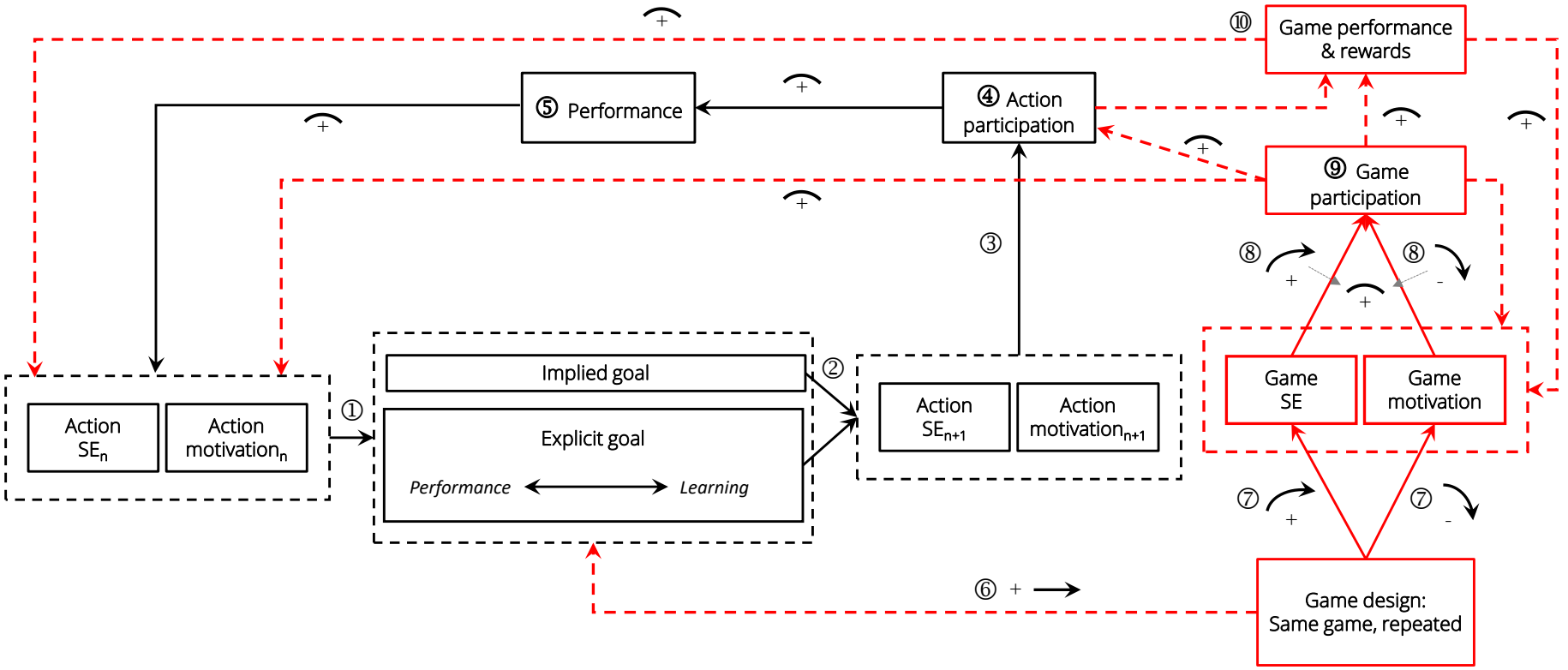
The significant theoretical contribution of this Paper is to sharpen the field's understanding of the effect of time on gamification. This section will discuss three scenarios, namely (1) the same game repeated for a prolonged period, (2) where game changes or enhancements are made at infrequent but appropriate intervals, and (3) where game changes or enhancements are made more rapidly.

3.3.1. Scenario 1: The same game repeated for a prolonged period

Paper 1 introduced a composite framework illustrating the relationship between gamification design and goal setting. Figure 59 below builds on this framework by expanding on the gamification elements in a temporal setting. Paper 1 introduced the relationship between goal setting and subsequent action self-efficacy and motivation in labels 1 to 5.

This section will now elaborate on labels 6 to 10 onwards with a temporal view. In the following sections, "game" is used to refer to the resulting platform of gamification design.

Figure 59 Game design framework: same game, repeated



As before, the researcher differentiates between "action" and "game" self-efficacy, motivation, and performance. For example, someone who is performance-driven may be increasingly motivated to engage with a game that includes leaderboards and other visible ways of tracking progress and "competing" with peers. In contrast, an individual who is less "tech-savvy" may have lower self-efficacy to engage with an app-based game that is perceived as complicated, despite having high self-efficacy related to the behaviour itself.

A. Relationship 6: Game design and goal setting in repeated games

In label 6 of Figure 59, the game design has a positive impact on goal setting: as previously discussed, gamification design provides opportunities for feedback regarding goal progress which plays an essential role in goal setting (Latham, 2016; Locke & Latham, 2002, 2019; Tondello et al., 2018). Since the game presumably continues to set the goals per cycle, the provision of goals to the individual's action cycles remains constant. This seems self-explanatory and does require a proposition.

B. Relationship 7: Effects of repeated games on game self-efficacy & motivation

We propose that where the same game design gets repeated over prolonged periods, the participant experiences an increase in game self-efficacy since, with each repetition, the individual is more familiar with the game requirements. In self-determination theory phrasing, the repetition promotes an increase in the individual's sense of competence. This increase in self-efficacy very likely plateaus over time since the marginal increases in self-efficacy become more difficult to achieve. Therefore:

> **Proposition 2: Repeated game design has an increasing but logarithmic effect on game self-efficacy (i.e., declining in positive effect towards a plateau).**

However, we further propose that the repetition of game cycles has a negative and declining effect on game motivation since the predictability of the game increases – once the novelty wears off, so does the motivation to engage. We propose that the motivational decline is gradual at first, since it will take some time for the novelty and hedonic effects to wear off, but that this decline increases in severity the longer that the game is repeated without change. Therefore:

> **Proposition 3: Repeated game design has a generally positive but exponentially decreasing effect on game motivation (i.e., increasingly declining in effect towards zero).**

C. Relationship 8: Effects of repeated games on game participation

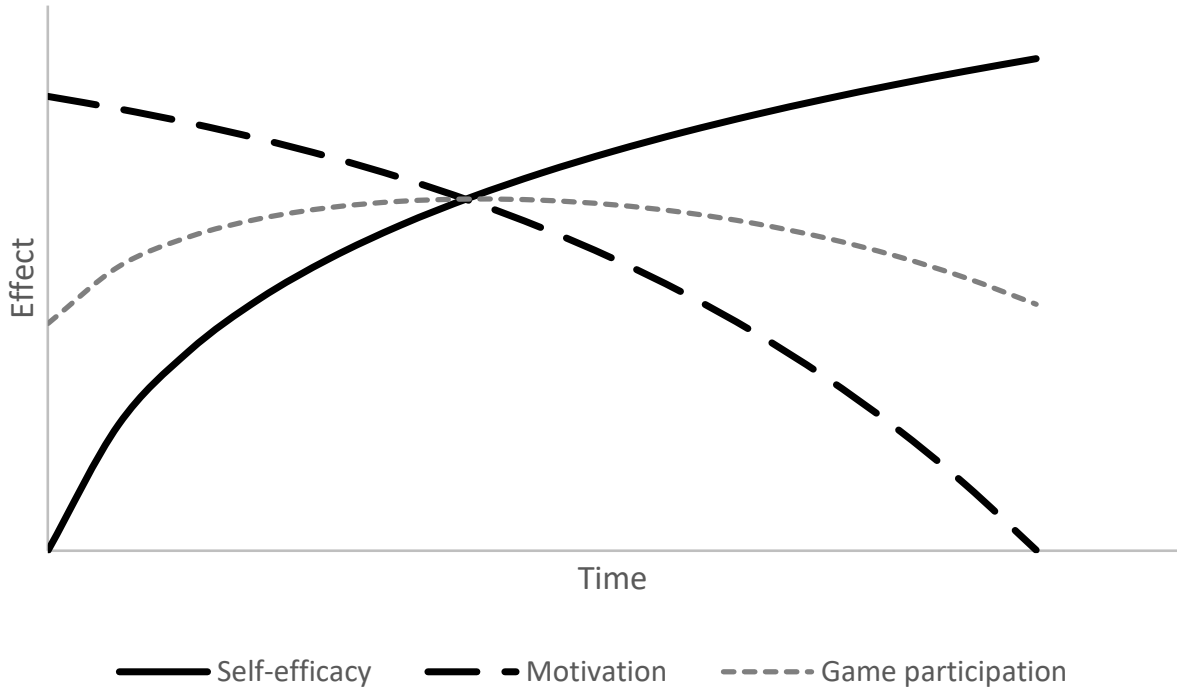
Due to the assertion in the base model discussed previously that there exists a generally linear relationship between self-efficacy and motivation on action participation, the researcher proposes that the same relationship, therefore, exist when considering the effect of the two on game participation (i.e., that changes in self-efficacy over time will have a positive, but plateauing effect on game participation but changes in motivation over time will have a negative and declining effect on participation):

Proposition 4a: Changes in self-efficacy over time are associated with increasing but logarithmic effects on game participation (i.e., declining in positive effect towards a plateau).

Proposition 4b: Changes in motivation over time are associated with exponentially decreasing effects on game motivation (i.e., increasingly declining in effect towards zero).

If we combine the proposed effects of game self-efficacy and motivation over time, the mathematical result is a negative curvilinear relationship as seen in Figure 60 below.

Figure 60 Net game effect: same game, repeated



The combined, proposed effects of repeated game cycles on self-efficacy and motivation would infer that game participation will potentially rise (due to the increasing self-efficacy and initially high motivation), peak near where the two curves meet, and then decline once the self-efficacy effect plateaus more strongly and motivation declines more strongly. It is reasonable to expect that the exact peak of participation depends on whether there is a differential weighting of self-efficacy and motivation on participation, which would be impossible to establish without empirical evidence (the case seen in Figure 60 where the peak occurs at the meeting point would only occur where the two are equally weighted). Therefore:

Proposition 4c: Game participation will have a negatively curvilinear shape with respect to time in repeated games.

It would be reasonable to expect that the overall effect on participation may remain generally positive, particularly in a gamification platform leveraging goal setting where the presence of goal setting is inherently more motivational than if it were absent (Locke & Latham, 1979, 2002, 2019). However, in an organizational context where there may be ongoing investment in the gamification layer, a gradual decline in game participation is not ideal. Furthermore, disengagement in the platform may have far-reaching effects, for example, reduced client loyalty (Ciuchita et al., 2023).

D. Relationship 9: Effects of long-term repeated games on game performance

Given that we proposed a linear relationship between game participation and performance within cycles, one can expect that the over impact of repeated games on performance follows the same pattern as for participation:

> **Proposition 5: Game performance, and, therefore, rewards, have a negatively curvilinear shape with respect to time in repeated games.**

E. Relationship 10: Effects on action self-efficacy & motivation in repeated games

Since the base model assumes a linear relationship between game participation or performance and action self-efficacy and motivation, the researcher once again proposes a negative curvilinearity on these variables as a result. It needs to be noted that these variables are certainly not entirely driven by gamification, therefore, these propositions are phrased accordingly.

> **Proposition 6a: The effect of gamification on action self-efficacy is negatively curvilinear with respect to time in repeated games.**
>
> **Proposition 6b: The effect of gamification on action motivation is negatively curvilinear with respect to time in repeated games.**

The above model begins to address a gap in the research. Gamification studies to date have not considered what happens once the novelty wears off or how the design might be adjusted over time to recover the positive impacts on behaviour. The above model addresses the former, and the below models help to shape the latter. There are concerns that gamification is not sustainable long-term (Cardador et al., 2017), and Figure 59 and Figure 60 above explain the declining effects of the same game repeated over time.

As noted above, the propositions to date are exclusively for repeated games with no major changes over time. The following section discusses games which are changed at appropriate intervals by designers. This is discussed in the following section.

3.3.2. Scenario 2: Appropriately changing or enhancing game elements

Some researchers believe that removing the gamification elements from an intervention will have a detrimental impact on ongoing motivation (Floryan et al., 2019; Hamari et al., 2014;

Richter et al., 2015; Seaborn & Fels, 2015). This concern is due to the largely extrinsic nature of gamification. In other words, once the extrinsic motivator (the gamification element) is removed the concern is that there is no longer a compelling reason for the individual to continue engaging. This may be mitigated if, through engaging in the platform, the user has internalised the importance of the behaviour and developed some level of intrinsic motivation that may sustain ongoing behaviour. Research notes that "its removal does not result in an immediate return to the "ungamified" state (Thom et al., 2012)" (Landers et al., 2018, p. 319). While there is research using iterative design techniques to introduce gamification design into a platform (Schöbel et al., 2020) and studies examining the effects of removing gamification from a platform (Floryan et al., 2019; Hamari et al., 2014; Richter et al., 2015; Seaborn & Fels, 2015; Thom et al., 2012), there is little research exploring the impact of changing the gamification elements in an existing platform over time, introducing new game elements over time or implementing a new game entirely.

The second scenario considered is one where game elements are changed or enhanced (the game may even be replaced with a new game altogether). The change occurs and then the new game is repeated for *k* cycles, where *k* is defined as a reasonable timeframe based on the participants' expectations (e.g., aligning with seasons, organisation launch cycles, or similar behaviour-related cycles). Despite changes to the game, the individual has the opportunity to familiarise themselves with the game once more. If the game repeats beyond a reasonable period without further changes, the framework reverts to that shown in Figure 59 above (the same game, repeated).

Figure 61 below shows the proposals for the scenario of sufficient and timely game alterations. The following subsections describe each phase again.

A. Relationship 6: Game design and goal setting in changed games

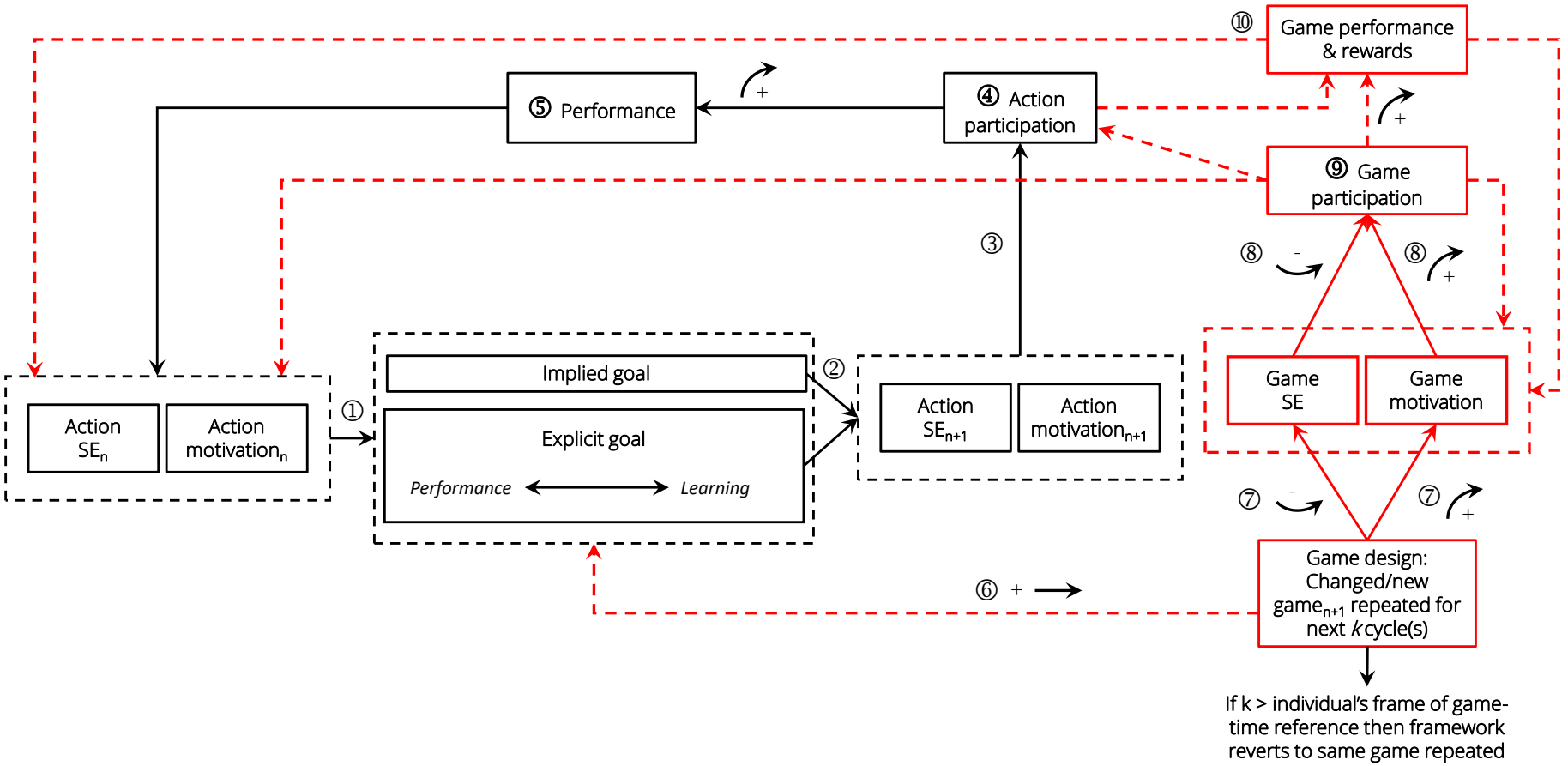
Once again, game design has a positive impact on goal setting, which again seems self-explanatory and does not require a proposition.

B. Relationship 7: Effects of refreshed design on game self-efficacy & motivation

When the game changes and repeats for a reasonable period, the proposed model is that the individual's game self-efficacy initially decreases since the individual needs to experience and acclimatize to the new elements. One may draw on self-determination theory, as enunciated above, to propose a reduction in a sense of competence in this scenario. However, game self-efficacy increases in subsequent cycles once the participant familiarises themself with the game. Therefore:

> **Proposition 7: Following a substantive change, game self-efficacy follows a positive curvilinear shape with respect to time within *k* cycles.**

Figure 61 Game design framework: existing game changed, or a new game introduced, repeated for *k* cycles



Due to the novelty of the changes, we propose that game motivation increases with each cycle following the change when the participants explore the changes. As the duration increases, this positive effect on motivation plateaus until the framework reverts to that of the "same game" scenario. Therefore:

> **Proposition 8: Following a substantive change, game motivation follows an increasing but logarithmic shape with respect to time (i.e., declining in positive effect towards a plateau within *k* cycles).**

After *k* cycles without further change, the motivation curve can be expected to revert to the previous model (Figure 59).

C. Relationship 8: Effects of refreshed games on game participation

Once again, given the linear relationships proposed within cycles for game self-efficacy and motivation on game participation, the longer temporal effects are expected to mirror P_8:

> **Proposition 9a: Following a substantive change, game self-efficacy will have a positive curvilinear effect on game participation within *k* cycles.**

> **Proposition 9b: Following a substantive change, game motivation will have a positive but logarithmic shape over time on game participation (i.e., declining in positive effect towards a plateau within *k* cycles).**

It is more challenging to predict the exact cumulative effects of changed game design on participation over time than for long-term repeated games, since the cumulative effect will not only depend on the exact shapes of the curves but the weights. However, in general, the model proposes that while self-efficacy is dropping most strongly (the user undergoes a "learning curve"), motivation is rising most strongly, and when self-efficacy begins to rise (the user refamiliarizes themselves with the game), motivation is plateauing and eventually will fall. Therefore, the effects of refreshed games on game participation are expected to be roughly bound within a range, with a generally upward trend as both self-efficacy and motivation reach their peaks within *k* cycles. It is reasonable to assume that the "learning curve" (the initial phase where self-efficacy declines) needs to be concluded before motivation starts to plateau, otherwise, the overall positive effect may be less pronounced.

This sort of effect is shown in Figure 62 below, noting again that the precise effects are variable.

At the very least, considering the upward trends of both self-efficacy and motivation in the second half of this timeframe, the researcher proposes:

> **Proposition 10: Within *k* cycles, game participation will have a generally upwards, albeit complex, trend following refreshment of the game.**

Figure 62 Proposed changes in self-efficacy, motivation, and game performance after refreshed games



D. Relationship 9: Effects of refreshed games on game performance over time

Given that we proposed a linear relationship between game participation and performance within cycles, we can again expect that the over impact of repeated games on performance follows the same pattern as for participation:

> **Proposition 11: Within *k* cycles, game performance and rewards have a generally positive shape with respect to time following a refreshed game.**

E. Relationship 10: Effects on action self-efficacy & motivation in refreshed games

Since the base model assumes a linear relationship between game participation or performance and action self-efficacy and motivation, we once again propose the same effects on these variables as a result. As before, it needs to be noted that these variables are certainly not entirely driven by gamification, therefore, these propositions are phrased accordingly.

> **Proposition 12a: Within *k* cycles, the effect of gamification on action self-efficacy is generally positive with respect to time after a repeated game.**
>
> **Proposition 12b: Within *k* cycles, the effect of gamification on action motivation is generally positive with respect to time after a repeated game.**

The final scenario considered is where game elements are changed in a short period (**within *k***) or more frequently.

3.3.3. Scenario 3: Overly rapid game changes

The question arises, what happens if the game design is changed too frequently? More precisely, the game changes and is then changed at least once again (or more) **within** *k* cycles, where the previous definition of *k* as a more natural or appropriate contextual timeframe remains. In this scenario, the game changes before participants have the opportunity to familiarise themselves with the game (as before, if the game does not change within a reasonable period, the framework reverts to that shown in Figure 59 the same game, repeated).

An important consideration from self-determination theory (Ryan & Deci, 2000), discussed in the introduction section of this thesis (see p. 17), is that motivation diminishes when an individual perceives limited control over their actions or environment. Changing a system too rapidly may negatively impact self-efficacy, motivation and engagement as individuals perceive the lack of control over their experience of the system more negatively than the positive effects introduced by the novelty of the changes. Therefore, it is necessary to maintain a balance between enhancing or incorporating new game features based on the underlying population and their needs.

Figure 63 below provides the final framework for this possibility. Once again, this framework builds on the previous models introduced earlier.

A. Relationship 6: Game design and goal setting in rapidly changed games

Once again, we propose that regardless of the rapidity of changes, the actual goal setting function of the game remains influential on the individual's goal set and again do not consider a proposition necessary in the temporal model.

B. Relationship 7: Effects of rapid changes on game self-efficacy & motivation

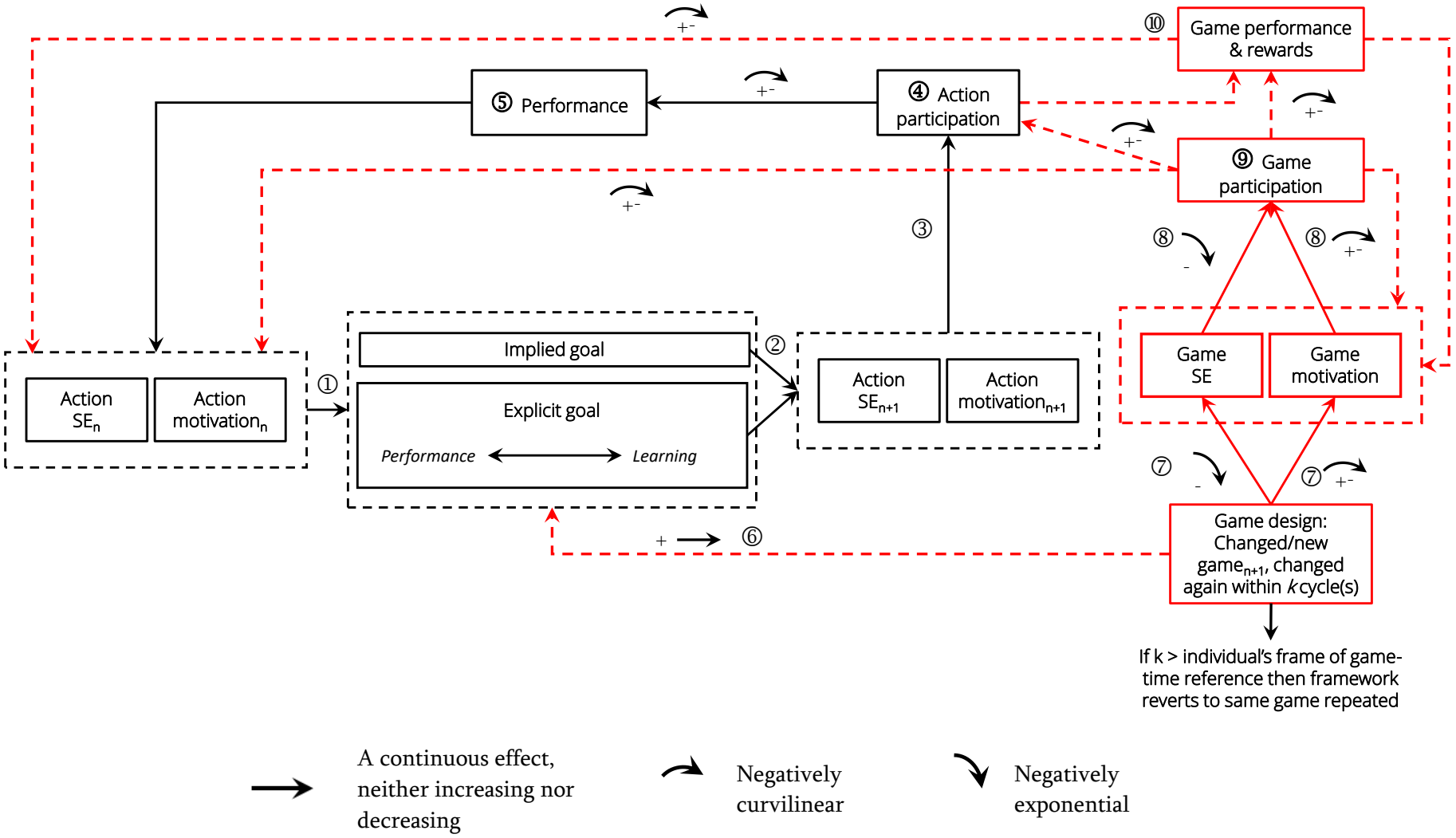
As before, we propose that game self-efficacy decreases as participants get exposed to the new game elements and reacclimatize to these (again, we draw on self-determination theory for this conclusion). However, since the game changes again before the participant is familiar with the new aspects, we argue that game self-efficacy may continue to decline. The decline accelerates with each iteration as the perception of the changes worsen. Therefore:

> **Proposition 13: If game multiple changes occur within *k* cycles, game self-efficacy will decline continuously over this period in a negatively exponential decline pattern.**

As before, game motivation may initially increase with multiple changes due to renewed novelty. However, we argue that motivation may then decrease after the subsequent changes within *k* cycles due to frustration and loss of control due to ongoing uncertainty, again, drawing on self-determination theoryTherefore:

> **Proposition 14: If game multiple changes occur within *k* cycles, game motivation will follow a negatively curvilinear shape.**

Figure 63 Game design framework: existing game changed, or a new game introduced, changed again within *k* cycles



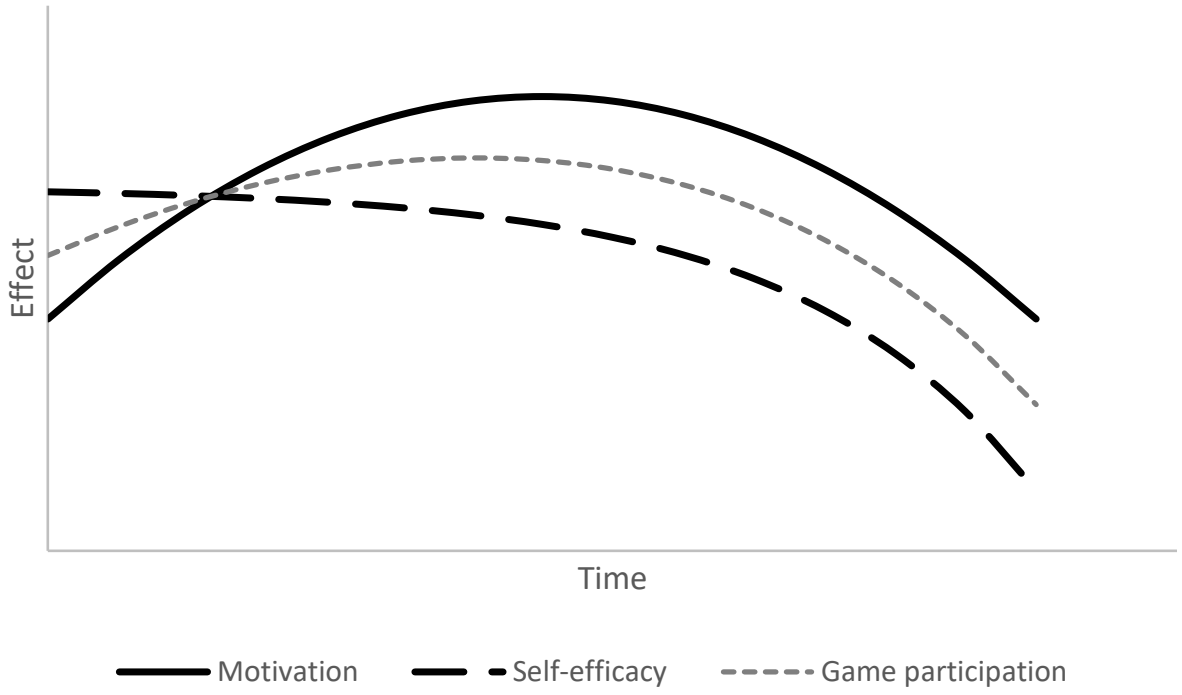
C. Relationship 8: Effects of rapid changes on game participation

As before, since within-period linearity is assumed for the effects of game self-efficacy and motivation on game participation, we anticipate equivalent mediation effects of the game effect on participation, in other words:

> **Proposition 15a: If multiple changes occur within *k* cycles, game self-efficacy will have a negatively exponential effect on game participation.**
>
> **Proposition 15b: If multiple changes occur within *k* cycles, game motivation will have a negatively curvilinear effect on game participation.**

If we combine the proposed effects of self-efficacy and motivation over time, the mathematical result is also expected to be a negative curvilinear relationship as seen in Figure 64 below, and similar to the effect of repeated games with no change (Scenario 1):

Figure 64 Proposed changes in self-efficacy, motivation, and game performance in repeated games



As seen in Figure 64, the combined, proposed effects of overly rapid game cycles on self-efficacy and motivation would infer that game participation will potentially rise (due to the increasing motivation and not yet overly affected self-efficacy), peak, and then decline as the dual declining self-efficacy and motivation takes over. As before, the exact peak of participation depends on whether there is a differential weighting of self-efficacy and motivation on participation. Therefore:

Proposition 15c: Game participation will have a negatively curvilinear shape with respect to time in repeated games.

D. Relationship 9: Effects of rapid changes on game performance

Again, the continued within-cycle linearities suggest that the prior effects knock on:

Proposition 16: Game performance, and, therefore, rewards, have a negatively curvilinear shape with respect to time under rapid game change conditions.

E. Relationship 10: Effects on action self-efficacy & motivation in games experiencing rapid changes

Similarly:

Proposition 17a: The effect of gamification on action self-efficacy is negatively curvilinear with respect to time in rapidly changed games.

Proposition 17b: The effect of gamification on action motivation is negatively curvilinear with respect to time in rapidly changed games.

3.4. GENERAL TEMPORAL PROPOSITION

In general, the three models taken together suggest that changing games at the 'appropriate' interval *k* will lead to the best long-term outcomes: only Scenario 2, which describes this, leads to consistently upward effects on performance and, therefore, positive effects on the action behavioural cycle. Changing either too infrequently or too frequently may have initially positive effects but ultimately is more likely to lead to declining game and action effects. Therefore, formalizing the notion of *k*:

Proposition 18: There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.

Obviously, determining *k* becomes critical in this context. The researcher explores this challenge in the case study presented in Paper 4.

Paper 3 has presented the first systematic attempt in the field of gamification to unpack how this growing design strategy may unfold over time and introduced valuable propositions to enhance the current understanding of gamification design over extended periods. The case study presented in Paper 4 will focus on a subset of these propositions.

Paper 4.
Investigating the Temporal Aspects of Gamification: A Natural Case Study

Paper 3 presented a literature review focusing on the temporal aspect of gamification design, highlighting that there is an insufficient consideration of time within gamification research (Hamari et al., 2014; Lowensteyn et al., 2019; Patel et al., 2017; Seaborn & Fels, 2015; Swann et al., 2020). Paper 3 expanded on the model introduced in Paper 1, focusing on the gamification elements and introduced a novel and enhanced strategy to implement gamification designs more effectively over extended periods. Paper 4 presents a mixed methods case study that tests key propositions presented in Paper 3.

The following section briefly reviews the theoretical framework and propositions developed in Paper 3. Thereafter, Paper 4 describes and presents the findings of the mixed methods case study conducted.

4.1. REVIEW OF PAPER 3'S THEORETICAL FRAMEWORK

Gamification, defined as the use of elements traditionally associated with game in a non-game context, was introduced in Paper 3 as a widely used design strategy to drive motivation and behaviour change (Deterding et al., 2011; Hamari et al., 2014; Johnson et al., 2016; Krath & von Korflesch, 2021; Lister et al., 2014; Seaborn & Fels, 2015).

Despite the apparent success of gamification, there are shortcomings that need to be considered in both research and implementation. Key takeaways were that, despite the widespread use of gamification, the long-term efficacy of this design strategy is not well understood (Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Seaborn & Fels, 2015). There are shortcomings in the experimental design of studies, with few extending over prolonged periods (Hamari et al., 2014; Johnson et al., 2016; Landers et al., 2018; Sailer et al., 2017; Seaborn & Fels, 2015). A concern with gamification design is that successful outcomes are more likely due to the novelty of the design, and that positive results will decline once this novelty wears off (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015). Furthermore, gamification designs are not always sufficiently grounded in theory, thereby diminishing their effectiveness as a design strategy to drive positive outcomes (Cugelman, 2013; Floryan et al., 2019; Landers, 2019; Patel et al., 2017; Tondello et al., 2018).

Paper 3 expanded on the model introduced in Paper 1 to improve the understanding of gamification design over extended periods by considering three scenarios for gamification design. Through these scenarios, Paper 3 introduced propositions, a subset of which will be investigated in Paper 4.

The initial scenario considered is the "same game, repeated" scenario. In this scenario, the gamification layer has an initial positive effect on game self-efficacy and motivation which has an overall positive effect on resulting participation and outcomes. However, with repetition, game self-efficacy plateaus and game motivation declines because the game is likely no longer sufficiently challenging. The effect on participation is an overall decline over time, however, the overall effect remains positive compared to when there is no gamification present.

> **Proposition 1a: Gamification has an initial positive and substantive impact on the targeted behaviour.**
>
> **Proposition 1b: The magnitude of the positive impact on behaviour reduces over time, but the overall effect remains positive.**

The second scenario considers when the designer(s) makes changes to the gamification platform after which the game repeats once more. The initial effect on game self-efficacy is negative since the individual needs to familiarise themselves with the changes, however, this improves when the game repeats and the individual "learns" the game. The initial effect on motivation is positive due to the novelty of the changes, however, this plateaus over time when the game repeats beyond a certain period. Overall, the effect is positive, however, this scenario tends to the "same game, repeated" scenario over time and further changes may need to be made once more.

> **Proposition 9: A substantive change will have a positive curvilinear effect on game participation within *k* cycles.**

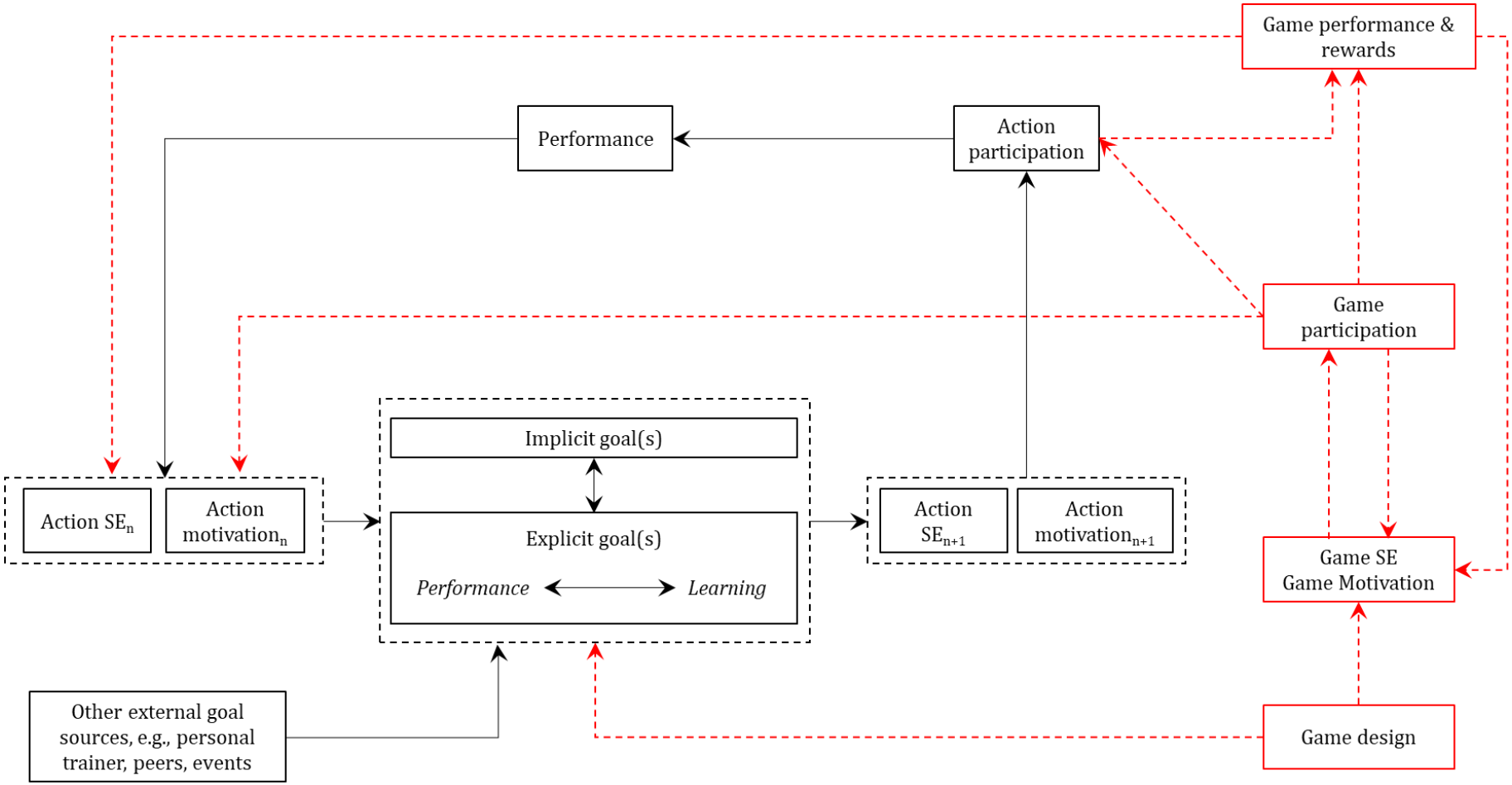
The third scenario considers where multiple platform changes are made within a short period of time. The initial negative effect on self-efficacy continues to decline because the individual does not get a chance to familiarise themselves with the changes. While self-efficacy declines, so too does motivation since the continued changes negatively effects feelings of autonomy and competence within the game structure. Overall, the effect of too-frequent changes to the game platform is negative.

> **Proposition 18: There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.**

Furthermore, Paper 3 introduced the variable *k* where *k* refers to the timeframe within a gamification platform where changes may be required to remain engaging and effective. Changes made within *k* and repeated for a reasonable period will likely be positively received, whereas multiple changes occurring within *k* with limited repeated cycles will likely lead to reduced outcomes.

Figure 65 below illustrates the gamification design framework introduced in Paper 1 and expanded upon in Paper 3. Paper 4 once more focuses on the gamification design elements of the framework in red and presents a mixed methods case study design that addresses these propositions.

Figure 65 The impact of gamification design on performance over time



4.2. OVERARCHING MIXED METHODS RESEARCH METHODOLOGY

The researcher conducted a case study using a mixed methods research approach to investigate the temporal effects of gamification on behaviour and performance. Case study research gives the opportunity to conduct an intensive investigation on a real-life intervention to study specific phenomena and then extrapolate to the broader context (Campbell, 2015; Rashid et al., 2019). This research applies a mixed measures methodology to the case study to investigate the impact of gamification design on performance over time and the impact of changing or enhancing game design elements on performance.

The case study uses the Vitality Active Rewards gamification platform as the case site, described in detail in the introduction section of the thesis (see p.15). The Vitality Active Rewards platform provides an ideal opportunity to investigate the propositions in a real-world context, since the platform has been live since September 2015 and has undergone at least two significant updates since its introduction. The researcher could perform quantitative analysis on the extensive secondary data available through the platform as well as conduct qualitative analysis through in-depth interviews.

4.2.1. Overall research design

Mixed methods research designs combine the statistical rigour of quantitative analysis with the narrative strength of qualitative analysis to provide a more holistic interpretation of the observations (Castro et al., 2010). The researcher divided the case study into a natural experiment for the quantitative study (Craig et al., 2012; Leatherdale, 2019) and in-depth interviews for the qualitative study (Alsaawi, 2014; Campbell, 2015) using the qualitative study to supplement or explain observations from the quantitative study. Each study is described in detail in the following sections.

4.2.2. Population and case site

The following sections describe the population and case site for the mixed methods case study.

A. Population

In the same vein as Paper 2, the case study was conducted in a gamified wellness setting and it therefore follows that the population extends to similar case sites, in other words: all recipients belonging to a wellness programme that deploys gamification to encourage behaviour change. This research contributes understanding to the long-term applicability of gamification and therefore extends the population to users of gamified platforms as well as organisations that deploy gamification. While the case site is a wellness programme that focuses on physical activity as the target behaviour, the research is likely generalizable to other contexts since the underlying behavioural principles apply to the game mechanics themselves.

Although not the direct population, the results of this study would be beneficial to any designer or researcher who uses a gamification design strategy as well as any organisations who intent to deploy such gamification platforms over extended periods.

B. Case site

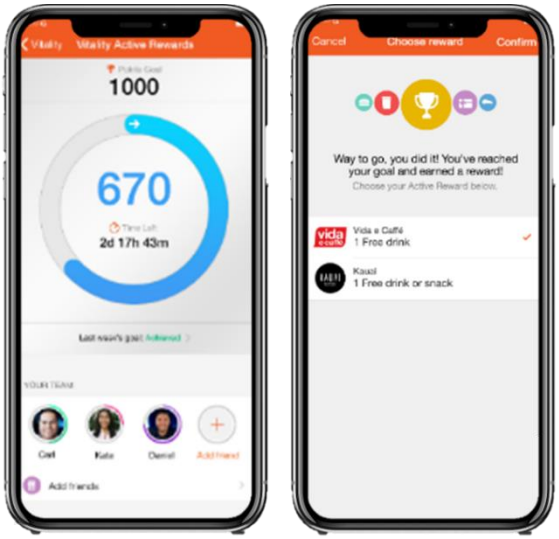
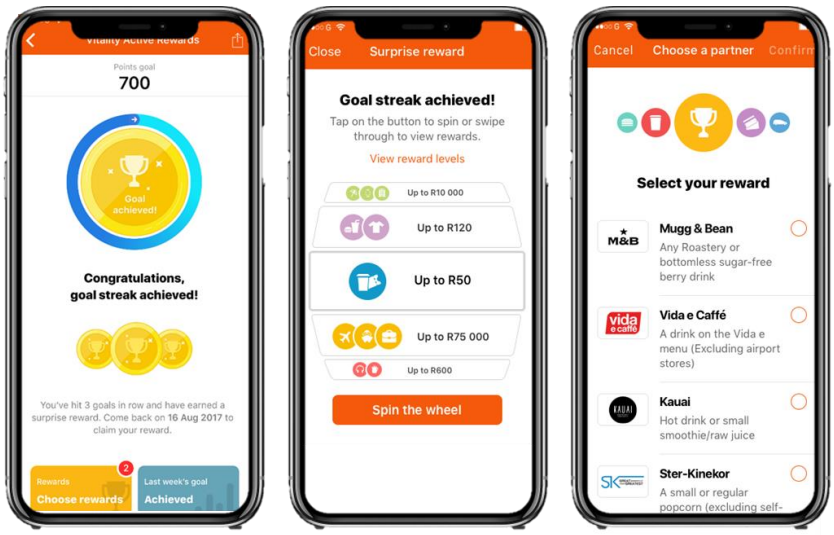
The researcher chose the South African wellness programme, Discovery Vitality, focusing on the voluntary Vitality Active Rewards benefit, as the case site. This case site is the same as the one used in the field study presented in Paper 2 and introduced in the introduction section of this thesis. (see p.15).

Although a broad range of contexts implements gamification design, in South Africa it is most frequently employed in education (Botra et al., 2014), employee engagement (Singh, 2012) or wellness (Hafner et al., 2020). In other words, participants of these platforms typically belong to a single group or organisation. The researcher chose Vitality Active Rewards as the case site because it is a real-life gamified platform that applies to a broader use-case, namely in the consumer space, and is therefore potentially more generally applicable. The gamification platform has been live since September 2015 (allowing the researcher to evaluate the positive but declining game effects over time) and the programme has implemented both significant and minor design changes over time (allowing the researcher to assess the ability of game changes to enhance game participation once more).

Vitality Active Rewards is a voluntary benefit of Discovery Vitality that is built using gamification design techniques, predominately goal setting, to encourage participants to engage in key behaviours. Similar to Paper 2, the case study focuses on the physical activity portion of the game to highlight the positive effects of gamification. The case study further considers gamification features of the platform not considered in Paper 2, showing the longevity of the gamification design platform over time.

Discovery has an annual launch cycle where new product enhancements are announced, including enhancements to the Vitality Active Rewards platform. Table 29 below summarises the most noteworthy versions of the Vitality Active Rewards gamification platform over time (denoted as Vitality Active Rewards 1.0, Vitality Active Rewards 2.0, and Vitality Active Rewards 3.0) as well as other fundamental updates.

Table 29 Notable moments in Vitality Active Rewards history

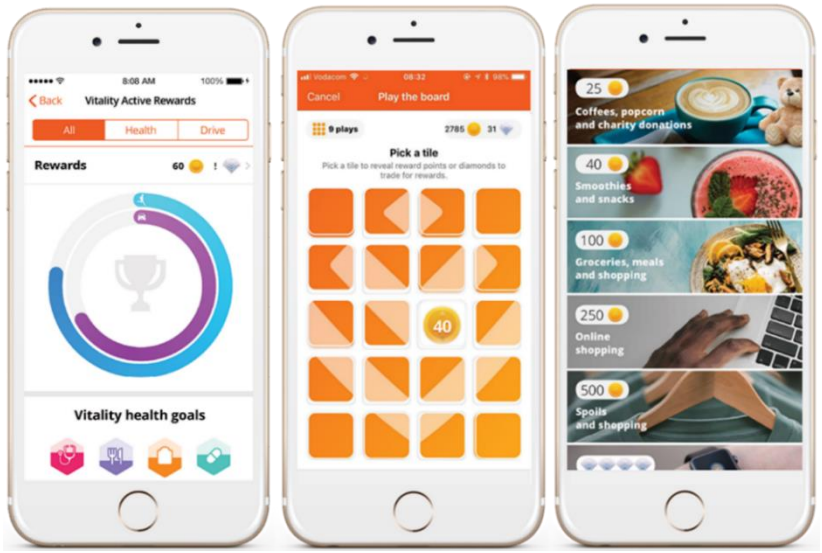
Launch period	Description of gamification
2015 (Vitality Active Rewards 1.0)	Members have a weekly physical activity points goal/target based on previous engagement and performance. If they achieve the weekly goal (closed the ring), members can choose from a guaranteed set of reward vouchers (e.g., coffee, smoothie, popcorn, MoveToGive). **Figure 66 Vitality Active Rewards 1.0** 
2017	"Surprise Rewards" were introduced: after every continuous 3-week goal streak members could "spin the wheel" to earn a random reward ranging from coffees to flights. **Figure 67 Surprise Rewards** 

2018

(Vitality Active Rewards 2.0)

The "Surprise Rewards" spinner was removed and the Vitality Active Rewards gameboard was introduced. In this version, when members closed their ring, they earned a play on the gameboard to uncover Vitality Reward Points. This virtual currency could be exchanged for a wide range of rewards in the Vitality Mall across a range of values and partners.

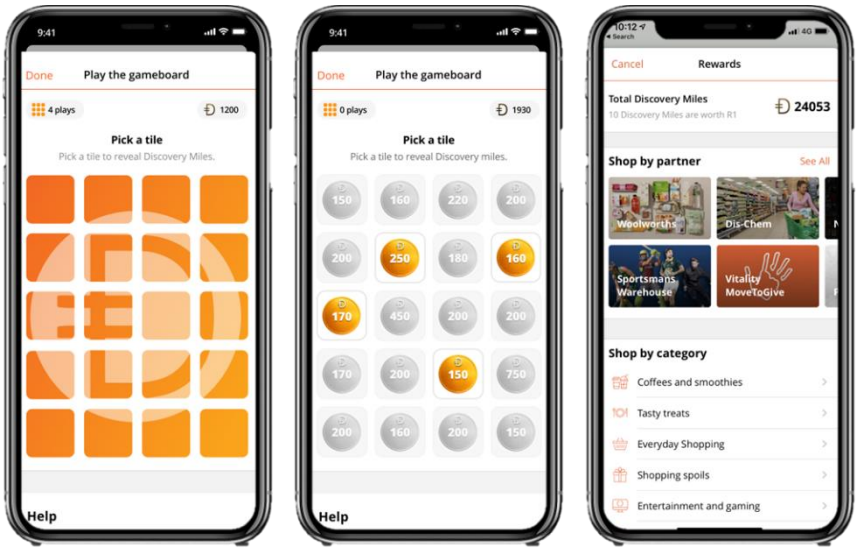
Figure 68 Vitality Active Rewards 2.0



2019

The launch of Discovery Bank allowed the initial game currency (Vitality Reward Points) to be replaced with Discovery Miles – an even more flexible currency that is potentially more valuable than cash due to benefit features and discounts afforded to clients. Discovery Miles can be spent in the Vitality Mall or Discovery Bank members can spend these Discovery Miles more broadly across a range of retailers and services and benefit from additional discounts, e.g., "Miles D-Day"[15].

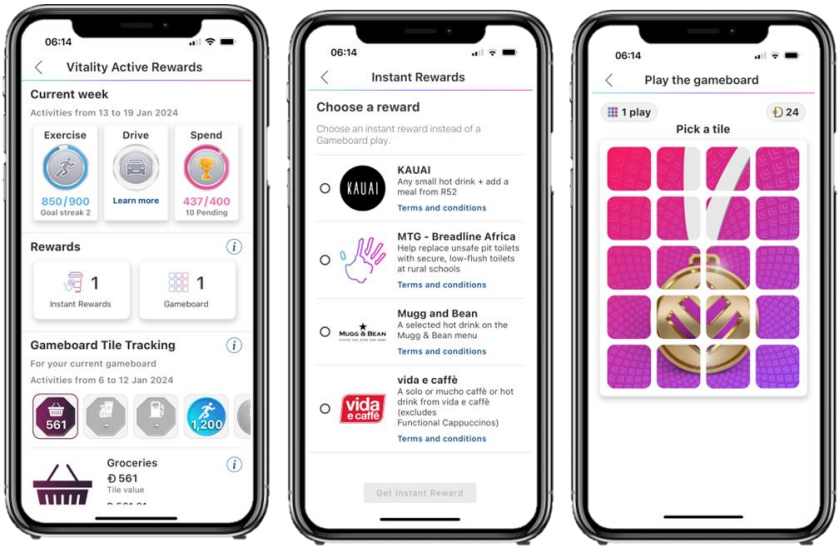
Figure 69 Switch to Discovery Miles



[15] Discovery Bank clients can earn up to 30% off when spending their Discovery Miles at online and in-store partners in the 15th of every month.

2022 (Vitality Active Rewards 3.0)	The introduction of enhanced personalisation and more gamification features, most importantly, the ability to choose between an instant reward (selection of a range of vouchers) or a play on the gameboard. These enhanced features are only available in the Discovery Bank app. Members may continue to play the game in the corporate Discovery app, but then they forgo the enhanced rewards and features. More detail is provided in Appendix C and Appendix D.

Figure 70 Vitality Active Rewards 3.0



Despite changes to the Vitality Active Rewards game platform over time, some elements have remained consistent throughout. One of the consistent elements is the weekly goal cycle and general timing of rewards. The goal cycle is a weekly from Saturday to Friday and rewards typically become available on the following Wednesday, marketed as “Rewards Wednesday”.

4.3. QUANTITATIVE STUDY

This portion of the case study investigates the propositions from Paper 3 using a quantitative research design. The following sections describe the quantitative phase in detail.

4.3.1. Quantitative research methodology

This section describes the research methodology for the quantitative study.

A. Quantitative research design

The quantitative phase of the case study presents a natural experiment considering historical actions taken by the organisation (Discovery Vitality) as the experimental conditions and archival data for the measures. Since the case site and enhancements made to the Vitality Active Rewards platform are out of the researcher’s control, this is a natural experiment in contrast to the quasi-experimental design employed in Paper 2, where the researcher could largely define elements of the experiment. The researcher chose this design due to the volume and nature of the archival data available. The datapoints that the underlying game

platform produces are well suited to quantitative analysis. It is generally believed that the findings from quantitative analysis may more readily be extrapolated onto a wider population due to the size of the samples, compared to qualitative designs where the specific nature of the sample population and the nature of data collected lends itself to deepening understanding of phenomena rather than more generalizable findings (Holton & Burnett, 2005; Watson, 2015).

Because the analysis is retrospective based on historic engagement, participants were not aware of any observations made of them and engagement represents authentic responses to the platform and changes made.

B. Quantitative sample and sampling method

In contrast to Paper 2, which focused on a random sample of 20 000 moderately engaged Vitality Active Rewards members (see p. 58), the sampling frame for the case study is the broader Discovery Vitality member base, focusing on the Vitality Active Rewards programme, described in the introduction section of this thesis (see p.15).

The following sections describe the samples studied during the case study in detail.

i. Sampling method

The case study only considers members who joined Discovery Vitality between January 2015 and August 2015 and were still on the programme at the time of the analysis, with no lapses since joining the programme. The sampling identified those members without Vitality Active Rewards (the unexposed population) and members with Vitality Active Rewards (the exposed population). Table 30 below summarises the unexposed and exposed populations.

Table 30 Summary of case study sample (as of December 2023)

Sub-sample description	Frequency	Percentage
Unexposed: Members without Vitality Active Rewards active	12 049	87%
Exposed: Members with Vitality Active Rewards active	1 770	13%

The reasoning for the omission of members joining Vitality outside of the period January 2015 to August 2015 is to control for exposure to the programme before activating Vitality Active Rewards. Members joining in this period had access to similar benefits at the time of joining the programme. Those who joined over a different date range would likely have had a different joining experience, thereby potentially skewing the analysis. Furthermore, members joining before January 2015 would include members that had more time to learn the underlying programme whereas those joining later had less exposure to the programme and its rules. Therefore, restricting the date range ensures that the exposed and unexposed

populations have a similar level of familiarity with the underlying programme prior to the launch of the Vitality Active Rewards gamification platform.

The Vitality Active Rewards population (i.e., the exposed population) is defined as those Vitality members who chose to activate Vitality Active Rewards between September 2015 and December 2015. The reasoning for this is again to ensure a similar joining experience for the population and a similar amount of exposure to the platform. This population has experienced all iterations of the Vitality Active Rewards gamification platform.

The research focuses on the effects of the gamification layer on the target behaviour (in this case, physical activity) and game-specific behaviour. Therefore, only members who engaged in some physical activity (denoted by Vitality points earning) during the analysis period was included in the analysis.

ii. Sample statistics

Table 31 below summarises the demographic breakdown for the unexposed and exposed populations. Both populations are reasonably evenly distributed between females and males, with 52% females in the unexposed population and 51% females in the exposed population. The populations have a different age profile, with a greater proportion of Vitality Active Rewards members aged 30-39 compared to the unexposed population (67% compared to 37%). The Vitality Active Rewards population is underrepresented in both the 18-29 and 50+ age ranges compared to the population without Vitality Active Rewards.

Table 31 Breakdown of demographics for unexposed and exposed populations

		Frequency		Percentage	
		Female	**Male**	**Female**	**Male**
Unexposed	18- 29	559	523	5%	4%
	30-39	2 493	1 986	21%	16%
	40-49	1 415	1 442	12%	12%
	50-59	915	963	8%	8%
	60+	910	843	8%	7%
Exposed	18- 29	10	14	1%	1%
	30-39	642	548	36%	31%
	40-49	174	188	10%	11%
	50-59	50	80	3%	5%
	60+	32	32	2%	2%

To understand the starting position of the populations in terms of Vitality engagement, Table 32 below summarizes the Vitality status distribution for each population in the month prior to Vitality Active Rewards being launched (September 2015). Discussed in the introductory section of this thesis, Vitality status (see p. 14) provides an overall view of an individual's engagement across all Vitality behaviours, including but not limited to physical activity. Considering the Vitality status prior to the launch of Vitality Active Rewards gives an indication of how familiar the underlying populations are with the different health promoting activities and how much they have engaged up until August 2015.

From Table 32 we see that the population activating Vitality Active Rewards had a much lower proportion of members on Blue status (18% vs 80%) and a much greater proportion already on Diamond status (26% vs 1%) – this is not unexpected since one could reasonably expect those members activating Vitality Active Rewards in 2015 would have been more engaged to begin with compared to those members who were not early adopters or did not activate Vitality Active Rewards at all. The difference in status distributions highlights that there is a strong selection effect that needs to be considered.

Table 32 Vitality status distribution for identified populations as at August 2015

		Frequency	Percentage
Unexposed	Blue	9 488	80%
	Bronze	1 690	14%
	Silver	443	4%
	Gold	214	2%
	Diamond	76	1%
Exposed	Blue	319	18%
	Bronze	413	23%
	Silver	357	20%
	Gold	228	13%
	Diamond	453	26%

There are both demographic and attitudinal (illustrated by the difference in health engagement levels) differences between the unexposed and exposed populations. To control for these differences between the populations all analysis comparing the two populations used a random selection from the unexposed population with the same age, gender, and Vitality status breakdown to ensure that any observed differences between the samples was not because of these underlying variations. In other words, the analysis uses a subset of 1 770

individuals from the unexposed population with a similar gender, age, and Vitality status composition as the 1 770 members in the exposed population.

C. Quantitative research measures

The quantitative study collected the following secondary measures directly from the Vitality and Vitality Active Rewards source tables using SQL.

i. Action participation (Vitality points earned)

Comparable to Paper 2 (see p. 63), the quantitative phase of the case study measures physical activity as the targeted outcome behaviour. Introduced previously, the Vitality programme uses a points system that allocates a fixed number of points to essential health promoting behaviours, including physical activity. Vitality members can link wearable fitness devices (e.g., fitness trackers and sports watches) and their gym memberships or they can participate in verifiable events (e.g., a timed running event) to earn Vitality points. These points earning activities are representative of clinically relevant, verifiable data and are not self-reported activities. The magnitude of the points is representative of the relative effort and the relative impact on mortality and morbidity (Griffin et al., 2023). Since the quantitative analysis is conducted within the gamification framework and the broader Vitality context, only points earned that contributed directly towards the Vitality Active Rewards game and Vitality status are considered.

ii. Implicit game participation

Implicit game engagement is measured through activation of Vitality Active Rewards, and is, therefore, a binary variable. It acts as the ultimate independent variable of interest for P_{1a}[16].

iii. Explicit game participation

It is possible to activate Vitality Active Rewards without engaging in the platform, or it is possible to still engage in the underlying action behaviour but disengage from the game (i.e., members are exercising, but they no longer "play the game", or redeem rewards). Explicit game engagement is a measure indicating the level of interaction with the game-specific elements, and each iteration of the game has a separate engagement metric associated with it, described in Table 33 below. This explicit game engagement metric is what the researcher measures to show declining or improved engagement over time for P_{1b}[17] and P_9[18].

In addition to the game-specific engagement in Vitality Active Rewards, members can access other Vitality benefits that leverage Vitality Active Rewards without necessarily being part of the game platform itself. For example, the Apple Watch benefit is an additional, voluntary benefit where individuals can pay off an Apple Watch device through Vitality Active Rewards goals. Similarly, "fitness boosters" are additional benefits where members can earn discounts

[16] Gamification has an initial positive and substantive impact on the targeted behaviour.
[17] The magnitude of the positive impact on the targeted behaviour reduces over time, but the overall effect remains positive.
[18] A substantive change will have a positive curvilinear effect on game participation within *k* cycles.

on running shoes, wearable fitness devices and apparel based on goal achievement. These booster benefits are voluntary, need to be activated separately and are not integral to the gamification platform. Therefore, the explicit engagement metric excludes take-up of these additional benefits and only considers pure game engagement directly associated with the gamification platform.

Table 33 Breakdown of demographics for unexposed and exposed populations

Game version	Go-live date	Description of engagement	Explicit engagement metric
Vitality Active Rewards 1.0	September 2015	The participant earns a reward voucher that can be selected from a fixed set of partners if they achieved the goal. The reward becomes available on "Rewards Wednesday".	$\frac{Vouchers\ Selected}{Vouchers\ Issued}$
Vitality Active Rewards 2.0	September 2018	The participant earns a play on a gameboard if they achieve their goal. Plays uncover a virtual currency that can be exchange for rewards. Plays become playable on "Rewards Wednesday".	$\frac{Game\ Plays\ Used}{Game\ Plays\ Allocated}$
Vitality Active Rewards 3.0	April 2023	The participant can choose an instant reward from a set of fixed partners immediately (i.e., as soon as the goal is shown as achieved), or they can wait until "Rewards Wednesday" to play the gameboard.	$\frac{Plays\ Used + \ Instant\ Rewards\ Selected}{Rewards\ Allocated}$

iv. Control variables

The study uses age, gender, and Vitality status to control for external effects and ensure that populations are sufficiently similar to compare.

D. Quantitative data analysis and interpretation

The quantitative portion of the case study follows a difference-in-differences approach to evaluate the effect of the introduction of Vitality Active Rewards in September 2015. The case study represents a natural experiment where the introduction of the Vitality Active Rewards gamification platform is effectively an interrupted time-series where the intervention (i.e., the introduction of the new Vitality Active Rewards programme) is implemented with immediate effect (i.e., there was no phased approach to introducing Vitality Active Rewards).

Difference-in-differences is the same analysis approach used in Paper 2, and the researcher chose this approach for the quantitative portion of the case study since it is well-suited to a longitudinal time-series where the impact of an intervention introduced with immediate

effect needs to be assessed. One of the strengths of a difference-in-differences analysis is that the results can be interpreted causally (Gopalan et al., 2020; Roth et al., 2023; Warton, 2020; Warton et al., 2016). The difference-in-differences analysis tests P_{1a}[19] .

Furthermore, the quantitative portion of the case study deploys an ARIMA[20] model to evaluate the explicit game-specific engagement over time. The researcher chose an ARIMA model because it is well suited to time series analysis where each data point is impacted by the previous data point, as is the case with the iterative game nature of Vitality Active Rewards. ARIMA models are also successful at modelling short-term forecasts, which is sufficient for this analysis (Ma, 2020; Schaffer et al., 2021). The ARIMA model tests P_{1b}[21] and P_9[22].

4.3.2. Reliability and validity of the quantitative study

The following sections discuss the reliability and validity of the quantitative study.

A. Reliability

Reliability relates to the consistency of an experiment, indicating that if another researcher were to replicate the experimental design, they would obtain comparable results. Noted previously in Paper 2, reliability is an indication of consistency (Armour & Williams, 2022; Hammersley, 1987; Roberts & Priest, 2006).

Much like the field experiment presented in Paper 2, the case study comprises solely of objective, quantitative research measures; notably repeated outcome measures over time consisting of archival data from the case site (i.e., Vitality Active Rewards). The case study spans a substantial temporal duration, thereby bolstering the reliability of the study.

The measures collected relating to the target behaviour (physical activity) is based on Vitality physical activity points, where points are an objective measure for physical activity based on verified, recorded activities with no self-reported measures. The measures relating to explicit game-specific participation, as defined in Table 33 (see p.157) are based on historic engagement data generated by the game platform itself and collected directly from the Vitality Active Rewards source tables using SQL.

Assuming future research occurred within a comparable context under consistent conditions, one may reasonably anticipate analogous outcomes, thereby suggesting heightened reliability in the quantitative phase of the case study.

B. Internal validity

Internal validity pertains to the extent to which the experimental design allows the researcher to effectively examine the propositions introduced in Paper 3, ensuring the ability

[19] Gamification has an initial positive and substantive impact on the targeted behaviour.
[20] Autoregressive integrated moving average
[21] The magnitude of the positive impact on the targeted behaviour reduces over time, but the overall effect remains positive.
[22] A substantive change will have a positive curvilinear effect on game participation within *k* cycles.

to draw robust and reliable conclusions from the obtained results (Slack & Draugalis Jr, 2001). In other words, internal validity establishes if the experimental design accurately represents what the study intends to measure (Armour & Williams, 2022; Roberts & Priest, 2006).

There is the opinion that field data provides lower levels of internal validity compared to experiments where there is greater control over the design (Roe & Just, 2009). However, in this case study, the researcher attempted to establish internal validity throughout the experimental design. Specifically relating to the sampling frame: the researcher restricted the sample to individuals joining Discovery Vitality between January and August 2015 and defined Vitality Active Rewards participants as those who activated the benefit between September and December 2015. Restricting the sample in this way implies that individuals joined the programme under similar conditions and any observations are less likely to be driven by differences in the underlying programme. Similarly, where the researcher compared members with Vitality Active Rewards to those without, the researcher controlled for differences between the population and ensured that they were sufficiently similar. Therefore, one may be reasonably certain that observed differences were as a result of the gamification platform and not underlying differences between the populations. Furthermore, the longitudinal nature of the quantitative study lends itself to higher internal validity.

The primary measures collected during the case study are those relating to the target behaviour (in this case physical activity) and game specific engagement, defined per iteration of the gamification platform in Table 33 (see p. 157). The measure relating to physical activity is based on Vitality points, discussed in the introductory section of the thesis (see p. 14), which are derived from verifiable activities (e.g., activities recorded with a wearable device, such as a fitness tracker) (Porter et al., 2014). Since Vitality points are based on measurable activities recorded through verifiable means, the measure relating to physical activity has high internal validity. The measure relating to the explicit game-specific participation is based on rewards used (e.g., vouchers selected, plays on the gameboard played or instant rewards selected) from those that were issued to the member for achieving their weekly goals. Since goal achievement is defined based on the underlying system and is clearly measured by the platform (i.e., the goal achievement is binary based on points earned ≥ weekly goal) and reward usage is measurable within the gamification platform, the measure relating to game-specific gamification has high internal consistency.

The case study sample consists of 1 770 members with Vitality Active Rewards and 1 770 members without Vitality Active Rewards; the sample is reasonable in size, and larger sizes may be associated with high internal validity due to the increased statistical power.

C. External validity

External validity questions the generalisability of the case study, in other words, it questions the applicability of research findings beyond the context of the specific case considered in the study (Findley et al., 2021; Steckler & McLeroy, 2008). While case studies are often seen as less generalizable due to the "small-N problem" (Tsang, 2014), the relatively large member

base of the case site and the inclusion of quantitative methods attempt to address this concern.

Extant literature has shown gamification to be a widely applicable design strategy (Deterding et al., 2011; Hamari et al., 2014) and findings relating to the long-term effect of gamification and changes made over time may very likely apply across multiple contexts. However, extending this research would very likely require adjustments based on the underlying context (for example, the game-specific engagement metric would need to be defined appropriately). Similarly, some adjustments may need to be made depending on the underlying game mechanics to ensure analysis remains relevant: Vitality Active Rewards focuses largely on explicit goal setting whereas other gamification platforms may deploy other mechanics which may or may not have implicit or explicit goal setting included in the design.

Although the case site is in South Africa, Vitality has partnerships in 40 international markets (including Australia, Germany, China, and Japan). The Vitality chassis is reasonably consistent across these markets and findings from the South African business may very likely be generalised to these international markets (Vitality Group, 2023). Furthermore, Vitality Active Rewards has been implemented successfully in other markets, indicating that the findings may likely be more applicable than only the South African context.

4.3.3. Limitations of the quantitative study

The quantitative portion of the case study is a natural experiment investigating historic actions made by the organisation (Discovery Vitality) on the gamification platform (Vitality Active Rewards) over time. Since this was a natural experiment, the researcher had no control over changes made. The researcher restricted the sample to individuals joining Discovery Vitality between January and August 2015 to ensure that all individuals considered joined the programme under similar conditions. For the exposed population (i.e. those with Vitality Active Rewards active) the researcher only considered those members who activated Vitality Active Rewards between September and December 2015 to ensure that all individuals had a similar level of exposure to the gamification platform. In addition to these restrictions to the population, the researcher controlled for underlying differences between the exposed (those with Vitality Active Rewards active) and unexposed (those without Vitality Active Rewards active) populations by choosing a random subsample of the unexposed population with a similar demographic (based on age and gender) and engagement (based on Vitality status) profile compared to the exposed population.

Vitality Active Rewards is a voluntary benefit that individuals choose to activate and participate in. Due to the voluntary nature of the benefit, there is a risk of selection bias. One can expect individuals who are already more physically active or those who are very engaged in the Vitality programme (indicated by Vitality status) to be inherently more engaged that those who are less active or those on lower statuses. In analysis where the exposed and unexposed populations are compared to each other the researcher controls for discrepancies

by ensuring that the exposed and unexposed populations have a similar demographic and engagement profile.

The case study considers only a single organisation, namely Discovery Vitality, focusing only on the Vitality Active Rewards gamification platform. Due to the nature of the case site the study focuses on the wellness industry and on physical activity as the primary target behaviour. This limitation implies that results may be less generalizable. It is reasonable to expect that other organisations or gamification designers would need to adjust these methods appropriately to the specific context. The single case site is not a severe limitation as there are few cases of long-term gamification designs outside of education and employee engagement programmes in South Africa, therefore, the research contributes more broadly to an improved understanding of the long-term applicability of gamification designs. Both gamification and goal setting theory (which is the primary game mechanic in Vitality Active Rewards) have been shown to be widely applicable across a range of contexts (Deterding et al., 2011; Hamari et al., 2014; Latham & Arshoff, 2013; Locke & Latham, 1979, 2019; Magylaitė et al., 2022), therefore, it not unreasonable to expect that the findings from this case study may be adapted appropriately for use in other cases.

Additional factors that may influence the effectiveness of a gamification platform are personal factors such as individuals' character traits or platform factors such as the inclusion of incentives. These factors are outside the scope of the research. Furthermore, the case study does not investigate the underlying game mechanics (in particular, goal setting). The focus of the case study is in evaluating the long-term effects of an existing gamification platform and investigating the impact of changes on game participation.

4.3.4. Ethical considerations of the quantitative study

The case study deploys a natural experiment on archival data based on historic actions taken by Discovery Vitality, focusing specifically on Vitality Active Rewards. The researcher obtained permission from Discovery Vitality to conduct the research, see Appendix A.

In the context of the case study, it is not possible to obtain informed consent from the data subjects, however, no personally identifiable data was collected during the study and all analyses were conducted at an aggregate level. In other words, it is not possible to identify individuals based on the data collected during the study.

The research did not impact the gamification platform in any way and clients were not inconvenienced or impacted as a result of the study.

4.3.5. Quantitative results

The following sections describe the results from the quantitative portion of the study.

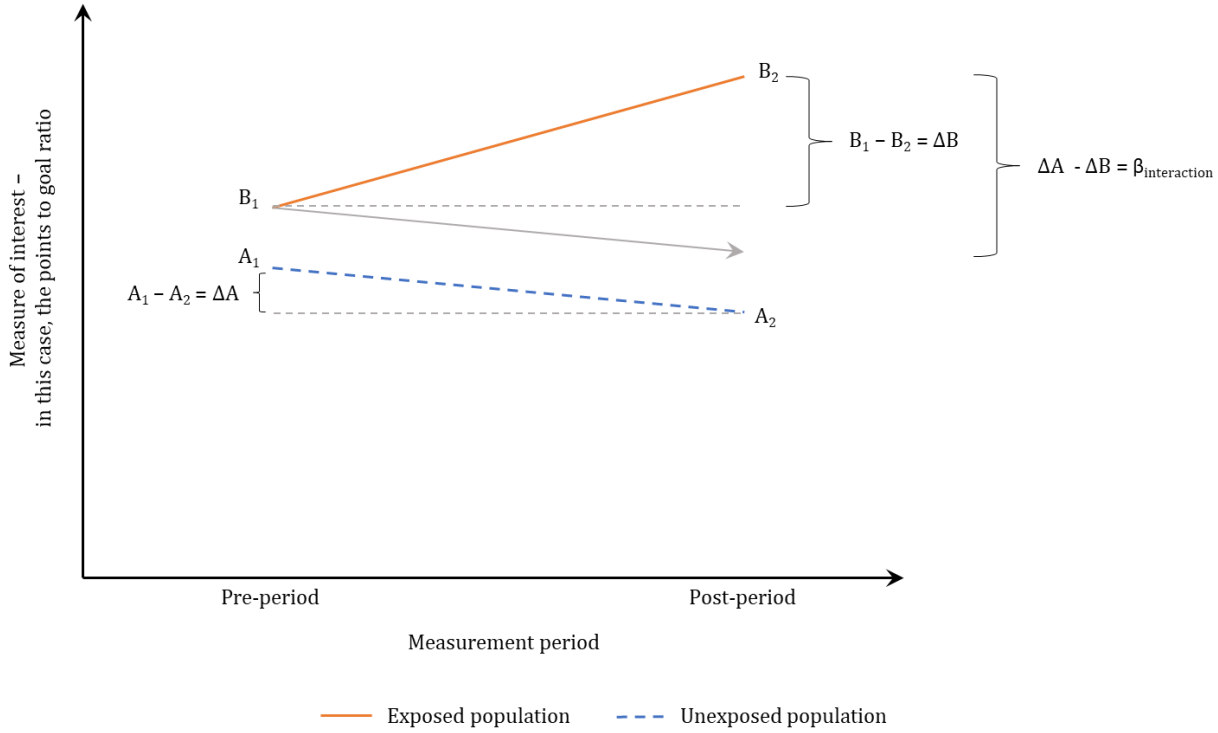
A. Initial positive effect

The research uses a difference-in-differences analysis approach to evaluate the initial effect of introducing the Vitality Active Rewards game on physical activity. The analysis measures

the average weekly Vitality fitness points earned before compared to after the introduction of the Vitality Active Rewards gamification platform.

Paper 2 introduced the difference-in-differences analysis approach, and the graphic representation is shown again in Figure 71 below. If the $\beta_{interaction}$ coefficient is statistically significant, then it is likely that the slopes are not parallel, and the intervention or interruption influenced the exposed population (in this case those with Vitality Active Rewards) compared to the unexposed population (those without Vitality Active Rewards). The analysis was conducted in SAS using PROC MIXED, because this allows for repeated measures (Warton, 2020; Warton et al., 2016).

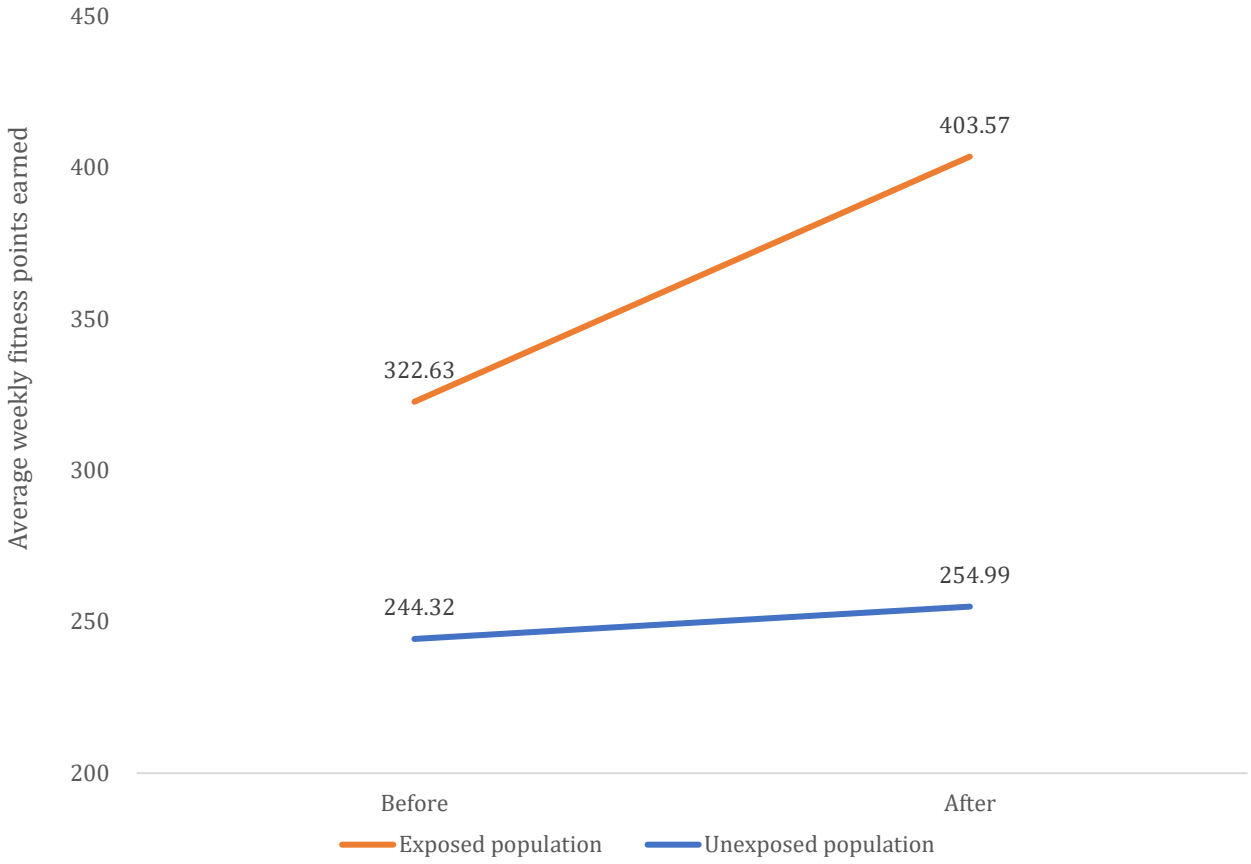
Figure 71 Graphic representation of the D-I-D design, adjusted from Warton et al. (2016)



The analysis considers the six weeks before and six weeks after the go-live of the Vitality Active Rewards programme. The researcher did not evaluate the effects over a longer period, since the impact of the intervention would likely dissipate over longer periods, based on the observations from Paper 2. Furthermore, the focus of P_{1a} is the *initial* effect of gamification on the targeted behaviour, therefore, the initial six-week period is deemed to be sufficient.

Figure 72 below shows the average weekly fitness points in the 6 weeks before the introduction of Vitality Active Rewards 1.0 compared to the 6 weeks after the platform went live.

Figure 72 Average weekly Vitality fitness points earned in the 6 weeks before vs after the Vitality Active Rewards 1.0 platform going live



The magnitude of the D-I-D coefficient is 70.27 and is significant ($p < .0001$), indicating that the slopes of the two groups are not parallel and that exposure to the Vitality Active Rewards gamification platform affected the outcome of the exposed group differently than the underlying background trend, captured by the unexposed, or control, group. Based on the coefficients from the linear model, exposure to the game increased the average weekly points earned by 80.94 and this was significant ($p < .0001$), compared to the unexposed population where average weekly points earned was increased by 10.68 ($p = .12$).

This finding provides support for P_{1a}, which proposed that gamification has an initial positive and substantive impact on the targeted behaviour (in this case, physical activity).

B. Declining effects of gamification over time

The researcher performed a time series analysis using the ARIMA model in SAS to investigate the long-term effects of the same game repeated over an extended period. Although it is possible to investigate this trend over time using the action participation metric (i.e., physical activity) similar to before, the researcher chose to illustrate the declining effects over time using the explicit, game specific, participation metric. Investigating the long-term effects on the game-specific participation metric is of value in both an academic and a practical context,

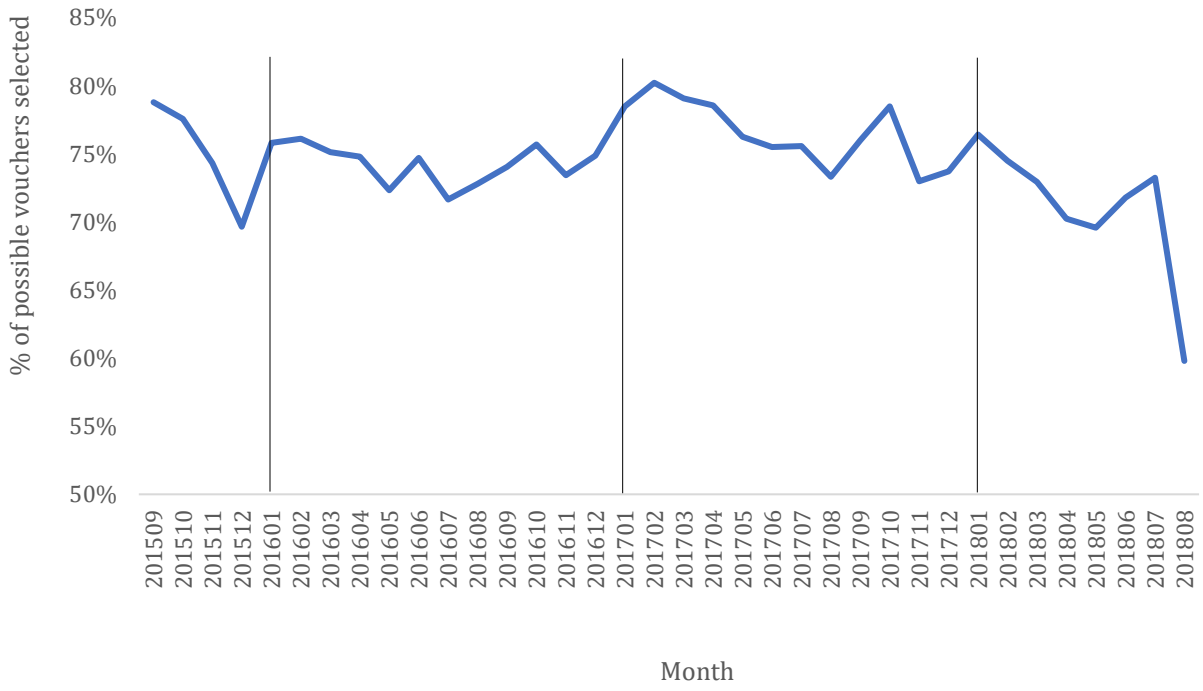
since it both contributes knowledge to the field of gamification and provides practical guidelines to practitioners for ensuring that these platforms remain relevant within the organisation.

The initial ARIMA model evaluates the trend of the engagement metric over the period September 2015 (when the Vitality Active Rewards gamification platform went live) to August 2018 (shortly before the second iteration of the platform went live). In this iteration of the gamification platform, Vitality Active Rewards 1.0, the engagement metric is defined as % of possible vouchers issued that were selected, regardless of whether the voucher was redeemed. The engagement metric is described in Table 33 (see p. 157):

$$\frac{Vouchers\ Selected}{Vouchers\ Issued}$$

Initial inspection of Figure 73, showing voucher selection over time, indicates that it is reasonable to assume an element of seasonality, with voucher selection increasing over December - January each year and then declining shortly after, with less pronounced increases over June and October. Based on this observation, the time series was differenced to correspond to the monthly seasonal cycle.

Figure 73 Voucher selection over time for Sep 2015 to Aug 2018



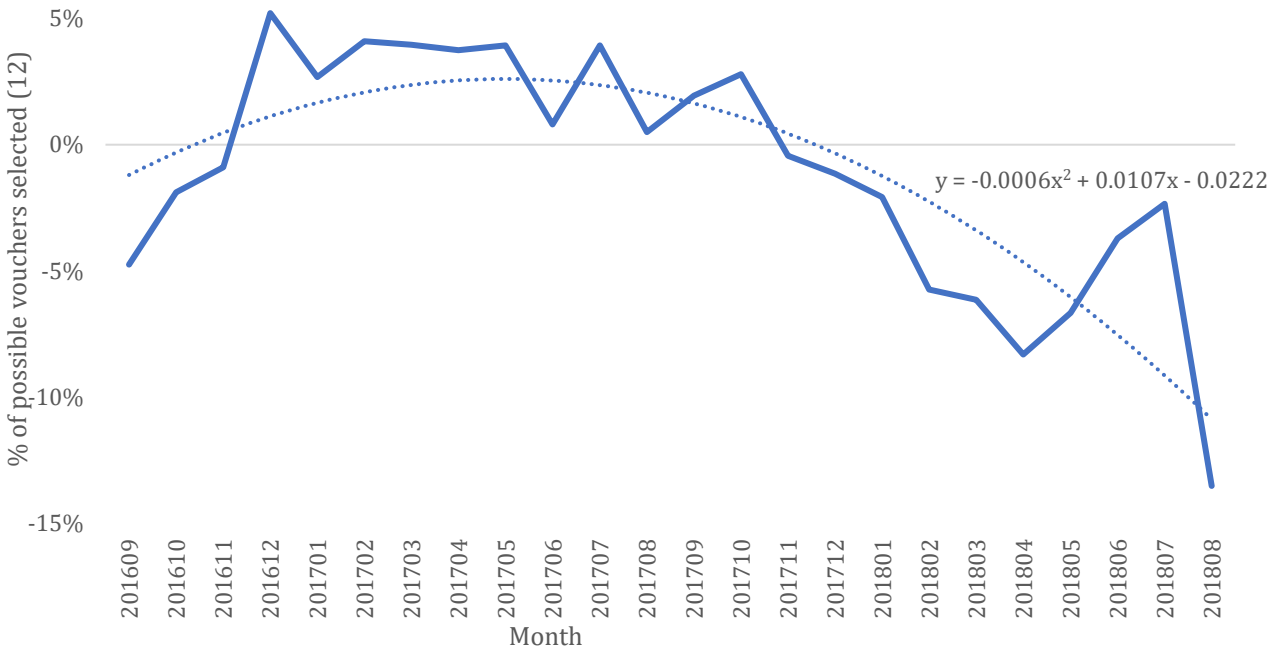
The researcher used PROC ARIMA in SAS, applying differencing and using the scan method to exploratively identify the autoregressive and moving-average orders of the model. Using the scan method, the researcher determined that the autoregressive term p=1 is the most

appropriate. The researcher compared various models and chose the one with the best fit (lowest AIC[23]).

From the differenced series, during the identification stage, the autocorrelations decrease rapidly indicating that the differenced series is a stationary time series (which is a requirement of ARIMA models) and the white noise hypothesis is rejected concluding that the time series is not white noise and can be modelled.

Figure 74 below illustrates the differenced time series, where (12) corresponds to the lag used in the differencing. A lag of 12 is appropriate for an annual seasonal cycle, which was observed in Figure 73 above. Figure 74 below includes the trend line, which illustrates that the differenced time series is a 2nd order polynomial (i.e., a parabola, or quadratic function).

Figure 74 Differenced time series for the Vitality Active Rewards 1.0 time series



The trend for the differenced time series shown above in Figure 74 clearly shows that game specific engagement declines over the extended period before Vitality Active Rewards 2.0 was introduced. This finding provides support for P_{1b}, which proposed the magnitude of the positive impact on behaviour reduces over time (in this case the game-specific behaviour indicated by the explicit game engagement measure).

The parabolic nature of the trend, highlighted by the curve overlaid on the time series in Figure 74, provides some insight into what an appropriate value for *k* might be. Based on the trend above, the gamification platform would likely have benefited from a change to the

[23] Akaike Information Criterion

programme by July 2017 since this is when game-specific engagement started to decline. The discernible quadratic characteristics evident in the trend line prompt speculation regarding the potential localization of the parameter k at the vertex of the parabolic curve (i.e., before the decline begins).

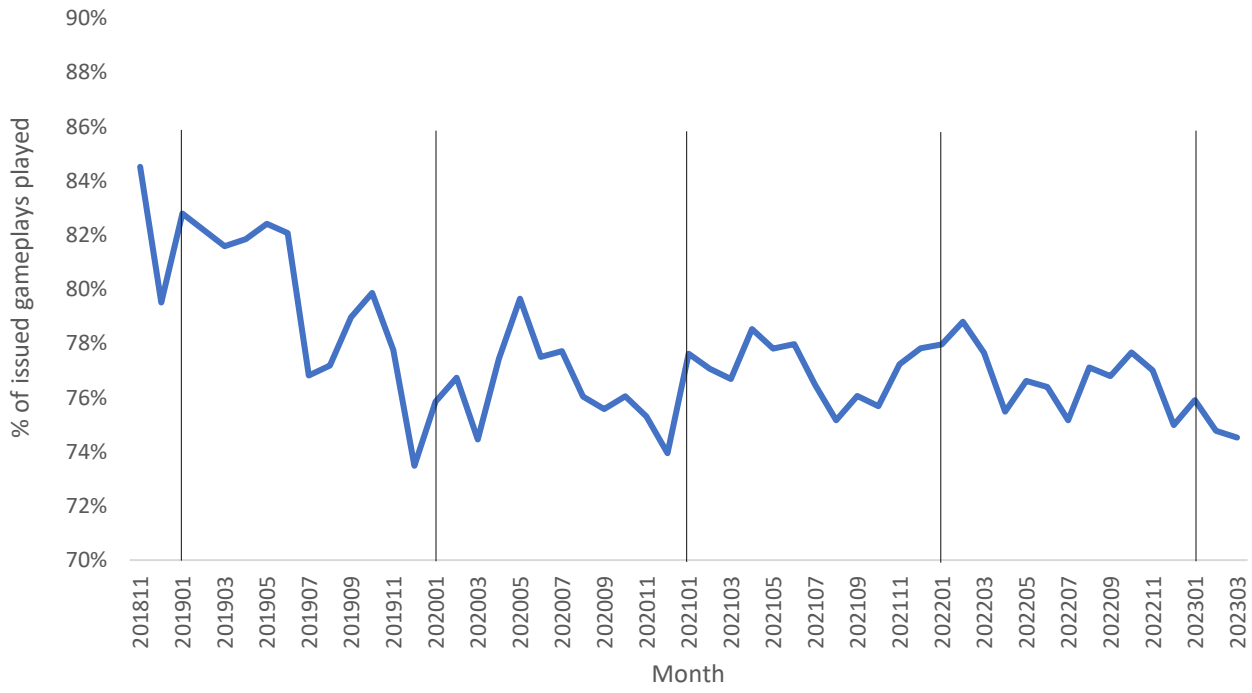
To understand if this underlying quadratic trend is repeated following the introduction of new game elements, the researcher considered a second ARIMA model for the period November 2018 to March 2023. In other words, the researcher investigates the trend over time for Vitality Active Rewards 2.0, where the explicit game participation is defined as the percentage of gameboard plays that were played, described in Table 33 (see p. 157):

$$\frac{Game\ Plays\ Used}{Game\ Plays\ Allocated}$$

Although the Vitality Active Rewards 2.0 benefits were implemented in August 2018, the researcher only considers the time series from November 2018 to allow for immediate effects following the updates to dissipate. Similar to the previous ARIMA model it is necessary to evaluate if there are any seasonality effects in the game specific engagement for Vitality Active Rewards 2.0 (in this case, members playing the gameboard) that need to be accounted for.

Following a similar approach to before, we investigate the game-specific participation metric over time in Figure 75 below. In alignment with what we observed previously, it is apparent that there is a seasonal effect: there is an increase over December to January with additional peaks between June/July and September/October. Therefore, the time series was once again differenced by the appropriate seasonal lag.

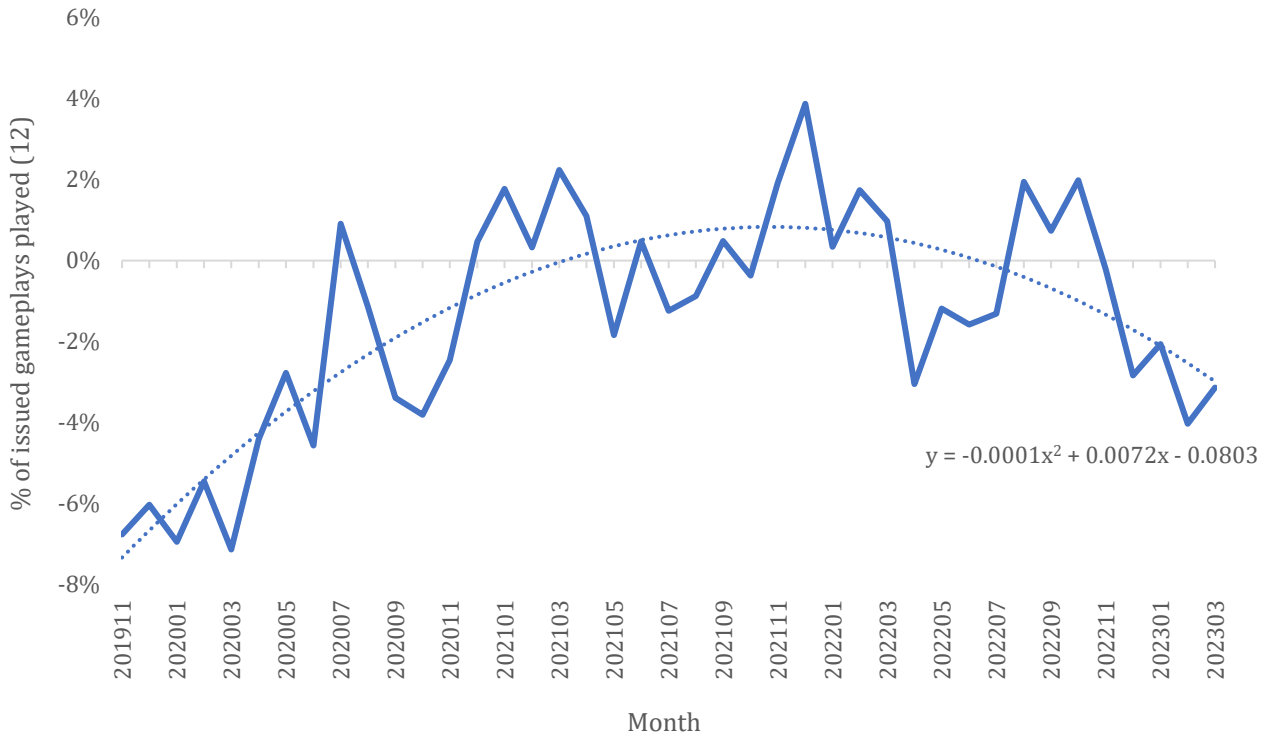
Figure 75 Gameboard plays over time for Nov 2018 to Mar 2023



The researcher applied the necessary checks for an ARIMA model and observed that the autocorrelations decrease rapidly indicating that the differenced series is a stationary time series (which is a requirement) and the white noise hypothesis is rejected concluding that the time series is not white noise and can be modelled.

Figure 76 below illustrates the differenced time series, where (12) corresponds to the lag used in the differencing. Analogous to what can be observed for the Vitality Active Rewards 1.0 period, a lag of 12 is appropriate for an annual seasonal cycle, based on Figure 75 above. Figure 76 below includes the trend line, which illustrates that the differenced time series is a 2nd order polynomial (i.e., a parabola, or quadratic function), comparable to what was observed before.

Figure 76 Differenced time series for the Vitality Active Rewards 2.0 time series



The trend shows a minor decline towards the end of the period, prior to when the next iteration of the game (i.e., Vitality Active Rewards 3.0) went live. This is expected based on P_{1b} which proposes that the magnitude of the positive impact on behaviour reduces over time. One can speculate that the introduction of Vitality Active Rewards 3.0 may have been more appropriate by March 2022 to avoid the decline in game-specific engagement that followed.

Once again, the function of the timeseries trend is parabolic in nature, further enhancing the observation that it is reasonable to suggest that the parameter *k* is at the vertex of the parabolic curve (i.e., before the decline begins).

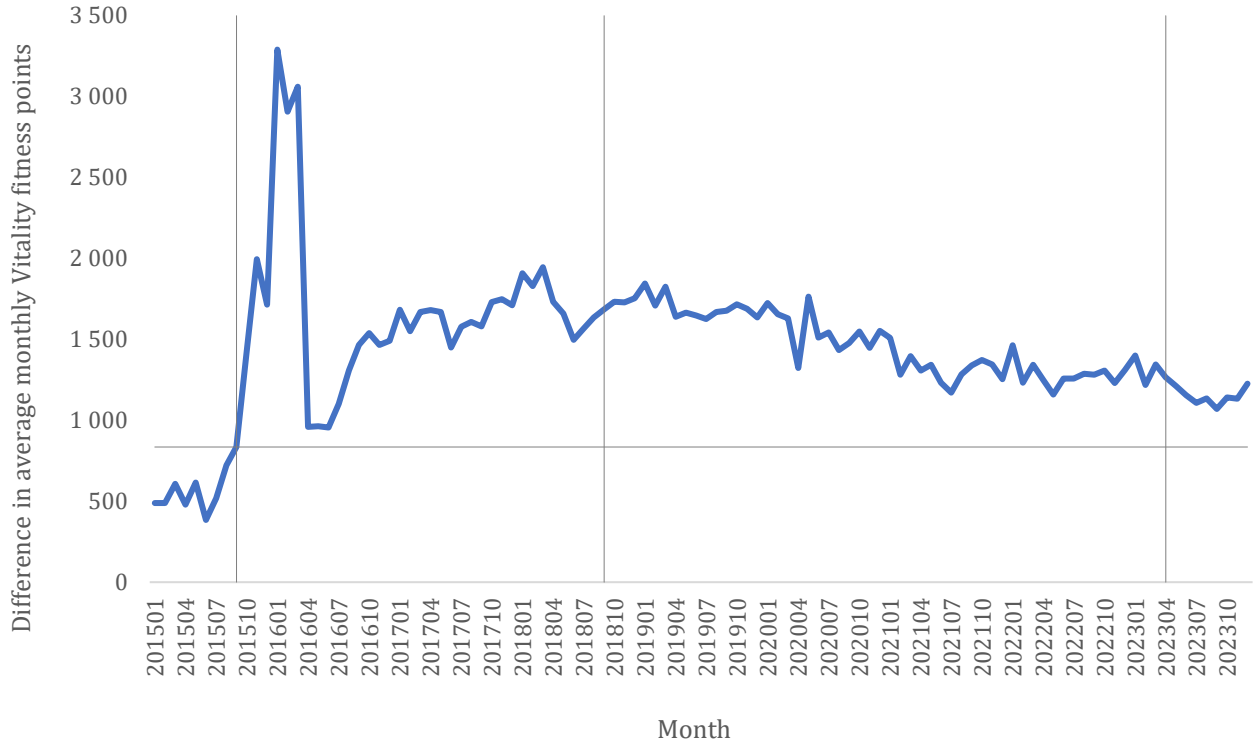
Despite the decline in game-specific engagement over time during the periods for both Vitality Active Rewards 1.0 and Vitality Active Rewards 2.0 the overall effects of the gamification platform on the targeted behaviour (in this case, physical activity) remains positive.

Figure 77 below shows the difference in average monthly Vitality fitness points between the exposed (i.e., those individuals with Vitality Active Rewards) and unexposed (i.e., those individuals without Vitality Active Rewards) populations. In other words:

$$\Delta_{month} = \overline{VAR\ Fitness\ Points}_{month} - \overline{No\ VAR\ Fitness\ Points}_{month}$$

Where "VAR" is used to denote the population with Vitality Active Rewards and "No VAR" is used to denote the population without Vitality Active Rewards. Consistent with the approach that the researcher used in the difference-in-differences analysis before, the population without Vitality Active Rewards is the subset with similar demographic and engagement breakdown as the population with Vitality Active Rewards to ensure that the profile of the two populations is comparable.

Figure 77 Difference in average monthly Vitality fitness points between population with and without Vitality Active Rewards active



The vertical lines indicate where each of the Vitality Active Rewards iterations went live, and the horizontal line indicates what the difference in average points was prior to the introduction of Vitality Active Rewards in September 2015. The greatest difference between the two populations remains the initial period immediately following the introduction of Vitality Active Rewards. Thereafter, the difference between the two populations stabilises

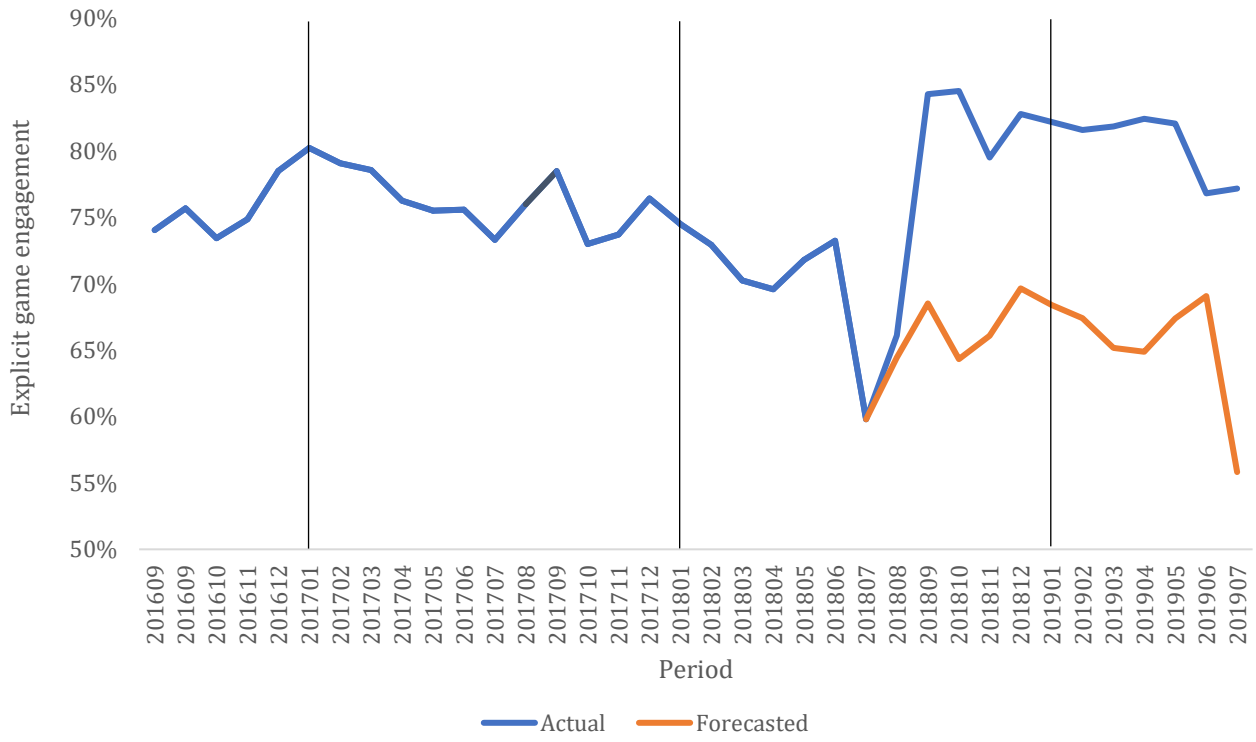
somewhat, but remains above the level where it was prior to the introduction of the gamification platform. Therefore, indicating that the overall positive effects of the gamification platform on the targeted behaviour (physical activity) persist over time.

C. Introduction of new game elements

One of the benefits of using an ARIMA model is that an ARIMA model is well-suited to providing forecasts over shorter periods (Ma, 2020). The researcher used the forecasting ability of the ARIMA models discussed in the previous subsection (i.e., the models evaluating the times series over the period September 2015 – August 2018 and the period November 2018 – March 2023) to compare the forecasted trends (i.e., the expected trend if no changes were made to the platform) to the actual experience of the game platform following the update made to the game.

Figure 78 below shows the actual trend compared to the forecast for the period during Vitality Active Rewards 1.0 and the initial introduction of Vitality Active Rewards 2.0. Figure 78 shows the declining rate of game-specific engagement, highlighting that the introduction of the new Vitality Active Rewards 2.0 game elements introduced in September 2018 showed a marked improvement explicit game engagement: seen by the delta between the orange line (the ARIMA model forecast) and the blue line (actual game engagement over the period).

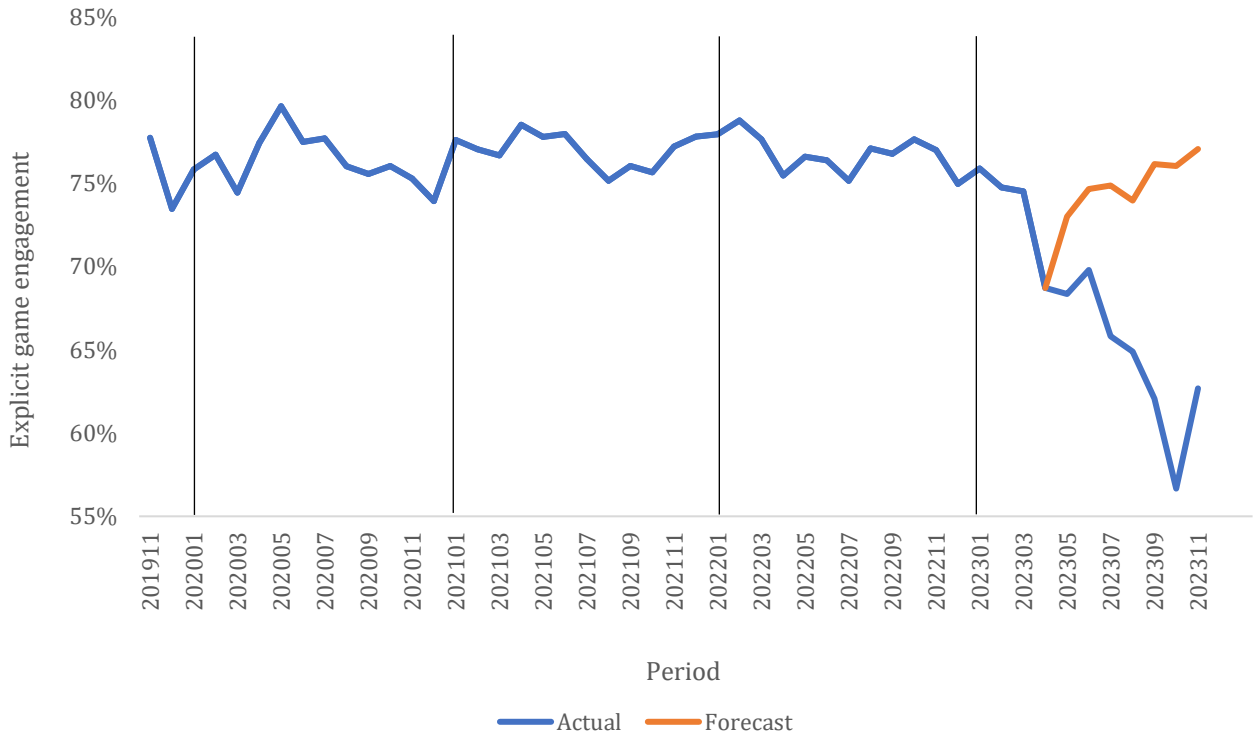
Figure 78 Actual experience vs ARIMA forecast for Sep 2016 to Jul 2019



This finding provides support for P_9 which proposed that introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods.

Figure 79 below shows the actual trend compared to the forecast for the period during Vitality Active Rewards 2.0 and the initial introduction of Vitality Active Rewards 3.0. Figure 79 shows that the introduction of the Vitality Active Rewards 3.0 game elements in April 2023 did not have the expected effect of improving explicit game engagement: seen by the delta between the orange line (the ARIMA model forecast) and the blue line (actual game engagement over the period). There is an upward trend towards the end of the "actual" curve and further analysis would be required to see if this upward trend is sustained over time.

Figure 79 Actual experience vs ARIMA forecast for Nov 2019 to Nov 2023



The researcher previously noted that the enhanced Vitality Active Rewards 3.0 features manifest in the Discovery Bank app. Individuals who chose to continue accessing the game through the Discovery corporate app are effectively still on the Vitality Active Rewards 2.0 version of the game and are still in the "same game, repeated" phase of the cycle. At the time of the analysis, 52% of the sample population had transitioned to playing the game in the Discovery Bank app. The researcher repeated the analysis on the subset who have transitioned to observe if the results were different compared to the overall result presented above, however, the researcher observed a similar result in this population.

This finding does not provide support for P_9 (introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods).

4.3.6. Discussion of the quantitative study

The following sections present a detailed discussion of the quantitative study results.

Table 34 below summarises the propositions that the quantitative study tested with an indication of whether the proposition is supported.

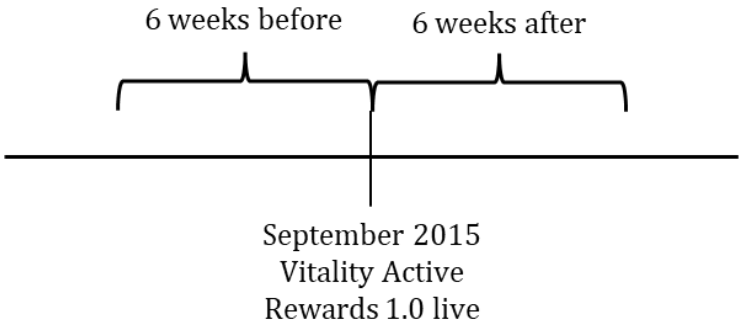
Table 34 Summary of results for the quantitative portion of the case study

Proposition	Detailed description	Results
1a	Gamification has an initial positive and substantive impact on the targeted behaviour.	Supported
1b	The magnitude of the positive impact on behaviour reduces over time, but the overall effect remains positive.	Supported
2	Introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods.	Partially supported
3	There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.	Could not be tested

A. Initial effects of gamification

Gamification is frequently cited as a design strategy that is successful at driving targeted behaviour change and motivation to engage (Cugelman, 2013; Deterding et al., 2011; Hamari et al., 2014). The expectation in the case study is that there is a greater positive effect on the targeted behaviour (physical activity) in the population that activated Vitality Active Rewards when the gamification platform was introduced compared to the population not activating the gamification platform. The researcher evaluated the effect of the introduction of Vitality Active Rewards through a difference-in-differences analysis since the introduction of the programme may be considered as an interruption (or intervention) in a time series and difference-in-differences is well suited to an interrupted time series design (Warton, 2020; Warton et al., 2016). The analysis considered the period six weeks before and six weeks after the gamification platform went live, illustrated in Figure 80 below, where the introduction of the Vitality Active Rewards platform is modelled as the intervention or interruption.

Figure 80 Illustration of timeline for D-I-D analysis



The magnitude of the positive D-I-D coefficient (70.27) is statistically significant ($p < .0001$), indicating that exposure to the Vitality Active Rewards gamification platform had a positive

effect on the outcome of the exposed group compared to the underlying background trend, captured by the unexposed, or control, group. Based on the coefficients from the linear model, exposure to the game increased the average weekly points earned by 80.94 ($p < .0001$), compared to the unexposed population where average weekly points earned was increased 10.68 ($p = .12$).

The predominant game mechanic in Vitality Active Rewards is goal setting and the goals align with the requirements defined in goal setting theory (Locke & Latham, 1979, 2002, 2019). In other words, the goals are specific and challenging, while still being achievable. Goal setting theory highlights that such goals are more effective at motivating individuals compared to no goals, which is largely the case with the unexposed population. While members without having Vitality Active Rewards might have self-set goals regarding their physical activity, they have not been exposed to the explicit game goals defined by Vitality Active Rewards. Goal setting is effective at encouraging an increase in effort leading to improved outcomes and effectiveness is increased when individuals receive feedback regarding the goal (which is the case in a gamification context where there is both visual feedback regarding progress towards the goal and a reward indicating success upon completion of the goal) (Latham, 2016; Locke & Latham, 2002, 2006, 2019). The initial success of Vitality Active Rewards highlights the importance of ensuring that gamification features are grounded in theory and appropriately implemented (Landers, 2019). Future research needs to consider the underlying game mechanics of a platform and assess which theories of motivation are most appropriate against which to assess the platform.

$P_{1a,}$ proposing that gamification has an initial positive and substantive impact on the targeted behaviour, is accepted based on the results of the difference-in-difference analysis.

B. The same game, repeated for a prolonged period

There is a belief in literature that the positive effects of gamification design is limited and that the effects are likely to decline over time (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015). A portion of the results in Paper 2 hinted at this phenomenon with a subset of the observed effects being over reduced periods (see Table 23, p. 112) indicating that the effectiveness of the additional study conditions in the gamification platform reduced over prolonged periods. In the context of the case study, it is anticipated that, despite the initial positive effects resulting from the implementation of the gamification platform, there may be a subsequent decline in individual engagement levels over time.

The researcher chose to model the explicit game-specific engagement to observe member engagement over time. Furthermore, the researcher observed the trend for the periods over both Vitality Active Rewards 1.0 (September 2015 – August 2018) and Vitality Active Rewards 2.0 (September 2018 – March 2023) to understand the long-term effects for multiple iterations of the gamification platform. In both periods, the explicit game-specific engagement over time shows effects of seasonality, therefore, the time series were differenced using an appropriate lag based on the monthly nature of the datapoints. In both cases the underlying trend of the time series shows a decline over time.

The decline occurs sooner in the period for Vitality Active Rewards 1.0 than for Vitality Active Rewards 2.0. This observation implies that there are likely multiple factors that may impact the longevity of a gamification platform. For example, a more stimulating reward mechanism (e.g., playing the gameboard in Vitality Active Rewards 2.0) may be likely to persist for more extended periods compared to a simple reward mechanism (e.g., earning a guaranteed coffee or smoothie voucher in Vitality Active Rewards 1.0). Future research needs to assess if there are other factors that may impact the rate of decline.

Despite the decline over time in game-specific participation, the researcher observed that the overall effect on the targeted behaviour (i.e., physical activity) remained positive. The exposed population (i.e., those who activated Vitality Active Rewards) exhibits greater average points earning compared to the unexposed population (i.e., those who did not activate Vitality Active Rewards). The increased points earning is greater following the introduction of Vitality Active Rewards and does not return below initial levels even after an extended period on the platform. This observation highlights the effectiveness of explicit game goals compared to no goals, "do your best" goals or poorly formulated goals.

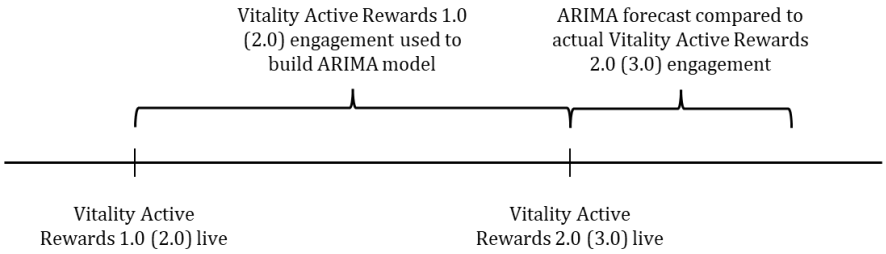
P_{1b}, proposing that the magnitude of the positive impact on behaviour reduces over time, but the overall effect remains positive, is accepted based on the underlying trends observed in both time series analyses.

C. Changing or enhancing game elements

Introduced in the previous section, a gamification platform implemented over an extended period is likely to experience a decline in user behaviour. In an organisational or practical context where gamification platforms may need to remain effective over extended periods (for example, with ongoing behaviours such as physical activity) it is necessary to understand how to maintain the longevity of these platforms. This is particularly true in cases where the organisation has invested in building and maintaining the underlying infrastructure to support such a gamification platform; the organisation needs to demonstrate a clear return on investment to justify ongoing support of the platform. The researcher predominately found literature on the effects of removing gamification elements (Floryan et al., 2019; Hamari et al., 2014; Richter et al., 2015; Seaborn & Fels, 2015), but found no research explicitly testing the effects of changes made to an established gamification platform. The expectation is that change implemented at an appropriate junction would have a positive effect on behaviours, since the change reintroduces novelty and salience into the gamification platform.

The researcher used the forecasting capability of ARIMA models to evaluate the effects of introducing Vitality Active Rewards 2.0 and Vitality Active Rewards 3.0. The approach is illustrated in Figure 81.

Figure 81 Investigating effect of introducing Vitality Active Rewards 2.0 (3.0)

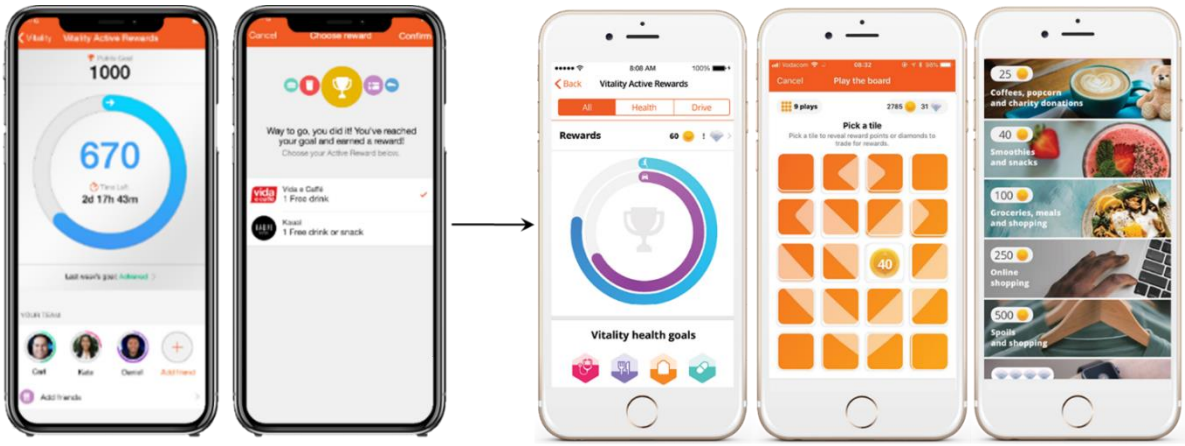


It is clear from Figure 78 (see p. 169) that the introduction of the Vitality Active Rewards 2.0 gamification elements had the desired effect of increasing game-specific participation. However, from Figure 79 (see p. 170) it is also clear that introducing the Vitality Active Rewards 3.0 gamification elements did not have the expected positive effect and game-specific engagement continued to decline. At the time of the analysis, it was not possible to obtain further datapoints since the enhancements have not yet been live for a full 12 months.

Based on the discrepancy in experience between introducing Vitality Active Rewards 2.0 and Vitality Active Rewards 3.0 it is apparent that not all changes are perceived equally, and it is not guaranteed that changes will have similar impacts. The qualitative study presented in the following section describes this phenomenon in more detail.

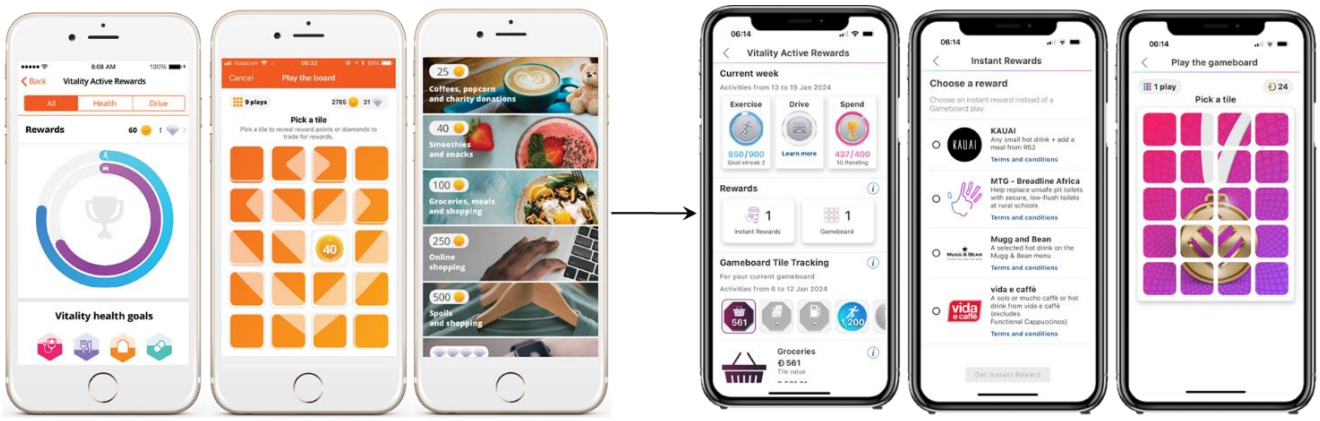
When considering the differences between the two iterations it is important to note that Vitality Active Rewards 2.0 introduced a fundamental shift in the gamification platform. Vitality Active Rewards 1.0 introduced the concept of immediate gratification into the Discovery Vitality programme and rewarded members with a guaranteed voucher reward for achieving their exercise goal. Vitality Active Rewards 2.0 progressed the reward from a fixed set of voucher rewards by introducing a game currency that translated to real-world value, the element of chance and the element of choice (both in terms of choosing which tile to uncover and whether to save or spend the currency uncovered). Introducing the gameboard in Vitality Active Rewards 2.0 introduced additional gameplay features over and above the initial goal setting mechanism. These differences are illustrated in Figure 82 below.

Figure 82 Vitality Active Rewards 1.0 vs Vitality Active Rewards 2.0



In contrast, Vitality Active Rewards 3.0 builds on Vitality Active Rewards 2.0. Vitality Active Rewards introduced more personalisation elements (e.g., earning special feature tiles on the gameboard based on engagement), enhanced recognition (e.g., multiplying the number of Miles earned when the member is on a "goal streak") and re-introduced the coffee/smoothie rewards from Vitality Active Rewards 1.0 in a new form of instant rewards that may be chosen in lieu of the play on the gameboard. Notably, the Vitality Active Rewards 3.0 features are only accessed through the Discovery Bank app compared to the standard Discovery app. Members choosing to continue in the standard Discovery app only experience the standard gameboard introduced in Vitality Active Rewards 2.0. Therefore, Vitality Active Rewards 3.0 consists of nuanced enhancements to the reward mechanism and a process change in terms of how the game is accessed. The differences in the front-facing elements are illustrated in Figure 83 below.

Figure 83 Vitality Active Rewards 2.0 vs Vitality Active Rewards 3.0



Vitality Active Rewards 2.0 Vitality Active Rewards 3.0

The absence of a discernible positive outcome following the implementation of Vitality Active Rewards 3.0 may be attributed to a transitional phase during which members are acclimating to the enhancements, and the anticipated upward trend has yet to manifest due to insufficient data points following the enhancement. Practitioners need to ensure that changes implemented may be "learned" quickly enough to see increased value shortly after the change. Alternatively, it is plausible that the introduced modifications were not of significant magnitude in comparison to the established status quo (i.e., Vitality Active Rewards 2.0), thereby lacking a notable impact on game-specific engagement.

P_9, introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods, is only partially supported and further research is required.

D. Towards further identification of *k*

During both the Vitality Active Rewards 1.0 and 2.0 iterations of the game the observed trend in the time series is parabolic in nature. The trend indicates an initial upward trajectory upon platform introduction or enhancements, reaching a peak of optimal engagement before

gradually declining over time. In practice, it is necessary for organisations to understand where a platform is on this trajectory so that enhancements may be made timeously. It is very likely that the peak of the trajectory may be used as a proxy for *k*, in other words, enhancements made closer to the peak will reduce the likelihood of a prolonged decline. In the practical implementation of gamification, designers are advised to systematically monitor user engagement over time. It is imperative to introduce enhancements to the platform judiciously, striking a balance between timely implementation to forestall decline while allowing players adequate acclimation to the enhancement(s).

Based on the observations during the Vitality Active Rewards 1.0 and Vitality Active Rewards 2.0 periods there were no changes that the organisation introduced too rapidly, thereby having a negative observed impact on game engagement. Therefore, P_{18}, which introduces that there is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour, is not explicitly investigated in the quantitative analysis. It was possible for the researcher to explore P_{18} in the qualitative portion of the case study.

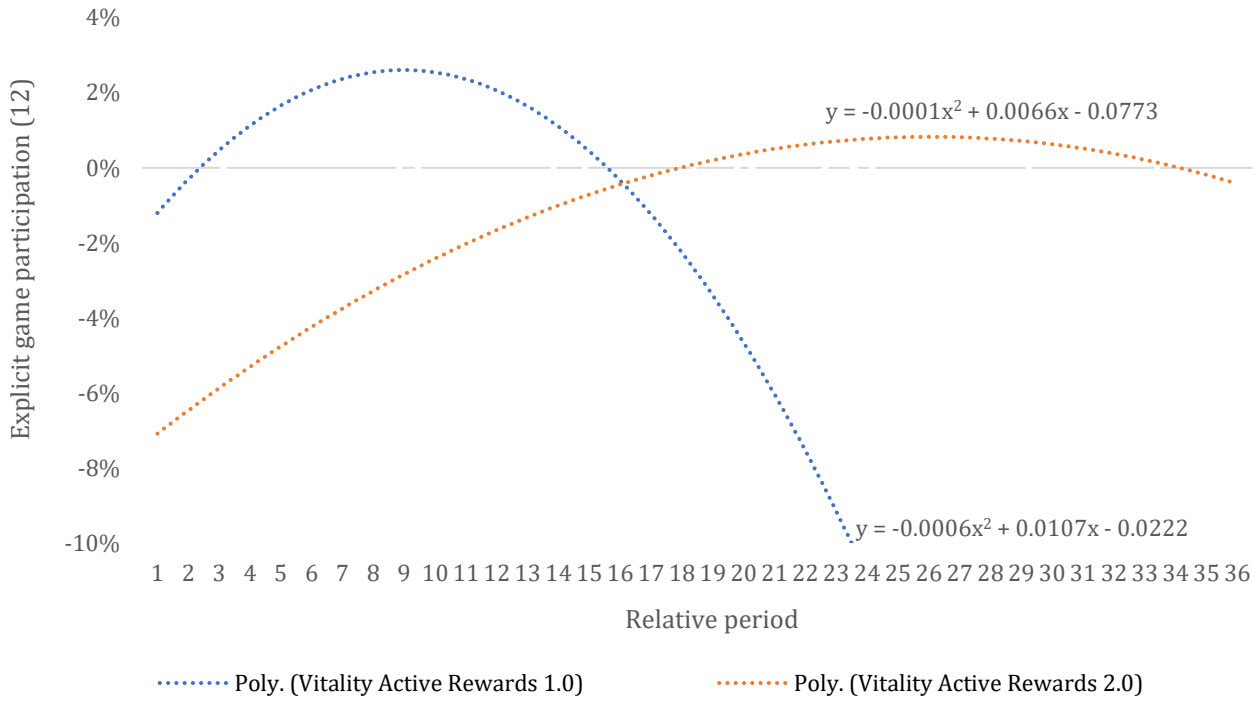
E. Implications for future research

This case study considered a natural experiment focusing on changes made by Discovery Vitality to the Vitality Active Rewards programme, in the South African market. The case study followed those members who joined Discovery Vitality in the months shortly before the Vitality Active Rewards programme went live and only considered those activating Vitality Active Rewards in 2015 as the "exposed" population. Based on these restrictions, the sample consisted of 1 770 exposed members. Future research may choose to expand on this case study by considering other population groups, or by considering the Vitality Active Rewards programme in the UK or US markets.

The researcher selected the Vitality Active Rewards gamification platform for the study due to the availability of extensive secondary data as well as the extended duration over which the programme has been in existence. Future research may consider extending the research to other case sites, either in the wellness industry or in another context.

The previous section suggested that there may be multiple factors that impact the longevity of a gamification platform, based on what was observed when investigating the decline of game-specific participation over time. The Vitality Active Rewards 1.0 time series exhibits decline earlier compared to the Vitality Active Rewards 2.0 time series, which can be seen when comparing the separate trend lines Figure 84 below. Future research needs to investigate other factors that may positively influence extended longevity of gamification platforms.

Figure 84 Difference in rate of decline for Vitality Active Rewards game iterations



The quantitative phase of the case study identified a parabolic trend in the game participation time series. Future research needs to understand how this may be refined and tested to optimise solving for *k* so that the timing of enhancements made within gamification platforms may be improved upon.

The researcher observed that the apparent success of the gamification platform may reasonably be attributed to the appropriate implementation of the underlying theory of motivation driving the behaviour change, namely goal setting theory (Locke & Latham, 1979, 2002, 2019). Future research needs to identify appropriate underlying theoretical frameworks and assess if they have been suitably implemented (Landers, 2019; Landers et al., 2018).

F. Implications for practice

Based on both extant literature (Cugelman, 2013; Deterding et al., 2011; Hamari et al., 2014; Tondello et al., 2018) and the observations in the case study, gamification may be used as a practical design strategy to positively impact desired behaviours. It needs to be noted that the effect is unlikely sustainable over prolonged periods (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015) which the researcher observed in the quantitative analysis. Therefore, organisations need to understand what their requirements are for the underlying platform. If the anticipated utilization of the gamification platform is limited to a brief duration, such as for short-term or singular activities like onboarding new employees, extensive efforts towards platform maintenance may be deemed unnecessary, other than ensuring the ongoing relevance of

underlying elements over time. In instances where the platform is anticipated to be utilized extensively by both existing participants and new entrants over prolonged periods, the organization must implement strategic measures to enhance the platform's longevity and maintain its long-term effectiveness, while simultaneously catering to new joiners and existing users alike.

The quantitative portion of the case study illustrated that implementing appropriate enhancements to the underlying gamification platform can increase platform engagement once more, ensuring the sustainability of the gamification platform in driving positive outcomes in the organisation's client base. However, this increase in engagement is not guaranteed and further research is needed to understand how to identify optimal platform enhancements that will lead to improved outcomes.

4.4. QUALITATIVE STUDY

The purpose of the qualitative portion of the study is to further explain the results from the quantitative analysis by providing a deeper insight into the "why" behind key observations. The following sections describe the qualitative phase in detail.

4.4.1. Qualitative research methodology

This section describes the research methodology for the qualitative study.

A. Qualitative research design

Introduced previously, the overall research design for Paper 4 is a mixed methods case study and the qualitative phase consists of in-depth interviews to gather detailed and contextually rich information about the case, Vitality Active Rewards. Qualitative research is well suited to situations where elements of the research cannot be quantified (Klopper, 2008) and may be explanatory, to provide additional insights into previously observed phenomena (Yin, 2003).

The previous section presented a quantitative study that provided insights into the measurable elements of Vitality Active Rewards (e.g., game participation) over time. Unlike Paper 2 where the psychological states (self-efficacy and motivation) were explicitly collected through surveys, this case study relies on historic observations and secondary data to provide insights into users' psychological states. In the case study it is not possible to quantify changes in members' underlying psychological states in response to the gamification platform or subsequent changes to the platform. However, it is possible to collect accounts regarding users' perceptions of the changes which would relate to their underlying psychological states.

The qualitative research consists of in-depth interviews with financial advisors to provide additional insights that were not possible through quantitative analysis alone. The researcher chose to conduct in-depth interviews with financial advisors as a data collection method due to the unique perspectives provided by this sample and the ability to gain depth into the nuances of the research propositions tested.

B. Qualitative sample and sampling method

The following section describes the sample interviewed during the qualitative study.

i. Sample description

The sampling frame consisted of financial advisors who are familiar with the underlying Discovery Vitality programme and, more specifically, the Vitality Active Rewards platform. The researcher chose financial advisors since they are more likely to be well versed in all the versions of the game platform compared to members, who may not be as familiar with all the iterations. Financial advisors typically also represent a large, varied base of members and they have an overall view of their clients' perceptions and experiences. This is especially true because they are frequently closely involved with assisting clients with service queries regarding benefit changes. Financial advisors provide a unique perspective that is more holistic compared to individual members, since each advisor represents their clients as well as themselves. In contrast, interviews with individual members would only provide that single user's viewpoint.

In the South African context, financial advisors assume a multifaceted role beyond providing advice on financial services products. They not only offer guidance to clients but also actively address client queries. In the context of Vitality, they play a pivotal role in assisting clients in navigating the benefits to unlock value from the product. For instance, financial advisors often organize "wellness days," enabling clients to undergo health checks and engage in discussions with their advisors. Additionally, these advisors serve as a primary channel for communicating benefit updates to members. It is noteworthy that such a dynamic contrasts with practices in other international markets, where products are more commonly sold directly to consumers.

ii. Sampling method

As part of the sampling process, nine franchise directors (i.e., the individuals responsible for training the financial advisors and disseminating information regarding product changes) were approached and requested to make introductions to financial advisors with sufficient Vitality and Vitality Active Rewards experience. These financial advisors were then invited to participate in in-depth interviews to get their views on the Active Rewards game, how it has changed over the years and how these changes impacted their client-base, both in terms of servicing and engagement.

iii. Sample

14 financial advisors consented to participate in these interviews. The financial advisors have experience ranging from 6 to 33 years of industry experience. All advisors sell the full range of Discovery products, including Vitality and all are directly involved in providing support regarding Vitality engagement. All have reasonable sized client bases. All advisors are on Discovery Vitality and on Diamond status, in other words, they have experience with the product from both a professional and personal perspective.

A breakdown of the respondents is provided in Table 35 below.

While age and gender are included, it is not deemed relevant in this study since the focus of the interviews was on client feedback and sentiment rather than that of the advisors themselves. There were little discernible differences between female and male advisors and age also didn't impact the feedback, therefore, it was not necessary to find a representative sample across age and gender.

Table 35 Summary of financial advisors interviewed

	Age	Gender	Size of client base	Main client base[24]	Products sold[25]	Years of experience
IDI 1	45 – 60	Male	1000+	Even combination	All	30+
IDI 2	45 – 60	Male	1000+	Even combination	All	15 – 30
IDI 3	45 – 60	Male	250 – 500	Individual	All	15 – 30
IDI 4	30 – 45	Male	1000+	Group	Health	15 – 30
IDI 5	30 – 45	Male	500 – 1000	Group	All	< 15
IDI 6	45 – 60	Male	250 – 500	Group	Life	30+
IDI 7	60+	Male	1000+	Individual	Life	30+
IDI 8	30 – 45	Male	1000+	Individual	Life	15 – 30
IDI 9	30 – 45	Female	1000+	Individual	Life	< 15
IDI 10	45 – 60	Female	250 – 500	Individual	All	30+
IDI 11	30 – 45	Male	500 – 1000	Individual	Invest	< 15
IDI 12	60+	Male	500 – 1000	Individual	All	30+
IDI 13	30 – 45	Male	500 – 1000	Individual	All	15 – 30
IDI 14	60+	Male	1000+	Individual	All	15 – 30

Note: Where "IDI" refers to in-depth interview

C. Research measures

The primary research measure in the qualitative study is individual interviews conducted with the financial advisors. The following research measures were collected.

[24] "Group" clients refer to those who join a medical aid through their company, compared to "Individual" which refers to those joining directly in their personal capacity.

[25] The Vitality product may be purchased in combination with Discovery Health, Discovery Life or Discovery Invest. Financial advisors may sell all products or specialise in a specific subset. All financial advisors interviewed sell the Vitality product.

i. Video recordings

Due to the time commitments of the financial advisors the interviews were conducted remotely via MS Teams. Each interview was recorded using the inherent functionality presented by MS Teams.

ii. Written transcript

The researcher used the transcription functionality provided by MS Teams and transcribed each interview. Following each interview, the researcher ensured that transcriptions were accurate and corrected any missing or incorrect details.

iii. Field notes

Following each interview, the researcher added additional field notes to the transcriptions to record non-verbal details (e.g., long pauses before answering questions, body language such as shrugs, notable facial expressions, etc.) and to record insights gathered from the interview. The researcher also added explanatory notes to provide additional context to key comments. As an example, several interview participants mentioned constructs such as Vitality status or Miles D-Day. To enhance clarity for future review, the researcher appended supplementary notes to elucidate these constructs and ensure readability.

iv. Comparative summary

Each interview was summarised in tabular format with column headings relating to individual respondents and rows relating to specific interview questions or underlying themes. The comparative summary document served as the final dataset upon which the researcher conducted the thematic analysis.

D. Qualitative data analysis and interpretation

The following sections describe the interview process and subsequent analysis in detail.

i. Data collection

The primary data source for this portion of the case study is in depth interviews with financial advisors. Each interview followed a semi-structured interview protocol with additional questions probing where follow-up questions were required. The researcher adjusted the interview protocol iteratively to include a broader range of questions following the initial interviews. 13 of the interviews were conducted virtually over Microsoft Teams and all the interviews were recorded (audio and video) using Microsoft Teams. Each interview resulted in a recording and a verbatim transcript.

Each interview was 30-45 minutes in length and the researcher covered three broad discussion points: (1) initial impressions of the Vitality Active Rewards game when it launched in 2015, (2) perceptions of how the game platform changed over time, and (3) perceptions of the timing and frequency of game changes. Each discussion point had up to 5 open-ended questions with the opportunity to expand on discussion points as needed. The researcher included a fourth discussion point explicitly after observing the theme emerge

organically in the initial interviews, namely (4) communication of changes. The final discussion guide is included in Appendix J. Each interview resulted in a verbatim transcript of roughly 8 to 10 pages.

ii. Thematic analysis

The researcher summarised each interview into an excel spreadsheet to create a comparative summary document. The columns represented each individual respondent and the rows represented questions, key insights, or recurring categories. For example, even though there was no explicit question relating to the goal setting construct within Vitality Active Rewards, a reasonable number of respondents referenced and provided insights regarding goal setting within this context that the researcher deemed it appropriate to include a separate row to record these insights.

The researcher used a reflexive approach to conduct a thematic analysis, or coding, to group the responses into common themes (Braun & Clarke, 2021; Campbell et al., 2021; Lochmiller, 2021) and did so manually using the comparative summary document. The researcher followed the six recursive phases of qualitative research (Braun & Clarke, 2021): (1) familiarisation with the content, (2) coding of the interviews, (3) generating the initial themes, (4) reviewing the themes, (5) refining, defining, and naming the themes, (6) writing up (presented in the results and discussion sections of Paper 4).

The researcher used reflexive thematic analysis since this is a widely cited method frequently used for qualitative data (Braun & Clarke, 2021; Campbell et al., 2021; Lochmiller, 2021). Most notably, the reflexive approach relies on a researcher's skills and familiarity with the underlying content and the researcher's subjectivity is an integral part of the research process rather than a hindrance (Braun & Clarke, 2021; Campbell et al., 2021). The researcher deemed this approach appropriate because it allowed the researcher to refer to observations in the quantitative research to generate and refine themes.

iii. Tests of credibility

The researcher shared the discussion guide and resulting comparative summary document with three external qualitative researchers. Two of the researchers are specialists in user experience design and research and the third researcher is the head of qualitative research in a global market research house.

Each external party reviewed the summary document with the relevant field notes in the context of the discussion guide and the research propositions. The external researchers were in agreement that the research methodology was reasonable. Furthermore, the external researchers identified similar key themes and corroborated the underlying conclusions.

4.4.2. Trustworthiness and rigor of the qualitative study

The following sections discuss the trustworthiness, transferability, credibility, and rigor of the qualitative study, described as dependability, credibility, transferability, and confirmability in a qualitative research context (Nowell et al., 2017).

A. Dependability

Dependability in qualitative research is akin to reliability in quantitative research and addresses the consistency of the process and findings over time (Korstjens & Moser, 2018).

The researcher provided a clearly documented research methodology and applied the process consistently to each of the interviews (Nowell et al., 2017). The researcher used the same process to become familiar with the data and to summarise the data for each interview. The researcher recorded each interview, and it is possible to review the video and raw transcripts alongside the summary views and thematic analysis results.

B. Credibility

Credibility in qualitative research is comparable to internal validity in quantitative research (Korstjens & Moser, 2018). In this case, credibility refers to the accuracy and believability of results. Nowell et al. (2017) describes that credibility "addresses the "fit" between respondents' views and the researcher's representation of them" (p.3).

For the qualitative portion of the study, each of the financial advisors interviewed has a large book of Discovery members with a range of integration and engagement. Furthermore, each advisor exhibited a deep understanding of the Vitality Active Rewards platform, the enhancements introduced over time, as well as the broader product.

There was consistency in feedback across the interviews, indicating that the views were representative of the broader base rather than only showing an individual perspective or bias. The researcher deemed that the consistency of responses illustrated credibility and highlights that these responses represent a broader version of the truth that aligns with general member sentiment.

The researcher invited three external qualitative researchers to review the results of the thematic analysis relative to the raw data to eliminate potential researcher bias and to contribute to the credibility of the findings.

C. Transferability

Transferability in qualitative research is equivalent to external validity in quantitative research. In a qualitative context, transferability is concerned with the extent to which findings can be applied to other contexts or populations. In other words, transferability is an indication of how generalisable the study is (Nowell et al., 2017).

While the case focuses on Discovery Vitality, and specifically on Vitality Active Rewards, the concepts underpinning Discovery Vitality apply more broadly than South Africa and the underlying Vitality concepts are successfully implemented in 40 markets (including Australia, Germany, China, and Japan). It is reasonable to expect that research findings from the South African business may very likely be generalised to these international markets (Vitality Group, 2023). Furthermore, Vitality Active Rewards has been implemented successfully in other markets, indicating that the findings may likely be more broadly applicable than only the South African context.

The qualitative study focuses on a single case site, namely the Vitality Active Rewards product within the broader Discovery Vitality programme. The case is focused on physical activity behaviour within a gamification platform within the South African wellness context. It is very likely that other researchers will need to adjust the research approach to ensure that the research is appropriate for the underlying context. For example, international markets do not have such a strong financial advisor presence and research conducted in one of these markets would need to consider an alternative sample that is more appropriate to the underlying context of the study.

Extant literature has shown gamification to be a widely applicable design strategy (Deterding et al., 2011; Hamari et al., 2014) and findings relating to the long-term effect of gamification and changes made over time may very likely apply across multiple contexts. However, it is necessary that researchers consider the nature of changes implemented within the game and the specific game mechanics to assess if they need to adjust the research accordingly.

The researcher provides thick rich descriptions to provide other researchers with the insights needed so they can assess if the research is appropriate based on their context and to decide how the research needs to be adjusted (Korstjens & Moser, 2018; Nowell et al., 2017).

D. Confirmability

Confirmability assess the neutrality and impartiality of research findings (Korstjens & Moser, 2018).

The researcher applied a reflexive thematic approach which relies on the researcher's underlying knowledge, therefore, the researcher's underlying knowledge and potential subjectivity in this case is seen as strength rather than a weakness (Braun & Clarke, 2021). The interview results were considered alongside the results of the quantitative analysis presented and were used to enhance the understanding of these results, rather than being used in isolation.

Furthermore, described previously, the research underwent external review by qualitative reviewers with a different knowledge base, therefore increasing the likelihood that the findings are impartial and unbiased.

4.4.3. Limitations of the qualitative study

The case study, both the quantitative and qualitative phases, only considers a single case site, namely Vitality Active Rewards within the Discovery Vitality product. The researcher limited the sample to financial advisors in the qualitative study.

Consistent with what the researcher introduced in the quantitative phase, while Discovery Vitality is within the South African wellness industry, the Vitality product has been successfully implemented across multiple markets. It is not unreasonable to expect that some of the insights may be more broadly applicable, provided that other organisations or gamification designers adjust these methods appropriately to the specific context.

The researcher chose to focus on financial advisors since each advisor is representative of their broader client base and has a deeper understanding of the evolution of the programme compared to the average user.

Within the analysis of the interviews there is a risk of subjectivity bias due to the researcher's background and experience with the underlying content. However, in reflexive thematic analysis this subjectivity bias is a core component of the approach and adds value to the analysis (Braun & Clarke, 2021; Campbell et al., 2021). Furthermore, there is the limitation of participant bias with participants responding based on what they believe is the desired response. The consistency of responses as well as unprompted insights that align across participants reduces the likelihood of this bias.

Qualitative interviews may be more difficult to replicate, and findings may be dependent on the underlying context. The researcher attempted to balance this shortcoming by ensuring transparency and detailed reporting, including thorough researcher notes. The researcher submitted the research to third-party reviewers to assess the results of the thematic analysis to corroborate the study methodology and results. Furthermore, the results of the qualitative study may be enhanced by interpreting them alongside the quantitative analysis.

4.4.4. Ethical considerations of the qualitative study

In the preparation for conducting interviews, the financial advisors were provided with a comprehensive overview of the research objectives. Prior to their voluntary participation, the researcher openly communicated their role and affiliation with Discovery Vitality. Participants were not coerced into joining the research, and they were well-informed about the expectations before choosing to participate. Importantly, there were no adverse consequences for those who opted not to participate. Explicit consent was obtained from all participants, including their agreement to have the interviews recorded. Participants retained the freedom to withdraw from the research at any point without facing repercussions. Throughout the interviews, confidentiality was maintained, and financial advisors were not required to disclose any personal information about their clients, ensuring the privacy of both the advisors and their clients was consistently respected.

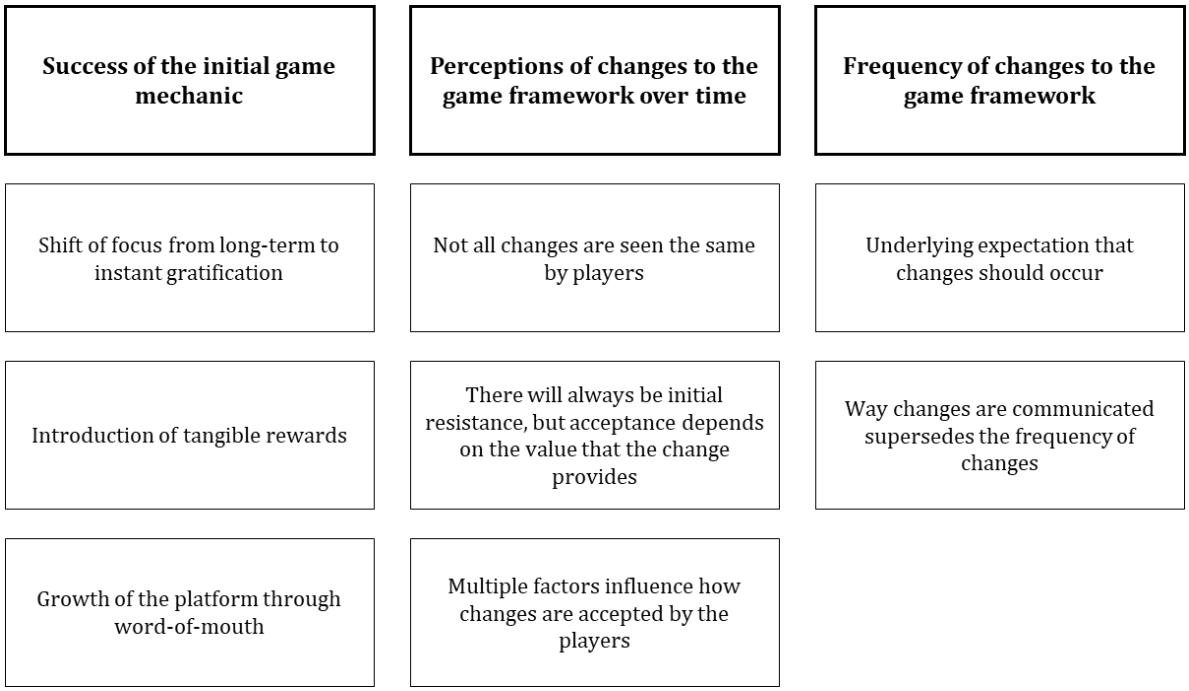
4.4.5. Qualitative results

The following sections report on the results from the in-depth interviews. In addition to the main themes that support the propositions tested, the researcher also identified themes that are noteworthy with respect to the overall model introduced in Paper 1 and expanded on throughout the study (see Figure 65 on p. 147). These additional themes are also presented in this section.

A. Main themes

The thematic analysis resulted in the themes summarised in Figure 85 below.

Figure 85 Main themes identified during the in-depth interviews



i. Success of the initial game mechanic

One of the key drivers in the Vitality programme is Vitality status, introduced in the introductory section of this thesis (see p. 14). A family, or policy, has a calendar year to accumulate Vitality points through engaging in health behaviours to reach Diamond status, or as close as possible. Prior to the launch of Vitality Active Rewards this objective of getting to Diamond was one of the primary engagement and reward mechanisms, since status is linked to a policy's Discovery Life paybacks and historically there were additional benefits associated with status (e.g., discounted flights).

When Discovery Vitality introduced Vitality Active Rewards in September 2015 the game introduced a new dynamic not experienced before where members could earn physical rewards in weekly increments. Vitality Active Rewards introduced instant gratification and an immediate feedback loop regarding progress based on weekly physical activity engagement. Even though the underlying behaviour (physical activity) still contributed to the member's status, the game mechanic introduced an additional time layer creating a sense of urgency frequently associated with successful goal setting.

> *"Even us as brokers didn't market it quite as well as we should have because we were more involved in trying to get the guy to Diamond status to try and see that he gets the reduced fees and all those factors in the policies rather than the actual little coffee reward. But when we realized how important it started becoming to some clients that they literally would go to gym, just to get their Kauai coffee".*
>
> IDI 12, 500 – 1000 clients, 30+ years' experience

The financial advisors found that Vitality Active Rewards was a successful tool at getting their clients to engage in physical activity, where previously it was more challenging for some clients.

> *"I saw that their Vitality levels were increasing since then. It was easier to get them involved and increase the levels than in the old days. Getting them from Blue to Bronze to Gold sort of thing."*
>
> IDI 14, 1000+ clients, 15 – 30 years' experience

Consistent feedback across all the financial advisors was that the initial success of the game was largely driven by the introduction of that immediate, tangible reward in the form of a coffee or a smoothie. Prior to the game Vitality rewards tended to be monetary paying out over longer periods (e.g., discounted gym premiums, cash back on healthy food items purchased at the end of the month, Life insurance premium paybacks based on Vitality status).

> *"[The coffee was] a tangible reward rather than a numbers reward that that could get lost in the process".*
>
> IDI 12, 500 – 1000 clients, 30+ years' experience

Even if the coffee or smoothie was not necessarily the most appealing reward, because it was perceived as free (the true cost of the coffee was the exercised performed to earn the coffee), it was perceived as more valuable than if the reward was simply discounted. The success of the free coffee as an initial reward can be ascribed to the zero-price effect from behavioural economics where individuals assign a higher value to something that is "free", thereby further increasing the demand for the reward (Ariely et al., 2018; Murata, 2017).

Many of the financial advisors mentioned that the initial growth of Active Rewards could be attributed to the word-of-mouth nature of people discussing their rewards in line at the coffee shop and the relative simplicity of the initial structure. The Vitality Active Rewards game platform introduced a social aspect to the programme that was not previously as strong in the broader Vitality programme.

> *"And then I think by word of mouth, you know, somebody says, 'Oh, I got my free smoothie or coffee or whatever.' 'What? How did you do that?' 'You know. It's easy.' And then, so I think that sort of community got people."*
>
> IDI 1, 1000+ clients, 30+ years' experience

ii. Perceptions to changes to the game framework over time

To ensure that the game remains relevant and engaging, the Vitality Active Rewards platform has undergone changes as described previously (see Table 29, p. 150). Many advisors noted that the initial reward (a guaranteed coffee or smoothie) became mundane, providing insight that gamification platforms do need to be maintained to ensure that they remain appealing.

During the interviews financial advisors were asked to describe the change(s) that they feel were most fundamental to the Vitality Active Rewards programme in terms of client feedback

and perception. The purpose of this questioning approach was to understand how the different changes rank, when unprompted, in terms of importance and impact. Except for three advisors (who cited external benefits such as the Apple Watch benefit introduced in Paper 2), all immediately referenced the current version of the game and grouped the change to the gameboard version and the transition to Discovery Miles as predominate changes to the platform. Only when probed further were the changes discussed in more detail. From this approach to the questions, it became clear that not all changes are perceived the same and some changes have a greater impact than others.

Changes typically fall into two broad categories.

The first category are changes that require the player to fundamentally change *how* they do things. This includes structural changes that impact how the game works (for example, the shift from the initial game to the introduction of the gameboard), or platform changes that don't necessarily impact the game mechanics but relates to how players do things (for example, functionality shifting to the Discovery Bank app). These changes are met with the most resistance because they are more likely to require the member to relearn existing behaviours relating to the platform over and above the targeted behaviour change already required from the game itself (in the case of Vitality Active Rewards, increasing physical activity). In other words, these changes introduce a change in game participation over and above the change in action participation.

> *"I know that you've improved it, and it looks better and all of those good things. But from a functionality point of view, most of the people that engage in this program know quickly where to go and do things. When we change it a little bit sometimes it frustrates them."*
>
> IDI 8, 1000+ clients, 15 – 30 years' experience

This resistance may be ascribed to status quo bias, where there is a preference for the current state and a bias against any possible future state, even if the changes potentially mean a better platform or even greater rewards. This bias is closely related to loss aversion where the change is a perceived loss of something familiar, and we know from behavioural economics that losses are felt more strongly than potential gains of equal magnitude (Fernandez & Rodrik, 1991; Kahneman et al., 1991).

Any change that is perceived to introduce friction without demonstrating increased value will be poorly received. A key element for gamification designers to keep in mind is that the player needs to "win" for the game to remain engaging and motivational. If changes limit the ability of a player to see value (e.g., through "winning"), then it will likely negatively impact feelings of self-efficacy and competence which in turn reduce the effectiveness of the gamification structure in encouraging behaviour change and engagement. In the case of a gamification design platform "value" may be extrinsic (e.g., earning a reward upon achieving the game goal) or intrinsic (e.g., through increased enjoyment of the platform as a result of game features or an increased feeling of competence brought about through engaging in a

challenging activity). If there is a prolonged period where the player sees reduced or no value, then it is more likely that they will disengage from the game.

> *"People aren't stupid. They look at that and equate the actual reward, and I mean how many times a week, even if you won the 750 Miles on the board or you're winning the maximum 1000 wonderful 1000 Miles. That's R100. OK. So that's great now, but how often do you get that? You know what I'm trying to say? Guys can go for months and only get their 150 Miles or whatever, and that on its own doesn't really give you much. So, it's not enough to get the guys really motivated, and you know there are some people that you do business with, and they buy in, and you know they're not gymmers and they'll never go to gym and whatever else. So, you've lost them."*
>
> IDI 12, 500 – 1000 clients, 30+ years' experience

The second category are changes with no or minimal impact on how the player engages with the game. Examples include changes in the reward partners or the change in currency from Vitality Rewards Points to Discovery Miles. Also included in this category are the introduction of additional game elements such as sneak peeks[26]. Even though these are new game elements that need to be learned, there isn't a significant deviation from how the game fundamentally is accessed and played. Furthermore, a user may still earn rewards in the same way the did prior to the change without engaging with the new features.

This category of changes could be seen as additive and are typically faced with the least amount of resistance. Gamification designers need to ensure that these changes make sense and demonstrate a clear increase in value (especially if they require members to learn new mechanics), otherwise there is a risk that members don't notice the change at all or that the change is perceived as annoying. This category of changes is unlikely to have a fundamental impact on engagement (both positively and negatively).

> *"There's a lot of confusion around that [instant rewards] … [the client] didn't realize that you have to wait until the next week to actually flip the board and get something else … once I've explained it, it's fine."*
>
> IDI 5, 500 – 1000 clients, < 15 years' experience

In addition to the type and magnitude of a change, the financial advisors noted that a member's age and the level of experience with the game and the broader platform can have an impact how members respond to changes. Older members were thought to be more resistant to change, especially due to the app-based nature of the game; however, this was not seen as a limiting factor to engaging in the game and seeing value. Furthermore, members on higher Vitality statuses were found to become comfortable with changes more quickly due

[26] The ability to uncover a tile and decide if you want to keep that tile or choose a different (potentially higher value) tile.

to their experience with the platform but were likely to be more resistant to the changes until they see value, likely because they are more familiar with how the platform used to work.

> *"Legacy clients, battle more because I think they get used to a certain system and they plug it in, and they play … sometimes the older clients maybe battle or there's a bit of a longing for when things were slightly more simple."*
>
> IDI 11, 250 – 500 clients, < 15 years' experience

Changes to the game eventually become the norm, as is evidenced by most financial advisors referencing the most up to date version of the platform when asked about significant changes. This phenomenon is not unexpected both when we look at gamification in general where the novelty of gamification features is believed to be relatively short-lived (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015) and if we consider the mere-exposure effect, or familiarity effect, where repeated exposure leads to familiarity, increased learning and eventual acceptance (Bornstein & Craver-Lemley, 2017; Johnson & Russo, 1984).

It is evident that one of the potential hazards associated with altering gamification platforms lies in the imperative to ensure that a substantial majority of players perceive continued value in the game platform, thus maintaining their engagement rather than opting for complete disengagement. This risk is comparatively more acceptable than the repercussions of maintaining the status quo without implementing any changes.

iii. Frequency of changes to the game mechanic

The financial advisors had mixed opinions regarding how frequently the game should change from a personal perspective, but the consensus was that, in general, members are less accepting of change.

> *"For me, I need you to speed up the changes. But I'm not your clients. Some, most clients, they don't like change."*
>
> IDI 7, 1000+ clients, 30+ years' experience

> *"So, it doesn't matter how good the platform is, people are going to moan first because of the change."*
>
> IDI 11, 250 – 500 clients, < 15 years' experience

The financial advisors agreed that changes need to occur with a frequency that allows the members to familiarise themselves with the rules before introducing further platform changes. The sentiment was that the annual launch cycle has created a reasonable expectation amongst members that alleviates some of the negative perceptions associated with changes discussed in the previous section. Because members expect change, they are

more accepting than if the change occurred randomly. More frequent changes would very likely lead to a reduction in satisfaction and engagement as introduced in P_{18}[27].

> *"The speed that you changing it is probably fine because the clients need to get used to it. And if we keep on changing, changing, changing, it's going to probably frustrate a lot of people because they don't really get to enjoy it."*
>
> IDI 8, 1000+ clients, 15 – 30 years' experience

A sentiment that came through unprompted for many of the financial advisors was that there is more negative sentiment around a delayed change that's been announced than to the change itself. If there is an expectation of improvements to the platform, then these need to be met within a reasonable timeframe.

> *"The Discovery systems have to launch at the same pace as they're launching the products or they are launching updates because sometimes it's a bit of a lag with that and the clients get frustrated because we're saying 'Yes, there's a fantastic system now and you can get this, and you can get this'. But the system itself is not geared yet to do those kinds of things, which creates a bit of frustration."*
>
> IDI 9, 1000+ clients, < 15 years' experience

The consensus amongst financial advisors was that the way in which changes are communicated to members and the education elements associated with the changes have more of an impact than the actual timing around when changes occur. If changes are well explained and players see increased value shortly after the change, then even frequent or complicated changes may be more readily accepted. Currently, members are informed about changes through email communication, social media, interactions with their financial advisor and in some cases through tutorials directly on the Vitality Active Rewards platform. The feedback from advisors was that these channels are not always sufficient to ensure adequate familiarisation with the game changes, even those included in the platform as part of the game journey.

> *"A lot of people are trying and then it's hit or miss, and they don't understand why they got the three plays, and they don't understand why they got a sneak peek, but it just happened. And then the next week, it doesn't happen and it's like, 'but what did I do different?'"*
>
> IDI 11, 250 – 500 clients, < 15 years' experience

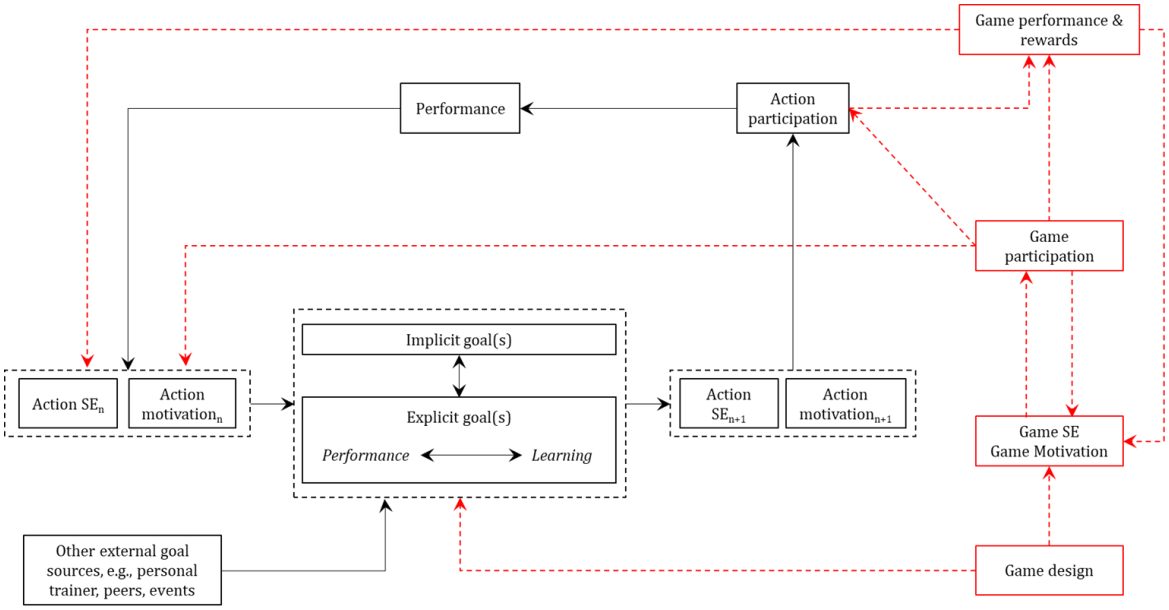
When there is not sufficient education (or re-education in the case of process changes) then it exacerbates the perception that the platform is complicated and that it is difficult to get value from the game. When players no longer see value then they are more likely to disengage.

[27] There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.

B. Secondary themes

In addition to the primary themes that provided insights to address the three propositions introduced in Paper 3, there were additional insights from the interviews that address the gamification design framework, shown again in Figure 86 below, and are noteworthy to include in the results of the qualitative study.

Figure 86 Positivist model for goal setting within a gamification design framework



These secondary themes are summarised in Figure 87 below.

Figure 87 Themes that support the gamification design framework

Internal factors impacting the game	External factors impacting the game
Goal setting is multi-dimensional	The game framework is in competition with day-to-day activities
Reduction in motivation or self-efficacy impacts game engagement and enjoyment	The broader organisational framework influences game engagement and enjoyment
	There are external factors that have a direct impact on game engagement and enjoyment – these become seen as part of the game

i. Internal factors impacting the game

Figure 86 above illustrates the proposed model for goal setting within a gamification design context that the researcher initially introduced in Paper 1. The model introduces that there may be both implicit and explicit goals at play and that they influence each other. This relationship was evident during the interviews, especially when advisors provided feedback from members regarding higher goal levels. Once members reach the maximum goal level there is little leniency for reducing engagement consistency. This interplay between the implicit and explicit goals may become at odds if the member exhibits a level of consistency relative to their own values, preferences and personal goals which might not satisfy the consistency required by the Vitality Active Rewards game. When this happens and the member feels that they are playing against the game then it has an adverse effect on motivation and self-efficacy. This reduction in motivation and self-efficacy in turn has a negative effect on future game engagement. Introduced previously, a prolonged period of failing to capitalize on potential value may lead to members disengaging from the platform.

> *"So, you need to have an active, vigorous exercise of 80+[28] to get your 300, and then if you go to the gym 6 times a week or do 10,000 steps, you're going to get your 900. But that means for us, for a person doing that, they are training 7 times a week."*
>
> *"So, it forces me to do more cardio, which I don't like doing."*
>
> IDI 12, 500 – 1000 clients, 30+ years' experience

When the game is perceived as prescriptive then it no longer promotes feelings of autonomy, which may reduce the individual's motivation to engage.

ii. External factors impacting the game

External to the gamification platform but impacting players' ability to engage and perceive the goal is the fact that the game needs to function alongside day-to-day activities. When game changes lead to the game engagement interfering with daily tasks (e.g., by introducing additional processes in an already established routine) these are likely to be perceived negatively. Similarly, when the game goal is in opposition with the player's broader responsibilities (e.g., when the points requirement is greater than the time commitment the player can give due to family and work responsibilities) then there is more likely to be negative sentiment. The player may reasonably be expected to experience a loss of autonomy driven by the non-collaborative nature of the game goal which further negatively influences ongoing motivation to engage.

> *"[The client will] say 'I can't afford to go to gym more than three times a week. I've got children I've got to drop early. I've got early meetings. I've got this. I've got that. I can't do it more than three times a week and don't tell me I must go*

[28] Reference to % of maximum heart rate (220 – age): members earn 300 points when completing a workout with an average hearth rate that is 80% or more of their maximum.

do parkruns[29] on weekends because my weekends the kids got this thing on and that on and I can't get to that.' So, they say they can get 400, 500, maybe 600 points, and if they don't make it then they start losing a little bit of that gym interest."

IDI 12, 500 – 1000 clients, 30+ years' experience

Furthermore, financial advisors noted that the gamification platform inherits many of the perceptions of the broader programme. This is true for positive elements (e.g., the strength of the Discovery Miles currency) as well as negative elements (e.g., the perceived complexity of broader programme). From an organisational context it is important for gamification designers to consider that this interplay goes both ways: positive or negative sentiment towards the game platform may result in similar sentiment on a broader level.

In the Vitality Active Rewards platform, there are external enablers (e.g., wearable devices) that enable the member to engage in the platform. These are not game elements, but they do impact the game. When anything causes these enablers to break down (e.g., delayed device syncing) even if the matters are resolved, it has a negative impact on the member's perception of the game. Even though these elements are not directly related to changes to the game platform these types of challenges are perceived in the same way as changes to the platform that influence how members engage, especially since these challenges potentially introduce additional perceived barriers for the member (e.g., logging into the app to check that their device synced after each workout). This observation aligns with previous research that showed that it is as necessary for the game platform to be cohesive and appealing as the actual gamification elements (Sailer et al., 2017).

"The time that you'll be using this is probably before a gym visit or after a gym visit. You're trying to relax. You're trying to go and exercise. You don't want changes, so now you just do a workout, and you log in and now you're like, 'OK, where do I find it? Where do I refresh?' This is frustrating ... They just leave this thing out and then we lose that client."

IDI 8, 1000+ clients, 15 – 30 years' experience

4.4.6. Discussion of the qualitative study

This section provides a detailed discussion of the qualitative results relative to the initial propositions tested. Table 36 below provides an indication of whether the qualitative results found support for the propositions tested.

[29] parkrun is a free weekly 5km event where members can earn 300 points.

Table 36 Summary of results for the qualitative portion of the case study

Proposition	Detailed description	Results
1a	Gamification has an initial positive and substantive impact on the targeted behaviour.	Supported
1b	The magnitude of the positive impact on behaviour reduces over time, but the overall effect remains positive.	Not tested directly*
2	Introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods.	Not tested directly*
3	There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.	Supported

Note: * The qualitative study focused more on the perception of the changes, since this could not be tested explicitly in the quantitative study using historic secondary data.

A. Initial effects of gamification

Based on extant literature, there is the expectation that the initial introduction of gamification would be positively perceived due to the improved motivational elements (Cugelman, 2013; Deterding et al., 2011; Hamari et al., 2014) as well as due to the novelty of the game (Cardador et al., 2017).

Following from the literature review, P_{1a} suggests that gamification has an initial positive impact on the targeted measure (in this case, physical activity engagement). The qualitative research highlights that the initial perception of the Vitality Active Rewards game was overwhelmingly positive. In addition to the positive perception, financial advisors also agreed that engagement in Vitality Active Rewards had a positive impact on the underlying Vitality status construct, which is an indirect response to an increase in the targeted behaviour, namely physical activity.

Financial advisors cited three primary drivers behind the success of Vitality Active Rewards.

The first driver was the shift from a long-term status focus to a short-term "game" focus. Goal setting theory emphasises the value to breaking up long-term (distal) goals into more relevant, short-term (proximal) goals (Donovan & Williams, 2003; Latham, 2016; Locke & Latham, 2002, 2006, 2019). Prior to the introduction of Vitality Active Rewards in September 2015 goal setting in the Discovery Vitality context was an implied, long-term goal: the member could set themselves a target to get to the desired status by December of each year. This goal could be influenced by multiple factors, including their level of product integration. For example, members with a Discovery Life product have a direct financial impact based on the status attained each year, since status determines the premium rebate that they are eligible for. The limitation with long-term goals is that they may lose potency as the time to goal achievement is prolonged. When Discovery Vitality introduced Vitality Active Rewards, members were given an explicit goal (in the form of a points target) that was only valid for a

week at a time. The short-term nature of the goal means that focused effort needs to be expended to attain the goal and if the goal was missed, then the member has a new opportunity to attain the goal the following week. The weekly engagement means that members are earning Vitality physical activity points towards their overarching Vitality status, therefore, engagement in the short-term goal ensures more likely success in the long-term goal.

The second driver was the introduction of tangible rewards in a paradigm that previously focused on financial rewards (which by their nature is less tangible). The near-immediate tangible reward directly associated with the goal introduced an immediate feedback loop or indication of progress, which is a key moderator in goal setting theory to ensure future success.

The third driver was the incidental creation of a social or community element as a result of the introduction of the game platform. The initial growth of the platform is largely attributed to how many individuals spoke about the rewards and the platform in general, thereby creating talkability and excitement amongst members. This community element of the platform increased the sense of relatedness for members, further increasing the motivation to participate.

B. The same game, repeated for a prolonged period

P_{1b} introduced that the magnitude of the positive behaviour declines over time. This proposition is supported by extant literature, which questions the sustainability of gamification interventions over time (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015).The qualitative research did not explicitly investigate the declining nature of the game over time. However, a considerable number of financial advisors spontaneously remarked on the diminishing appeal of the rewards and the initial game mechanic over time. The prevailing sentiment indicated that the incorporation of the gameboard mechanic in 2018 markedly enhanced the overall experience. Furthermore, financial advisors described change as a necessity in the game.

C. Changing or enhancing game elements

P_9 and P_{18} introduced that change within a gamification platform may have positive effects on behaviour, however, any changes need to occur within a reasonable timeframe to afford users ample opportunity to acclimate themselves with the changed features of the game.

Where the quantitative portion of the game highlighted the effects of changes to the underlying gamification platform by investigating the actual trend compared to the forecasted trend of game-specific participation, the qualitative phase provides insight into how the changes were perceived over time and which factors may influence acceptance of the changes. The financial advisors alluded that the changes to the game ensured that the platform remained relevant, thereby ensuring ongoing engagement. This ongoing engagement because of changes to the underlying gamification platform provides some

support for P_9, stating that introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods.

The qualitative phase of the research considers change under two categories: (1) perception of the changes over time to provide insight into P_9[30], and (2) frequency of change over time to provide insight into P_{18}[31].

i. Perception of changes

The researcher identified three main themes relating to the perception of changes to the gamification platform over time.

Distinction between categories of changes

The first theme was that not all changes to the platform are perceived equally and not all changes will necessarily lead to an increase in targeted outcomes. The researcher's initial expectation was that changes to the underlying game mechanics would have the greatest impact on how the game is perceived and would likely be perceived similarly. For example, it was assumed that the introduction of the gameboard (i.e., Vitality Active Rewards 2.0) and the incorporation of enhanced features tied to long-term goal achievement (i.e., Vitality Active Rewards 3.0) would both impact the underlying game and be perceived similarly, leading to comparable outcomes. The researcher did not have any expectations regarding changes that impact the aesthetics, or other elements of the gamification platform. During the thematic analysis the researcher identified two categories of game changes that the financial advisors distinguished between. Based on the financial advisors' feedback, these changes are not perceived the same by individuals and some changes have a greater impact than others.

The first category relates to change that directly impacts *how* a user engages with the platform. This includes changes to the game mechanics (such as the initial introduction of the gameboard in Vitality Active Rewards 2.0) as well as changes to the underlying platform (such as moving key functionality into the Bank app for Vitality Active Rewards 3.0). This category is typically met with the greatest amount of resistance, most like attributed to status quo bias which is strongly related to loss aversion (Fernandez & Rodrik, 1991; Kahneman et al., 1991). This category also, potentially, has the greatest impact on engagement.

These changes are likely to introduce initial friction into the system since the member needs to relearn elements that they may have understood well prior to the change. From a self-determination theory perspective (Ryan & Deci, 2000), this friction will likely have an impact on a player's feelings of autonomy since the change is not in their control as well as their feelings of competence since their understanding of the game is challenged by a new process. A reduction in autonomy and competence may lead to a decrease in the player's self-determined motivation to engage. From a goal setting theory perspective (Latham, 2016;

[30] A substantive change will have a positive curvilinear effect on game participation within *k* cycles.
[31] There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.

Locke & Latham, 1979, 2002, 2006, 2019) we can expect the reduced understanding of the game to lead to a decrease in the user's self-efficacy relating to the game, since they may not be comfortable with the new processes.

This initial decrease in self-efficacy and motivation following change aligns with the model discussed in Figure 61 (see p. 138). Provided that the individual can familiarise themselves with the changed processes and achieve their goal within a reasonable period, thereby seeing progress in the game once more, one can expect self-efficacy and motivation to increase once more. If the outcome of engaging with the game features under the new structure is greater than before the change (either through an increase in rewards or an increase in enjoyment due to the game) then users are more likely to perceive the changes favourably. For example, under Vitality Active Rewards 1.0 users earned a guaranteed free coffee reward. Under Vitality Active Rewards 2.0 individuals earned the ability to uncover greater rewards through the gameboard mechanic. Furthermore, the element of surprise when uncovering favourable tiles on the gameboard contributed to increased enjoyment of playing the game. However, if the individual persists in non-achievement of their goal then it is unlikely that the psychological states will improve (Donovan & Williams, 2003) and it becomes more likely that the individual will disengage from the gamification platform. Similarly, if the change results in an outcome similar to before the change, then it is unlikely that engagement will increase beyond levels prior to the change.

The second category of changes refers to changes that have minimal or no impact on how the player "plays the game". This includes changes such as the change of the game currency from Vitality Reward Points to Discovery Miles (described in Table 29, see Figure 69 on p. 151) or the introduction of sneak peeks[32] (one of the enhancements from Vitality Active Rewards 3.0). Even though these are elements that members need to familiarise themselves with, the primary game mechanic of closing the ring to achieve their goal remains unchanged and the average user may easily continue engaging without changing anything. These changes are typically perceived as additive and are faced with the least amount of resistance. Gamification designers need to ensure that these changes are communicated well, make intuitive sense, and demonstrate clear value, otherwise they may not even be noticed at all, but they are unlikely to influence engagement (both positively and negatively).

The researcher needs to note that many of the new features in Vitality Active Rewards 3.0 have the potential to introduce an element of implicit goal setting over and above the explicit game goal. For example, to achieve a sneak peek the user needs to double their game goal. These new mechanics will likely only drive behaviour change if an individual understands the new mechanic sufficiently, the implied goal (to double the game goal) aligns with their abilities and underlying values, and the individual values the resulting outcome sufficiently to change their behaviour accordingly. This acceptance of the implied goal very likely only impacts members that are at higher levels of engagement compared to the average client, which is highlighted by how few financial advisors spoke about the Vitality Active Rewards

[32] The ability to uncover a tile and decide if you want to keep that tile or choose a different (potentially higher value) tile.

3.0 enhancements unprompted. Therefore, even though these enhancements have the potential to change *how* the game is played (largely through implicit goal setting) since they don't impact the overall user base on average, these changes appear to be in the second category of game changes. It would be of interest for future researchers to assess the impact of changes within specific populations (for example, members with higher goals, or those on higher consecutive streaks) to understand if these categories still hold in "super users" compared to the average population. Such research would contribute to informing the types of changes that should be made in the case where gamification designers might want to target specific outcomes in particular user populations.

Willingness to accept change

The second theme relates to an individual's willingness to accept changes to the platform. In general, the consensus amongst financial advisors, was that members are more likely to accept change if they see value within a reasonable time. In addition to the need to see value, it is necessary to ensure that the value is sufficiently enhanced to justify introducing the change. This observation is particularly true for process changes, which fall into the first category of changes introduced previously, since these don't necessarily impact the game mechanics but nevertheless introduces perceived friction.

Due to the frequent reliance of gamification on rewards (e.g., through points or badges), value in a gamification context frequently refers to extrinsic value (e.g., Discovery Miles earned through achieving rewards in Vitality Active Rewards), however, value may also be intrinsic through increased enjoyment of the game or increases in competence, autonomy, or relatedness through certain game mechanics. Platforms that demonstrate intrinsic value are likely to be more sustainable than those relying purely on extrinsic value creation. If either extrinsic or intrinsic value is demonstrated through the change to the platform, then it is more likely that the change will be accepted.

Despite the initial resistance to change, largely due to status quo bias, users eventually come to perceive the "new" game simply as the "current" game. This eventual acceptance is ascribed to the mere-exposure effect (Bornstein & Craver-Lemley, 2017; Johnson & Russo, 1984). One can assume that this acceptance of changes relates to how soon an individual can regain their motivation and self-efficacy, due to once more successfully playing the game (i.e., "winning"). This phenomenon highlights the prevailing concerns in research that the positive effects of gamification are relatively short-lived (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015).

The financial advisors agreed that it is unlikely to create a platform that everyone will resonate with. It is therefore necessary for gamification designers to ensure that changes to the gamification platform still appeals to many players. In other words, *most* individuals still see sufficient value in the game platform to continue engaging rather than choosing to disengage entirely. Gamification designers need to be cognisant that changes may lead to drop off in some populations when they do not see sufficient perceived value – it is up to the gamification designer to understand what constitutes a "reasonable loss" and which populations are most essential to retain.

Factors influencing perception and acceptance of change

The third theme considers factors that influence how changes are perceived and accepted by individuals. These factors were most frequently described as the member's age and the member's familiarity with the underlying platform.

The sentiment was that older members may struggle to adjust more due to the app-based nature of Vitality Active Rewards. However, financial advisors were clear that the platform is still relevant to older populations despite the likelihood that this population is less "tech savvy". The implication is that this population may drive more servicing queries when changes are introduced, and appropriate education is necessary to ensure that members may familiarise themselves with the changes.

Financial advisors felt that individuals on higher Vitality statuses (indicating greater levels of engagement with the underlying products) are likely more resistant to change but because of their experience they are more likely to become familiar with the changes sooner. One may reasonably expect that individuals exhibiting greater engagement in the platform have developed key strategies to engage and some may even have internalised the behaviours sufficiently for motivation to be closer to intrinsic levels. Therefore, these individuals are less likely to be severely adversely affected by changes compared to those less engaged in the programme.

ii. Frequency of changes

Overall, all financial advisors shared the sentiment that that introducing changes too frequently could negatively impact engagement and long-term acceptance. This stance lends support to P_{18}, that there is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour. In other words, change that occurs sooner than what is deemed appropriate (based on the broader industry expectation or the user base in particular) has a negative impact on behaviour.

Beyond the general perception of frequency regarding changes, the researcher identified two additional themes, offering deeper insights.

Change is expected

When questioned about the frequency of changes to the underlying gamification platform, advisors agreed that change is expected. This expectation is largely attributed to the nature of the broader Discovery eco-system. In general, Discovery is seen as innovative company and the annual launch cycle across all product houses has introduced an underlying expectation that benefits such as Vitality Active Rewards will experience enhancements over time.

Since change is expected, a greater cause for dissatisfaction occurs when the product enhancements are delayed beyond a reasonable period. It is likely that members anchor on the changes and the delay is seen as a loss of potential value. In other words, the expectation of change introduces the expectation of increased value. When this change is not delivered in time then the member faces a perceived deficit due to the delay. From behavioural

economics, we know that a loss is perceived more strongly than a gain of equal magnitude (Fernandez & Rodrik, 1991; Kahneman et al., 1991).

The researcher notes that dissatisfaction due to a delay in when features are available would likely depend on how proactively advisors have communicated with their clients and how extensively the enhancements have been marketed by Discovery Vitality prior to the enhancements going live (for example, through emails or social media). The financial advisors interviewed are actively engaged with Vitality, assisting their clients in utilizing the platform. It may well be that this dissatisfaction is less pronounced in populations with less engaged financial advisors or those who joined Discovery Vitality through non-broker channels.

Furthermore, the researcher suggests that the expectation of change may also be related to the app-based nature of the gamification platform. It is necessary to understand if such an expectation would exist in a non-technological context. Since a large number of gamification platforms are app-based due to the prevalence of smartphones and the scalability of the platform (Cugelman, 2013; Research and Markets, 2024), it is necessary to keep this expectation in mind.

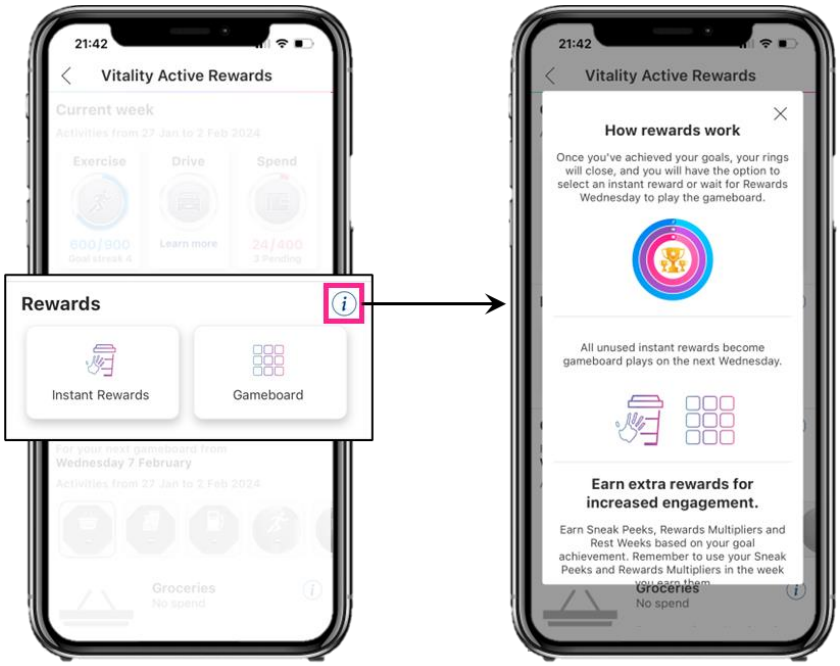
Communication is essential

The shared sentiment amongst financial advisors was that the way in which changes to the platform are communicated to members is potentially more important than the frequency or even magnitude of the changes. Poor sentiment brought about by changes to the platform may very likely be mitigated through appropriate education and communication.

If changes are not sufficiently communicated to members, then it is feasible that the change may extend the period before members start achieving their goals again. In other words, it may prolong the period in which reduced, or no value is seen. Previously observed, this perceived reduction in value may realistically lead to drop-off if this phase is too extensive. When changes are not well communicated, and members do not understand the updates made to the platform, then it may lead to further reduced self-efficacy and lowered feelings of competence. This negative impact on the psychological states has a negative outcome on the effectiveness of goal setting (Latham, 2016; Locke & Latham, 1979, 2002, 2006, 2019) and leads to a likely reduction in self-determined motivation (Ryan & Deci, 2000).

Educational elements may manifest in the aesthetics of the game, for example through additional tutorial screens and information buttons that reveal information to members regarding the changes, illustrated in Figure 88 below. However, these may not be sufficient for all members and a multi-channel approach is recommended, especially while the features are still unfamiliar to members.

Figure 88 Aesthetic elements to assist with education regarding new game features



There was agreement amongst financial advisors that the current communication strategy relying on member-facing emails and direct interaction with advisors is not sufficient, however, the financial advisors had differing opinions regarding the most appropriate channel to use when disseminating information regarding changes to members.

The researcher suggests that a more complete statement of P_{18} is that there is an inverse curvilinear relationship between the frequency of changing or enhancing game elements or the time needed for players to familiarise themselves with the enhancements and the impact on behaviour.

D. Internal and external factors influencing gamification design over time

While not directly related to the propositions tested in Paper 3, the researcher noted insights that are broadly valuable to both goal setting and gamification design and align with aspects of the proposed goal setting and gamification model introduced previously.

i. Internal factors

The model highlights that goal setting in a gamification context is likely multi-dimensional with the potential for implicit goal setting (either through game mechanics or due to personal factors) to occur in conjunction with the explicit game goals. This phenomenon was corroborated in the interviews, particularly the relationship between personal goals and the explicit game goal. Financial advisors noted that when personal goals are at odds with the game goal, then there is a risk that members will rather disengage from the game goal(s) and prioritise their personal goal(s). The game goal is not set collaboratively with members and this misalignment may be perceived as challenging an individual's autonomy relating to the goal. The reduction in autonomy may lead to a decline in motivation (Ryan & Deci, 2000).

One of the moderators in goal setting theory is goal commitment (Latham, 2016) and when the explicit game goal no longer aligns with the individual's underlying values (represented by the personal goal(s) they set themselves) then goal commitment may decrease and goal setting is unlikely to be as effective as when the implicit and explicit goals complement each other.

Furthermore, the model positions the gamification platform as cyclical in nature: self-efficacy and motivation impacts future self-efficacy and motivation. This is particularly true of a platform such as Vitality Active Rewards, where the goal is repeated weekly. When self-efficacy and motivation are impacted negatively over extended periods, there is a likelihood that the individual will disengage from the game goal going forward (Donovan & Williams, 2003).

ii. External factors

Apparent from the advisor interviews, there are external factors that influence the effectiveness of a gamification design platform, including the goal setting component(s) of the model.

Related to the previous section, an individual's day-to-day experiences and activities may conflict with the explicit game goals. When the game goal is perceived as in direct competition with an individual's lifestyle, the disparity challenges feelings of autonomy and task volition leading to a decline in motivation to engage with the goal (Latham, 2016; Ryan & Deci, 2000). In these scenarios there is a perception that one is playing "against" the platform.

In an organisational context, there is an apparent duality between the gamification platform and the broader product within which this resides. This phenomenon may be seen as a type of "brand stretching" since Discovery Vitality introduced the new gamification dynamic not previously associated with the brand prior to 2015. This duality implies that the gamification platform inherits many of the expectations associated with the broader programme (seen in the expectation for frequent innovation and changes previously). The broader implication is that any negative perceptions or experiences regarding Discovery Vitality may negatively impact the gamification platform. Furthermore, negative perceptions of the gamification platform may in turn negatively impact broader member satisfaction. This observation highlights the ability of gamification platforms to play a significant role in enhancing client sentiment and loyalty (Ciuchita et al., 2023).

Finally, financial advisors observed that external elements, though separate from the gamification platform, may impact engagement and enjoyment of the platform. Most generally advisors referred to the underlying requirement for members to have a type of wearable device or fitness tracker linked to the gamification platform to enhance the experience. When these devices do not perform as expected (for example, if there are challenges with syncing workouts, or if the device broke) there is a negative impact on game enjoyment and motivation to engage. Notably, when a goal is missed due to external factors

it has a more negative effect on motivation than if the missed goal is due to member error (Donovan & Williams, 2003).

E. Implications for future research

The qualitative phase of the study focused on financial advisors in Vitality's South African business. The researcher chose to focus on financial advisors due to the depth of insight that they may provide given both their experience with the Discovery Vitality programme as well as the range of clients that each advisor represents. Future research may consider a broader combination of interview participants, including members across a range of engagement levels. It would be necessary to conduct broader sampling in the member base, since one can likely expect more extreme differences in perception between clients who engage extensively (for example, those clients with goal streaks in excess of 100 consecutive goals) and clients who are new to the programme or who engage sporadically. Both populations would be valuable to investigate. Furthermore, conducting the research in the member base would require a more extensive selection process to ensure that clients interviewed have the necessary background of the game changes to provide meaningful insight. Future research would need to select the sampling frame appropriately to ensure that insights are meaningful, while maintaining a credible and unbiased selection. In this scenario, a mixed methods approach would again be informative.

The quantitative phase of the study discussed that future research may be performed in the other international markets where a version of Vitality Active Rewards is live. Similarly, future qualitative research may be conducted in the international versions of the gamification platform. Such research would need to consider what the most appropriate population is to interview, since not all the markets rely as strongly on financial advisors as South Africa. In this context, the research would need to ensure that any member interviews conducted considers an appropriate combination of members.

F. Implications for practice

From the qualitative research one may infer that change that has a marked effect on how an individual accesses and "plays" the game will be met with initial resistance. Resistance will likely be short-lived provided that the user sees sufficient value (either extrinsic or intrinsic) resulting from the change. It is essential that practitioners evaluate the impact of process or aesthetic changes as well changes to the game mechanics since these changes may also influence long-term engagement.

While it's unlikely that all members accessing the gamification platform will resonate with every feature, practitioners must be clear what the key objectives are when introducing changes. It's essential to understand and accept an acceptable drop-off in platform engagement and access.

In an organisational context, the duality observed between a gamification platform and the broader product introduces opportunities to strengthen broader brand loyalty and perception through a well-implemented gamification structure. Nevertheless, the reciprocity

of this association is noteworthy, since unfavourable perceptions of the gamification platform can detrimentally impact the overarching brand, especially when the gamification platform assumes the role of a keystone benefit.

4.5. OVERALL DISCUSSION

This section provides a detailed discussion of the combined quantitative and qualitative results relative to the initial propositions tested. Table 37 below provides a summary view of the overall results, considering both quantitative and qualitative phases of the study.

Table 37 Summary of overall case study results

Proposition	Detailed description	Quantitative Results	Qualitative Results
1a	Gamification has an initial positive and substantive impact on the targeted behaviour.	Supported	Supported
1b	The magnitude of the positive impact on behaviour reduces over time, but the overall effect remains positive.	Supported	Not tested directly*
2	Introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods.	Partially supported	Not tested directly*
3	There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.	Could not be tested	Supported

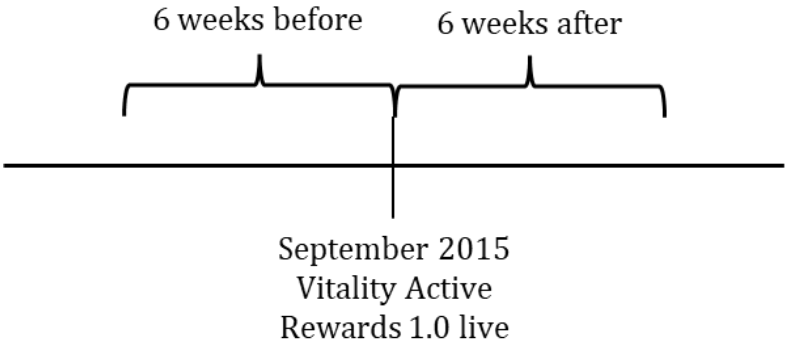
Note: * The qualitative study focused more on the perception of the changes, as this could not be tested explicitly in the quantitative study using historic secondary data.

4.5.1. Initial effects of gamification

Based on extant literature, the expectation is that gamification design has a positive effect on behaviour and is an effective tool at driving motivation and behaviour change (Cugelman, 2013; Deterding et al., 2011; Hamari et al., 2014; Landers, 2019; Landers et al., 2018). The expectation in the case study is to see a positive effect on the targeted behaviour (i.e., physical activity) following the introduction of the Vitality Active Rewards gamification platform in September 2015.

The quantitative portion of the mixed methods study deployed a difference-in-differences analysis approach, modelling the introduction of Vitality Active Rewards as an intervention implemented in a time series, illustrated again in Figure 89 below.

Figure 89 Illustration of timeline for D-I-D analysis



The population activating Vitality Active Rewards between September and December 2015 was defined as the "exposed" population and the population not activating Vitality Active Rewards was defined as the "unexposed" or control population. The analysis compared the average weekly Vitality fitness points earned between the populations.

The magnitude of the D-I-D coefficient is 70.27 and is significant ($p < .0001$) indicating that the introduction of Vitality Active Rewards had a positive effect on the exposed population and changed the targeted behaviour as expected. Based on the coefficients from the linear model, exposure to the game increased the average weekly fitness points earned by 80.94 points ($p < .0001$), compared to the unexposed population where the average weekly points increase by 10.68 points ($p = .12$).

The quantitative portion of the study provides support for $P_{1a,}$ which introduced that gamification has an initial positive impact on the targeted behaviour. However, the quantitative portion alone does not provide a deeper understanding for *why* the positive effect is observed. In the absence of further investigation one can most likely ascribe the positive effects due to the goal setting element of Vitality Active Rewards, since goal setting has been proven to provide individuals with an increase in focus and effort in behaviours relating to the goal (Latham, 2016; Locke & Latham, 1979, 2002, 2006, 2019). Furthermore, one may reasonably assume that the novelty of the gamification layer drove initial engagement (Cardador et al., 2017).

The qualitative portion of the study provides additional key insights into *why* the gamification platform was as popular and successful as what it was. Three principal catalysts are described when discussing the initial success of the Vitality Active Rewards platform. Firstly, the gamification platform introduced a fundamental shift in how physical activity is perceived and rewarded within the broader Discovery Vitality programme. Secondly, Vitality Active Rewards introduced immediate, tangible rewards through a guaranteed free coffee upon goal achievement. Lastly, the platform capitalized on a social, word-of-mouth mechanism as a driver for its rapid growth.

The first catalysts are related to the underlying goal setting component of the game and provide additional insight into which aspects of goal setting theory are effective in this context. The initial Discovery Vitality programme provided members with an implicit "do

your best" long-term goal of reaching Diamond status by the end of the year. The introduction of Vitality Active Rewards repositioned the implicit goal into an explicit, weekly (i.e., short-term), points-based target. Although Vitality Active Rewards focuses on the physical activity portion of the overall programme, engagement in this area will provide members with sufficient points that they will very likely see progress within their broader Vitality status. Many of the financial advisors spoke about the effectiveness of Vitality Active Rewards in driving Vitality status. This shift from long-term to short-term, explicit, goal setting is a well-established method for increasing task motivation (Donovan & Williams, 2003; Latham, 2016; Locke & Latham, 1979, 2002, 2006, 2019).

The introduction of an immediate, tangible reward introduced a clearer way of communicating progress to members, and progress is one of the key moderators in goal setting theory (Latham, 2016; Locke & Latham, 1979, 2002, 2006, 2019) as well as a key game mechanic in gamification design (Kim & Lee, 2015). The initial simplicity of the gamification platform and the perceived value of the tangible coffee-reward led to wide talkability that contributed to the initial growth of the platform. This talkability, or community aspect, led to an increase in relatedness further increasing motivation to engage.

During the interviews with financial advisors, it was clear that the initial success of the Vitality Active Rewards programme was not only due to the novelty of the platform but due to the introduction of a fundamentally different approach to members engaging with the programme. This observation highlights that gamification design needs to be more well thought out than simply layering game elements (most notably, points) to an existing platform (Landers, 2019; Landers et al., 2018). The Vitality Active Rewards platform is grounded in theory, further contributing to the expected successful outcomes that one would expect from implementing such a platform.

Overall, there is support for P_{1a}, that gamification has an initial positive and substantive impact on the targeted behaviour.

4.5.2. The same game, repeated for a prolonged period

There are concerns regarding the long-term applicability of gamification designs and many researchers observe that the initial positive effects of gamification may not be sustained over extended periods (Cardador et al., 2017; Hamari et al., 2014; Johnson et al., 2016; Lister et al., 2014; Raftopoulos, 2020; Seaborn & Fels, 2015). The expectation in the case study is that a decline in game engagement would be observed, but that the overall effects on the targeted behaviour, physical activity, would remain positive compared to the population not exposed to the game.

The researcher used an ARIMA model in the quantitative phase of the mixed methods study to evaluate game-specific participation during both Vitality Active Rewards 1.0 (the initial version of the game, September 2015 to August 2018) and Vitality Active Rewards 2.0 (the introduction of the gameboard mechanic, September 2018 to March 2023). The Vitality Active Rewards 1.0 engagement metric is defined as the proportion of rewards vouchers selected from those issued. The Vitality Active Rewards 2.0 engagement metric is defined as

the proportion of issued game plays that were played. In both Vitality Active Rewards 1.0 and Vitality Active Rewards 2.0 the researcher observed seasonality in the timeseries and the differenced the time series appropriately in the ARIMA model.

The observed trend for the differenced time series for both Vitality Active Rewards 1.0 and Vitality Active Rewards 2.0 exhibits a decline over time. In both iterations of the platform the trend observed is parabolic in nature: an initial increase, peaking at some point followed by a decline. The parabolic trendline provides some insight into optimising *k,* the period within which changes to the gamification platform may most likely be positively received.

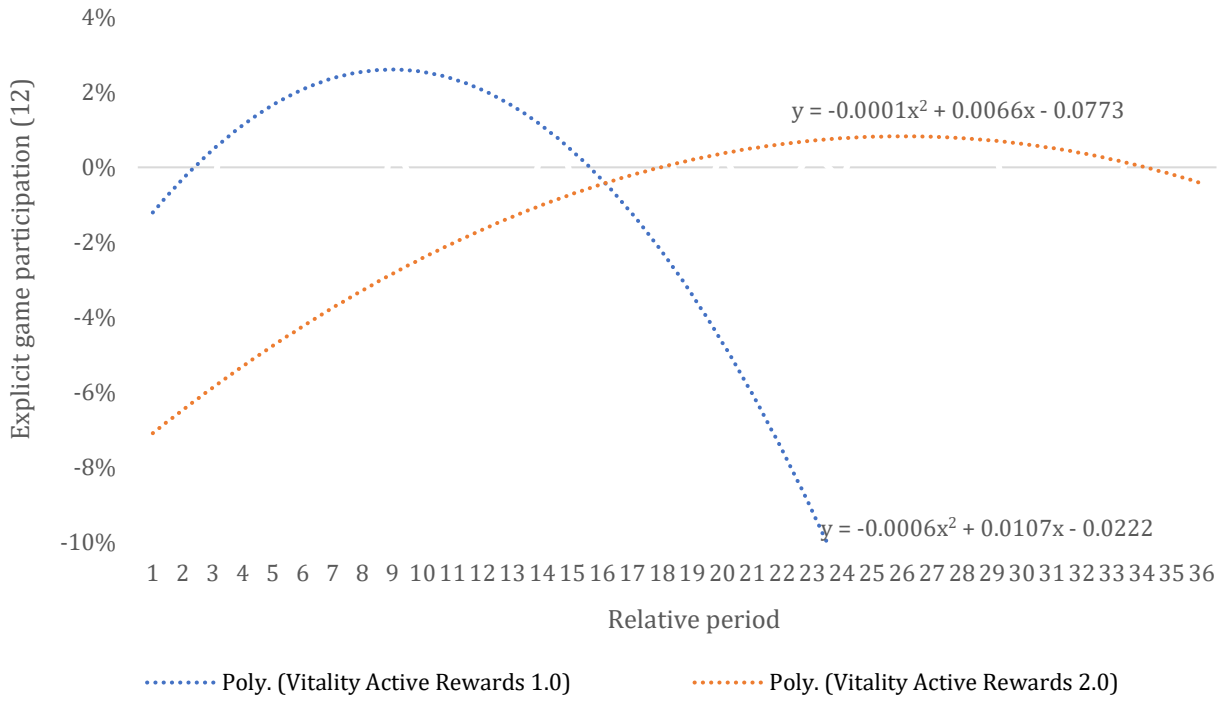
The cause for the decline over time may most likely be described by goal setting theory since goal setting is the primary game mechanic in Vitality Active Rewards. Goal setting theory states that for a goal to be effective it needs to be specific, challenging, and achievable (Locke & Latham, 1979, 2002, 2019). Upon initial examination, the Vitality Active Rewards goal adheres to these requirements: the goal is specific by its very nature (a fixed points target each week), since the goal increases based on previous engagement one may reasonably assume that the goal remains challenging, and since there is a wide range of points earning opportunities available to members one may assume that the goal is achievable. However, upon closer inspection, the challenging and achievable nature of the goal is not always guaranteed as the gamification platform progresses over time.

With repetition, an individual may be expected to become familiar with the game and to become more proficient each week. This increase in proficiency over time may lead to the perception that the goal is no longer as challenging as when it was initially introduced. This does not imply that gamification designers should increase the goal with no limitations, since there is a finite amount of activity that can be reasonably expected within a weekly period. Instead, a more appropriate observation is that within the gamification platform the goal is not as stimulating, and an introduction of new elements may be sufficient in introducing a new challenge that needs to be mastered. This is explored in more detail in the following section.

The qualitative study provides additional insights by introducing key observations that questions the assumption that the explicit game goal remains achievable. The qualitative study highlights that there are external factors that influence an individual's ability to play the game. An example of an external factor influencing the game is that of time. If an individual perceives that the goal is not achievable within the parameters of their daily activities then this leads to a reduction in feelings of competence and autonomy (Donovan & Williams, 2003; Ryan & Deci, 2000) which reduces motivation to engage with the goal. Furthermore, an individual may have implicit goals, either relating to their values or to elements of the game, that occur in parallel with the explicit game goal. If the implicit goals and game goals no longer align it may challenge an individual's belief that the game goal is attainable, and the individual is more likely to prioritise their personal goals where they have greater perceived autonomy and task volition (Ryan & Deci, 2000).

It is noteworthy that the rate of decline is different for Vitality Active Rewards 1.0 compared to Vitality Active Rewards 2.0, illustrated in Figure 90 below.

Figure 90 Rate of declining engagement in Vitality Active Rewards 1.0 and Vitality Active rewards 2.0



This observation highlights that there are potentially multiple drivers influencing decline in game participation over time. The qualitative study provides additional insights not necessarily possible from the quantitative study on its own. The qualitative study introduces the concept of value due to engagement with the gamification platform where value may be extrinsic (e.g., rewards) or intrinsic (e.g., the joy derived from engaging with the platform). It is reasonable to suggest that the value derived from the platform may be a primary factor in informing the rate of decline in a platform. There was broad agreement amongst financial advisors that the initial version of the game (Vitality Active Rewards 1.0) was becoming stale. The value derived from the platform reduced when the guaranteed free coffee reward became mundane, thereby reducing the initial pleasure derived from the reward. This decline in perceived value implies that the coffee reward did not maintain relevance sufficiently to encourage continued engagement at high levels initially observed. The complexity of the underlying game elements may be another factor influencing the longevity of a gamification platform: Vitality Active Rewards 1.0 introduced a one-dimensional game mechanic whereas Vitality Active Rewards 2.0 introduces more variability in the weekly rewards through the gameboard and enabled more opportunities to drive member experience through related benefits (for example the increased value of the game currency in the broader Discovery ecosystem).

Despite the decline in the game-specific engagement metric over time, the overall effect of the game on physical activity has remained positive. The population with Vitality Active

Rewards active earns more physical activity points each month compared to a comparable control population. This difference in physical activity is most notable in the period immediately after the introduction of Vitality Active Rewards and is stabilising over time.

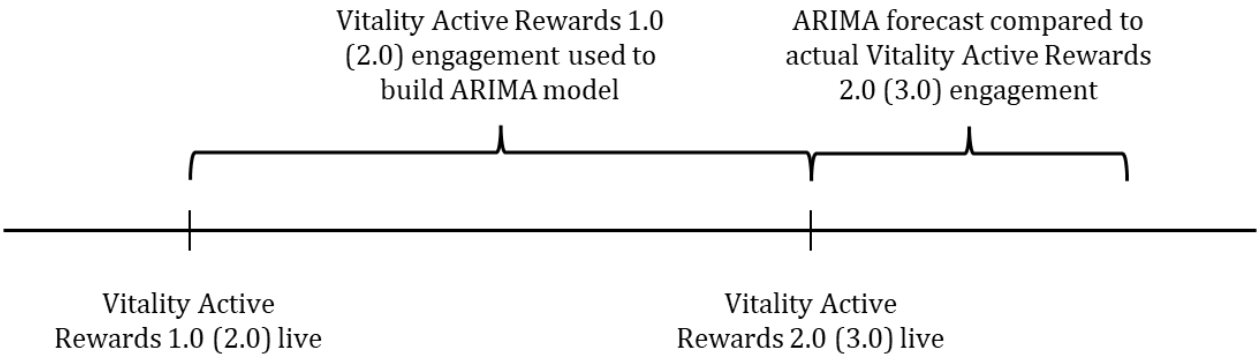
Overall P_{1b}, the magnitude of the positive impact on behaviour reduces over time, but the overall effect remains positive, is supported. However, more research may be required to uncover the underlying factors driving the decline.

4.5.3. Changing or enhancing game elements

The previous section discusses the likelihood that a gamification platform that is repeated over an extended period may exhibit a decline over time. Both the quantitative and qualitative phases of the study provide some support for this observation. Particularly within an organisational context, where it is essential that the features of a product remain relevant, it is necessary to understand what may be done to mitigate the inevitable decline over time. The researcher could not find evidence that changes to gamification platforms have been explicitly investigated, however, the researcher extended the observations from goal setting theory and self-determination theory to introduce P_9[33] and P_{18}[34], relating to changes occurring within a gamification platform.

The quantitative phase of the mixed methods study used the forecasting ability of the ARIMA models introduced previously to understand the effects of introducing changes to the platform over time. As before, the researcher considered the effects on Vitality Active Rewards 1.0 and Vitality Active Rewards 2.0. Figure 91 provide a visual explanation for the approach.

Figure 91 Investigating effect of introducing Vitality Active Rewards 2.0 (3.0)



The expectation is that both these changes should have a positive effect on engagement following the introduction of the change.

When investigating the effects of updating the game platform from Vitality Active Rewards 1.0 to Vitality Active Rewards 2.0 this expected positive effect is clearly observed, illustrated

[33] A substantive change will have a positive curvilinear effect on game participation within *k* cycles.
[34] There is an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour.

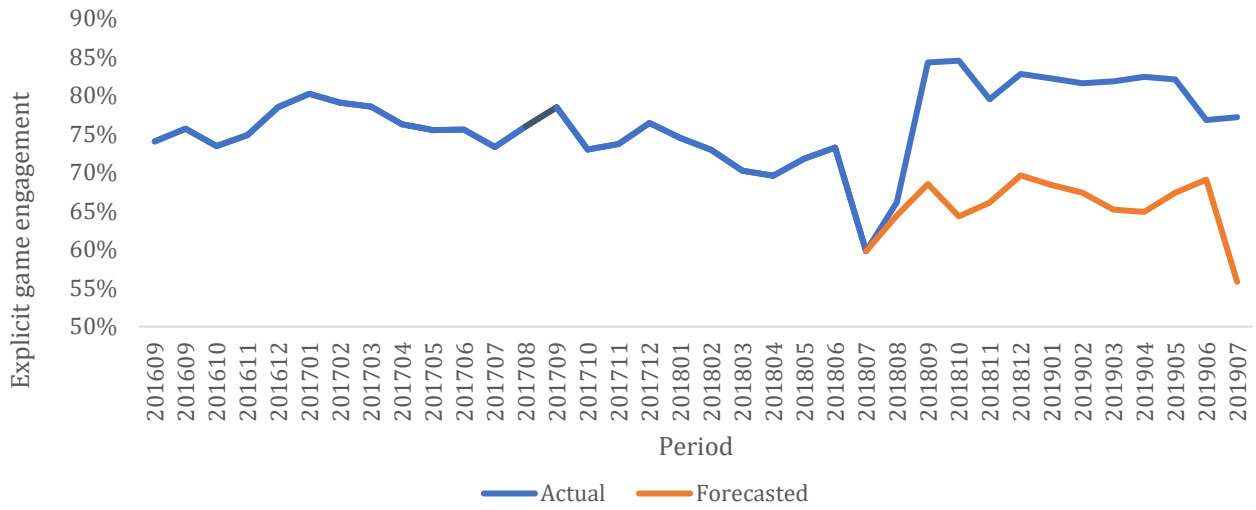
in Figure 92 below. However, updating the game platform from Vitality Active Rewards 2.0 to Vitality Active Rewards 3.0 did not show the expected positive effect, illustrated in Figure 93 below. In the absence of further information, one may reasonably assume that sufficient data for demonstrating the long-term effects of the introduced changes is not available. This iteration of the game may still be in a phase where individuals are acquiring proficiency in the new features.

The qualitative phase of the mixed methods research provides additional insights to explain the discrepancy in trends observed between the two iterations of the game platform.

The qualitative research highlights that changes may be broadly categorised as: (1) those that have a fundamental on impact how a player accesses and engages with the game, and (2) those that have minimal or no impact on how the player plays the game (but are necessary nonetheless). Within these categories changes may impact the game mechanics directly or they may be structural or process updates to the underlying platform. Changes that fall within the first category are likely to be met with the most resistance from members and may directly affect an individual's motivation to engage with the game. Provided that the change results in increased value (either extrinsic or intrinsic) within a reasonable period of time, these changes are eventually accepted. Changes that fall within the second category are less likely to have a fundamental impact on motivation or engagement, however, these changes are necessary to ensure relevance of the platform (for example, the introduction of more rewards partners will unlikely have a marked effect on deeper engagement, but it does ensure that the platform remains appealing and relevant).

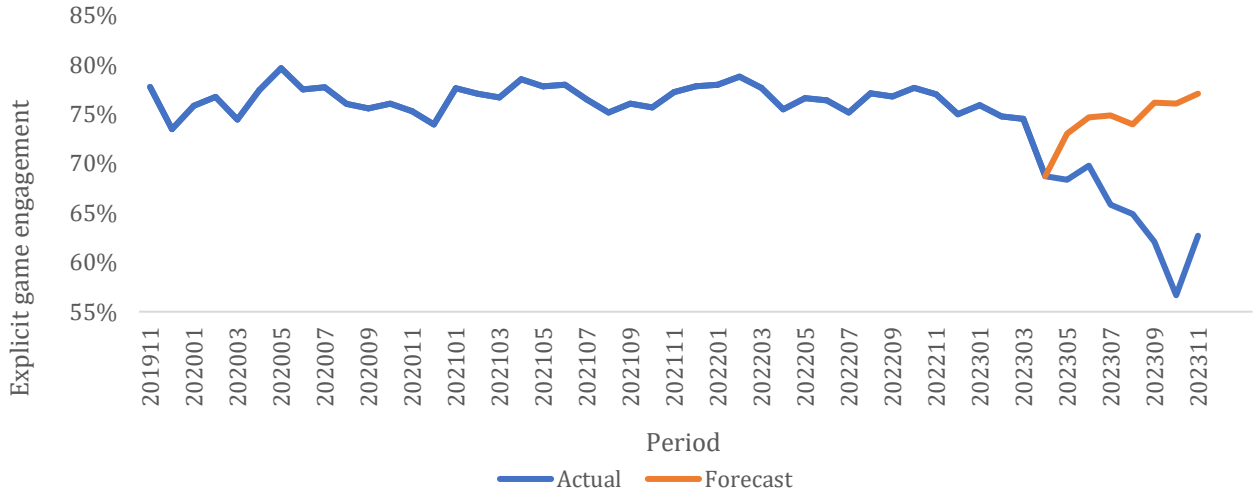
Vitality Active Rewards 1.0 introduced a very simple game mechanic: if an individual achieved their physical activity goal, they earned a guaranteed coffee or smoothie voucher. The second iteration of the platform, Vitality Active Rewards 2.0, introduced a fundamental shift in how members derive value from the platform by introducing the gameboard whereby members uncovered virtual currency that may be exchanged for larger rewards. The underlying goal mechanism remained unchanged between the two iterations; however, the organisation introduced more gamification features and increased the value that a member can get through the change. Vitality Active Rewards 2.0 introduced more relevant reward opportunities, introduced a new element (the gameboard) that needs to be "mastered", and provided opportunity for members to be "delighted" by uncovering different reward values on the gameboard each week. This change was sufficient to increase engagement with the game once more, apparent in Figure 92.

Figure 92 Actual experience vs ARIMA forecast for Sep 2016 to Jul 2019



Vitality Active Rewards 3.0 introduced multiple changes to the platform. According to financial advisors, the most noteworthy change was the transition of the Vitality Active Rewards game into the Discovery Bank app. Notably, members may still access and play the game in the corporate Discovery app, however in this scenario they would not access the enhanced reward elements introduced in Vitality Active Rewards 3.0. In other words, those choosing to remain in the corporate app would be on the Vitality Active Rewards 2.0 platform, which would be the "same game, repeated" scenario. The shift of Vitality Active Rewards 3.0 into the Discovery Bank app is considered a change that impacts *how* the member accesses the game, since members need to relearn how to access key elements. In isolation, this change to the game introduces perceived friction without an increase in directly observed value (measured through rewards), which provides valuable insight into the continued declined game engagement observed as opposed to the expected increase, seen in Figure 93 below.

Figure 93 Actual experience vs ARIMA forecast for Nov 2019 to Nov 2023



Although the platform change was perceived to be the greatest change according to financial advisors, Vitality Active Rewards 3.0 introduced more changes than only the platform change. The key changes introduced in Vitaliy Active Rewards 3.0 were: (1) the ability to choose an instant reward in lieu of playing the gameboard, (2) greater recognition of engagement through new game mechanics such goal streaks, miles multipliers and sneak peeks[35], and (3) the introduction of feature tiles on the gameboard directly linked to member engagement throughout the programme. For the overall changes introduced by Vitality Active Rewards 3.0 to have the same positive effect as the introduction of Vitality Active Rewards 2.0, it is necessary for these additional game features to outweigh the friction from the platform change through unequivocally increased value.

Despite these extensive changes in Vitality Active Rewards 3.0, few financial advisors noted them spontaneously. Upon further investigation these benefits didn't resonate widely with financial advisors since they were perceived to only be relevant to a small proportion of their client base. Although members may uncover more value through the gameboard due to these enhancements, the overall perception was that value largely remained unchanged. Therefore, the changes introduced additional friction (by moving the features to a new app, requiring members to re-learn key features), while introducing a lateral shift in rewards that didn't materialise in a notable improvement from Vitality Active Rewards 2.0. It may well be that the increased value will materialise over time as more clients familiarise themselves with the enhancements, however, it is necessary for practitioners to note the time needed for value to become apparent and ensure that it is reasonable.

The third scenario that Paper 3 introduced considered the situation where game changes are implemented overly frequently. The expectation is that changes that occur too frequently would have a negative effect on outcomes since the players would likely experience decreased feelings of autonomy and competence when they do not have a reasonable opportunity to familiarise themselves with the new game elements (Ryan & Deci, 2000), leading to reduced motivation and goal commitment over time (Donovan & Williams, 2003; Latham, 2016). Despite Vitality Active Rewards introducing frequent enhancements over time through improved rewards and extended reward partners, the platform has only undergone two significant changes since 2015 and these were sufficiently separate from each other that this scenario could not be tested through the quantitative portion of the study. The qualitative portion of the study touched on the scenario briefly and the financial advisors agreed that too frequent changes would be negatively received.

An unprompted observation made by advisors was that the communication and education strategy to introduce members to the new game features is potentially more important than the frequency of changes. Upon further consideration, communication of changes to members directly impacts their ability to become familiar with the new game elements, thereby enabling them to see increased value sooner. Changes introduced that have a marked effect on how members access and play the game may lead to an initial feeling of reduced

[35] The ability to uncover a tile and decide if you want to keep that tile or choose a different (potentially higher value) tile.

competence while the member is unfamiliar with the feature; which negatively affects the member's motivation to engage (Ryan & Deci, 2000). Adequate communication and education provide members with sufficient guidance to familiarise themselves with the new features and therefore increase feelings of competence once more. In the scenario where there is insufficient education available (or the available content is insufficiently clear) the period needed for the member to familiarise themselves with the new features is prolonged, thereby prolonging the period in which the member sees reduced or no value. If the period in which the member does not see progress is too extensive, it will likely have a negative effect on goal commitment and it is more likely that the member will disengage from the game entirely (Donovan & Williams, 2003).

The mixed methods study provides overall support for the propositions relating to changes within a gamification platform. In other words, there is evidence that introducing new game elements increases the magnitude of the positive effect on behaviour in subsequent time periods. However, there is also an inverse curvilinear relationship between the frequency of changing or enhancing game elements and the impact on behaviour. It is, however, clear that there are nuances within these observations and more than just frequency of change or time between change influences what effect a change will have on the underlying gamification platform. From this research it is apparent that more important than the time between changes is the time it takes the member to see enhanced value as a result of the change. Value may be limited to extrinsic reward value as in the case of Vitality Active Rewards or may manifest more intrinsically through increased feelings of competence, autonomy, and relatedness because of the change, or increased enjoyment derived from the platform's hedonic elements. Further research is needed to fully understand the mediators and moderators of change within a gamification platform further.

4.5.4. Implications for future research

Described previously, this study focuses on a single case site (Vitality Active Rewards within the broader Discovery Vitality product) and focused on the early adopters of the gamification platform for the quantitative analysis. It is possible for future research to consider alternative samples within the Vitality Active Rewards base. Furthermore, it is possible to extend the research to the other Vitality markets that have implemented Vitality Active Rewards (notably, US and UK).

This research explicitly investigated the potential decline in positive behaviour over time within a gamification context. Both the quantitative and qualitative phases of the research provide support for the proposition. Furthermore, the researcher observed evidence that this rate of decline is not consistent and may be moderated through other elements such as underlying goal mechanic complexity. It is necessary for future research to investigate these moderators more thoroughly.

The researcher proposed that introducing change in a gamification platform may have a positive effect on negating the decline in positive behaviour over time. The findings of the study highlights that while changes can have a positive effect, not all changes will guarantee

a positive outcome. Future research needs to better investigate the types of changes that may be made and how they will impact behaviour.

Furthermore, the researcher suggested that the time between changes impact the positive effects of the change. From the study, it is apparent that it is more likely the time it takes for the member to become familiar with the change than the time between changes itself that will have a positive or negative effect on outcomes. Provided that individuals can become proficient at the game quickly (either through improved education available in the game, or through less complicated changes) there may be higher tolerance for frequent changes. Future research needs to investigate what the other moderators of change are.

4.5.5. Implications for practice

In practice, gamification platforms need to be more than just layering game elements onto an existing structure (Landers, 2019; Landers et al., 2018). The platform needs to add significant value over and above what is already available in the platform. In this case, value may refer to explicit rewards or to something more nuanced and valued in a personal context (for example, providing the individual with a sense of joy or accomplishment after engaging with the game). Similarly, changes to the gamification platform need to be significantly different to have the desired positive effects. Most importantly, the gamification elements need to be based on appropriate theories of motivation and these need to be implemented appropriately to observe the desired outcomes (Landers, 2019; Landers et al., 2018; Landers et al., 2017).

4.6. CONCLUSION

The objective of the case study was to evaluate the long-term effect of gamification in a real-world context and to investigate the effect of changes in such a platform. The researcher chose the Vitality Active Rewards platform as the case site and implemented a mixed methods study design.

The quantitative portion of the analysis focused on the population that joined Vitality between January and August 2015 and considered the population activating Vitality Active Rewards between September and December 2015 as the exposed population. To ensure that the unexposed population was as similar as possible to the exposed population, the researcher identified a random sample with a matching age, gender and Vitality status profile. The final population consisted of 1 770 unexposed and 1 770 exposed individuals. To show the initial positive effect of gamification a difference-in-differences analysis was conducted, comparing the average weekly Vitality fitness points earned in the six weeks prior to the go-live of the game platform (i.e., the intervention) and the six weeks post the go-live of the game platform. The results showed a significant, positive effect on the exposed group compared to the unexposed group. To show the decline over time ARIMA models were fitted for the periods reflecting the Vitality Active Rewards 1.0 and Vitality Active Rewards 2.0 phases of the platform, applying the necessary differencing to account for seasonality. A declining trend over time was evident in both the Vitality Active Rewards 1.0 and Vitality Active Rewards 2.0 phases, however, the decline occurred later in Vitality Active Rewards 2.0

highlighting that there are likely multiple factors that impact the decline in performance over time. To show the positive impact of a change to the platform the forecasting ability of ARIMA models was used showing the forecasted trend for Vitality Active Rewards 1.0 if no change had been made compared to the actual impact of introducing the Vitality Active Rewards 2.0 features. The researcher observed a clear increase in game-specific engagement compared to the forecasted trend. The researcher did not observe this increase in game participation following the introduction of Vitality Active Rewards 3.0, however this lack of a positive result could be explained though the qualitative analysis. The quantitative analysis did not investigate the effect of too rapid changes, as the Vitality Active Rewards gamification platform aligns with the broader Vitality launch cycle, which has become accepted in the industry as well as amongst members.

The qualitative study provided additional depth to the narrative, highlighting the perceptions of members throughout the evolution of the Vitality Active Rewards platform. This phase of the analysis consisted of in-depth interviews with financial advisors who are well versed in the Vitality programme. The researcher selected this population since financial advisors represent a range of members and could provide insights across a broader base with a more detailed understanding compared to the average member. Investigating the positive impact of gamification, financial advisors agreed that there was a definite shift in the member base that participated in the game (as evidenced in the quantitative analysis) and that it was easier to get these members to engage in the broader programme because of the game. The consensus was that the initial success could be ascribed to the introduction of instant gratification in the form of tangible rewards and the word-of-mouth growth. When investigating the declining efficacy of the gamification layer, there was agreement that the initial coffee and smoothie rewards grew stale and that the introduction of the gameboard improved game experience by providing more valuable rewards (which could be observed in the declining game-specific engagement followed by an increase upon the introduction of the gameboard during the quantitative analysis).

General sentiment regarding changes to the platform could be investigated through the interviews, which would not be possible in a quantitative analysis. The qualitative analysis highlighted that all changes are not perceived equal and introduced a category of changes not initially considered: namely process changes to the underlying platform outside of the game mechanics and dynamics. The interviews highlighted that there will inevitably be resistance to change, but if the change creates additional value for the players in a reasonable period, then change will likely result in acceptance and improved outcomes. The effects of rapid changes to the gamification platform could be explored during the interviews. The consensus amongst financial advisors was that change is expected and works well when aligned with an existing launch cycle. If changes occurred too rapidly then it would not give members the opportunity to learn and enjoy the reward components. Financial advisors agreed that the way in which the change is managed in terms of communication of the change and education is even more essential than the timing of the change. Furthermore, of more importance, is the amount of time needed for players to derive value once more from the underlying game elements.

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Appendix A: Permission to conduct research

Discovery Vitality

1 November 2019

Prof Lee
Wits Business School

Re: PhD research - J. Nortje

Dear Prof Lee,

Jacqueline Nortje, an employee of Discovery, is completing her PhD research through Wits Business School. Her research topic is "The impact of gamification on key customer metrics in the wellness industry". This letter confirms that we are supportive of this research and that Jacqueline will have full access to the Vitality data to use as part of her research.

Regards

Nic Salmon
Head of the Research and Development Lab

Discovery Vitality (Pty) Ltd. Registration number: 1999/007796/07. An authorised financial services provider. 1 Discovery Place, Sandton, 2196 | www.discovery.co.za

Directors: A Gore* (Group CEO), H L Bosman, Dr B A Brink, S E De Bruyn, R Farber, H D Kallner*, F N Khanyile, N S Koopowitz*, Dr T V Maphai, H P Mayers*, Dr A Ntsaluba*, A L Owen (UK), A Pollard*, B Swartzberg*, D M Viljoen*, S V Zilwa (*Executive).
Secretary: M J Botha

301402

Appendix B: Human research ethics committee clearance certificate



UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Nortje

CLEARANCE CERTIFICATE	PROTOCOL NUMBER: H20/10/21
PROJECT TITLE	Customer behaviour change through gamification: temporal and goal framing effects
INVESTIGATOR(S)	Mrs J Nortje
SCHOOL/DEPARTMENT	Wits Business School/
DATE CONSIDERED	16 October 2020
DECISION OF THE COMMITTEE	Approved Risk Level: Low
EXPIRY DATE	15 November 2023

DATE 16 November 2020 CHAIRPERSON J. Knight
(Professor J Knight)

cc: Supervisor : Prof G Lee

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature Date 16 / 11 / 2020

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix C: Background on Vitality and Vitality Active Rewards

This study focuses on gamification tools employed in a South African wellness programme to improve health behaviour. Part of the research is the case study focusing on the Active Rewards programme in Discovery Vitality. The below sections describe each iteration of the Vitality Active Rewards gamification platform.

I DISCOVERY VITALITY

Discovery Vitality is a South African wellness programme that underpins Discovery Health and Discovery Life to attract healthy individuals as well as provide wellness interventions for members to improve their health. As a wellness programme, it employs various behavioural techniques to incentivise and reward healthy behaviours.

Vitality members accumulate points through engaging in health behaviours, including physical activity, to reach an annual status to earn even more rewards.

Vitality Active Rewards was introduced in September 2015 to increase physical activity. The gamification platform leverages the underlying Vitality points structure. The following sections describe the evolution of the gamification platform.

II VITALITY ACTIVE REWARDS

In 2015 Vitality Active Rewards was launched, introducing short term physical activity goals. While the game has changed over time, the goal setting mechanism has stayed consistent throughout.

Each week members are given a weekly points goal where the goal is determined systematically by the game and is based on previous physical activity and game engagement. If the member achieves their goal, then they are eligible to earn a reward. The evolution of the gamification platform largely focuses on these rewards and the following sections describe the changes in more detail.

The goal resets each week and increases/decreases based on achievement and engagement. In other words, when a member increases their physical activity, so too does the goal. The goal does not exceed 900 points – at this stage the individual enters a “maintenance phase”. This weekly increase ensures that the goal remains challenging.

Members track their weekly progress through a visual ring that fills up as they completed activities. While the aesthetics of the ring have changed over time to fit in with the overall “look and feel” of the app, the underlying mechanism itself has remained unchanged. Points can be earned predominately by going to the gym, participating in outdoor events (e.g. parkrun) or tracking activity with linked wearable devices tracking steps and workouts.

i Vitality Active Rewards 1.0

The first iteration of the Vitality Active Rewards platform went live in September 2015 and was straightforward: members chose a guaranteed reward from a fixed selection of vouchers (most notably, coffees or smoothies). Rewards became selectable on “Rewards Wednesday”. Figure 94 below shows the Vitality Active Rewards 1.0 journey.

Figure 94 Vitality Active Rewards 1.0 journey



The weekly goal starts at 0 every Saturday

The ring fills up as the member earn Vitality fitness points

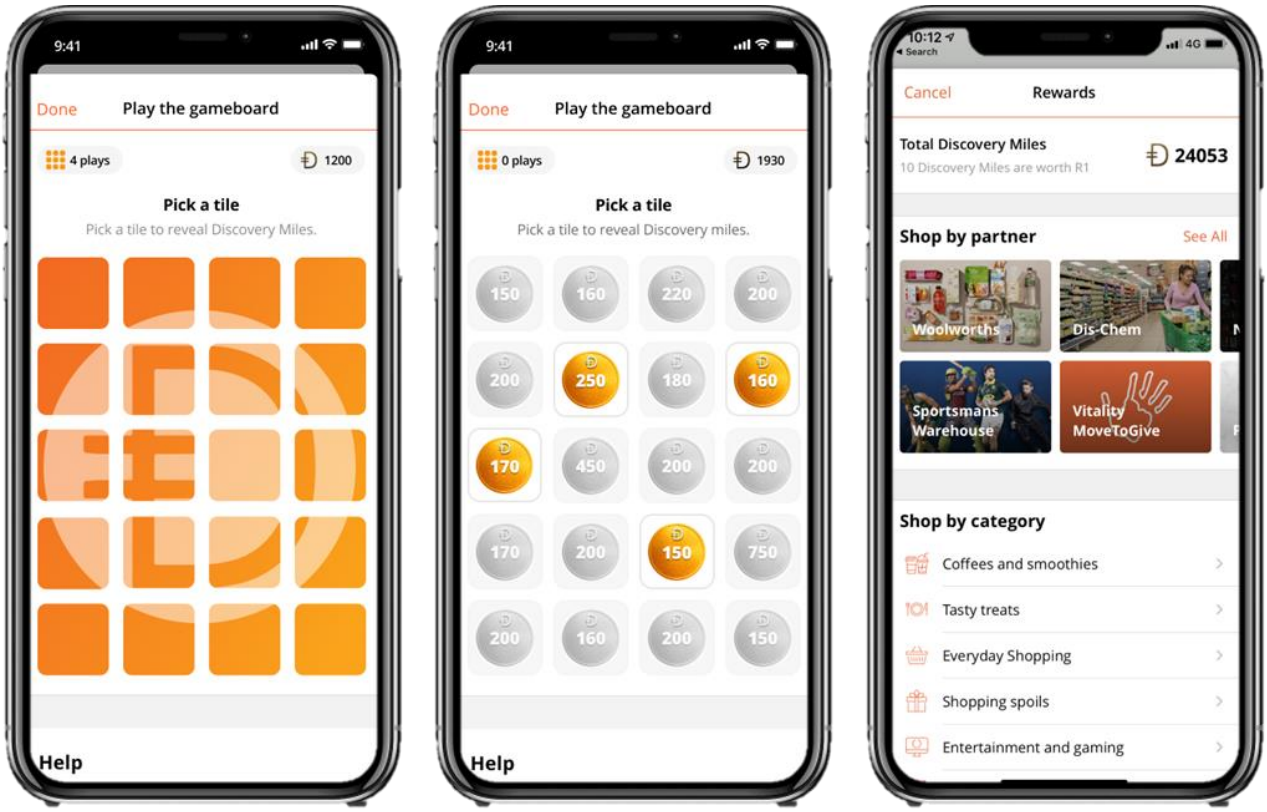
The goal is shown as achieved once the ring is filled up (before the Friday of that goal week)

Members choose a reward from a fixed list of options

ii Vitality Active Rewards 2.0

In September 2018 the underlying structure was updated to incorporate more game-like elements. The underlying goal setting and tracking mechanism (the ring) remained the same; however, the reward mechanism was updated to incorporate game design elements like virtual currencies and surprise and delight elements. When a member achieved their goal, they earned a play on a gameboard. Each tile uncovered revealed a reward currency (Vitality Reward Points which has subsequently been changed to Discovery Miles with the launch of Discovery Bank) that may be accumulated and exchanged for a range of rewards. The game was further extended to incorporate other behaviours across the Discovery products (notably, Vitality Drive and later Vitality Money – representing Discovery Insure and Discovery Bank). Aligned with Vitality Active Rewards 1.0, the goal week is from Saturday to Friday and rewards become redeemable on the following Rewards Wednesday. Figure 95 below shows the Vitality Active Rewards 2.0 journey.

Figure 95 Vitality Active Rewards 2.0 journey



The weekly goal starts at 0 every Saturday

The weekly goal starts at 0 every Saturday

The weekly goal starts at 0 every Saturday

iii Vitality Active Rewards 3.0

The most recent iteration of Vitality Active Rewards went live in April 2023. Similar to the previous iterations, the goal setting mechanic remained unchanged, and the weekly goal cycle remains from Saturday to Friday. Vitality Active Rewards 3.0 introduced a range of enhancements to introduce more personalisation into the programme. A noteworthy change to the platform is that the Vitality Active Rewards 3.0 enhancements are only applicable to individuals accessing the gamification platform through the Discovery Bank app. Those individuals who choose not to use the Discovery Bank app continue to access the core Vitality Active Rewards 2.0 features in the corporate Discovery app. The following sections describe the enhancements. The enhancements predominately manifest through nuanced aesthetic updates, e.g., icons becoming visible when the feature is activated.

Instant Rewards

Individuals may choose to select an instant reward immediately as soon as their ring has been closed. The individual can choose from a fixed list of rewards, including coffees, smoothies or MoveToGive donations. If an individual chooses an instant reward, then they forego the gameboard play in that week. The instant reward effectively reintroduced the

tangible reward from Vitality Active Rewards 1.0 and updated the game mechanic to align with the current game.

Sneak Peeks

If an individual earns double their weekly goal, then they can get a "sneak peek" at a tile on the gameboard that allows the member to see under a tile before making the final choice. In other words, if an individual uses a sneak peek and uncovers a "poor" tile (in other words, a lower value tile) then the individual may choose to discard that tile and uncover a new tile. Notably, the individual only earns the Discovery Miles from selected tile and not both.

Rewards Multiplier

Individuals double the amount of Discovery Miles uncovered with an exercise play for every 5^{th}, 10^{th}, 15^{th}, 25^{th}, 50^{th} and every multiple of 100^{th} goal streak (i.e., consecutive goals achieved). This multiplier is earned once per calendar year. For example, if an individual achieves 5 goals in a row, then their Discovery Miles are multiplied on the next play. If the individual misses the 6^{th} goal, then the individual will only earn a Rewards Multiplier again when they have reached 10 goals consecutively.

Rest Weeks

Individuals may earn a rest week for every streak of 25 consecutive goals. Individuals may apply their rest week and still maintain their goal streak and all rewards in the week that they use the rest week.

Feature Tiles

The gameboard includes additional tiles personalised based on an individual's engagement in the week. These tiles are based on fitness points earned, money spent at key Discovery partners (for Bank clients) and based on an individual's underlying Discovery products.

Appendix D: Vitality Active Rewards Benefit Guide

The following benefit guide has been reproduced with permission from Discovery Vitality, and highlights all benefit rules and guidelines pertaining to the Vitality Active Rewards gamification platform.

Vitality Active Rewards encourages and rewards you for living well. When you achieve your Exercise, Drive or Spend* goals, you will have the option to choose one of the following:

- Select an instant reward like a coffee.
- Wait to play the gameboard on Rewards Wednesday to earn Discovery Miles – our rewards currency that you can spend on a range of exciting items.

*Discovery Bank clients have access to an enhanced Vitality Active Rewards in the Discovery Bank app. Find out more.

I WHO QUALIFIES FOR VITALITY ACTIVE REWARDS?

- Vitality Active Rewards is available to Discovery Vitality and Discovery Insure clients who are aged 18 years or older and have an active policy. You need a compatible iOS (Apple), Android or Huawei device to access this benefit in the Discovery app and Discovery Insure app. Download or update to the latest versions of the apps.
- The enhanced Vitality Active Rewards is available to qualifying Discovery Bank clients who are aged 18 years or older and have an active account. You need a compatible iOS (Apple), Android or Huawei device to access this benefit in the Discovery Bank app. Download or update to the latest version of the app.
- Vitality Active Rewards for Teens is available to teenagers who are aged 14 to 17 years. This benefit gives them access to a limited version of Vitality Active Rewards. To find out more, see the Vitality Active Rewards for Teens section further on in this benefit guide.
- Vitality Active Rewards for Kids is available to children who are aged 2 to 13 years. This benefit gives them access to a customised and limited version of Vitality Active Rewards in the main member's Discovery app. Find out more about Vitality Active Rewards for Kids.
- If you have an active Vitality Health membership, you can get rewarded for achieving the personalised Exercise goal we set for you each week. These goals are clinically informed and will guide you along specific and progressive exercise pathways to keep you motivated and active.
- If you have an active Vitality Drive membership through Discovery Insure, you can get rewarded for achieving your weekly personalised driving goal.
- If you are the primary accountholder of a qualifying Discovery Bank account and have activated Vitality Money, you can get rewarded for achieving your spending goals in

the enhanced Vitality Active Rewards experience exclusively in the Discovery Bank app. Find out more.

- As a Vitality Health, Vitality Drive or Vitality Money member, you will also have access to discounted rewards in the Vitality Mall in the Discovery app based on your qualifying Discovery products.
- If you do not have an active Vitality Health product but have any Discovery product that qualifies for a Vitality Health policy, you will be able to use the Vitality Health Tracker to track your Exercise goals. This gives you access to a limited version of Vitality Active Rewards. See the detailed Vitality Health Tracker rules.

II SHARING INFORMATION

By using this benefit, you agree:

- That Discovery Vitality (Pty) Limited, Vitality's fitness partners and Vitality's rewards partners may share your personal and payment information to administer the benefit effectively
- To share your driving behaviour and information with Discovery Insure and Insure's telematics partners (Vitality Drive members only)
- That Discovery Vitality (Pty) Limited and Discovery Bank Limited, their partner network and third parties associated with the benefit may share your payment and personal information to manage the benefit and make certain rewards available to you.

III WHAT YOU PAY

This benefit is free to activate. Vitality Active Rewards is available through the Discovery app, which is free apart from any data costs which apply when you download or use the app or update to the latest version. Booster benefits linked to Vitality Active Rewards may have separate activation costs which will be charged for as part of the activation process.

IV HOW IT WORKS

i Download the Discovery app

- Get started by downloading the latest version of the Discovery app on your iOS, Android or Huawei compatible mobile device.
- Log in to the Discovery app using the same credentials as you do for the Discovery website.
- Activate the Vitality Active Rewards benefit through the Discovery app.
- Start earning Discovery Miles for living well.

ii If you are a Vitality Health member, get active to achieve your Exercise goal

- Based on your current health status and activity levels, we will set you a weekly personalised Exercise goal. Your goal adjusts upwards or downwards based on your activity level and goal completion over previous weeks to do one of the following:
    - Gradually encourage you to the next level
    - Keep you motivated and engaged at the current level
    - Ease you to a lower level more suitable for your fitness ability.
- To achieve your weekly Exercise goal, you need to earn a certain number of Vitality fitness points in any of the following ways:
- Through any of Vitality's fitness partners
- By using a wearable fitness device or fitness app linked to your Vitality Health profile.
- As you achieve your goals, your next goal will increase. This is to make sure that you continue to become fitter over the weeks. Each person will reach a cap of points – your goal will not continue to increase indefinitely. Your goal cap is worked out based on your goal achievement, fitness and health.
- Goals are calculated weekly based on past goal achievement. You can track your progress as you work towards your goal.
- Goal cycles run from midnight on a Friday until midnight on the following Friday. Only events or fitness activities completed in that period count towards the weekly goal. We allow until midnight on the Tuesday following your goal week for your exercise data to reflect. Your fitness activities may not reflect right away but your activities will count towards your goal, as long as:
- You have captured your activity, by syncing your device or capturing any race events, within your goal week
- We receive the data before midnight on the following Tuesday.
- Even if your Vitality fitness points aren't currently reflecting, you won't lose out. We will retrospectively award gameboard plays earned in a particular week and make sure that your weekly Vitality Active Rewards (including your Apple Watch repayments and booster benefits) are not affected.
- A goal cycle is attributed to the month in which the goal cycle ends. For instance, if a goal cycle starts on Saturday, 25 September and ends on Friday, 1 October, we will attribute the goal cycle to October and not September, as the goal cycle ended in October.

iii If you are a Vitality Drive member, drive well to achieve your Drive goal

- Based on your previous week's driving behaviour, we will set you a weekly personalised Drive goal.

- To achieve your weekly Drive goal, you need to drive well to maintain your 50 or 60 daily Drive points that are given to you at the start of each day based on your tracking device type.
- Harsh driving events will reduce your daily Drive points balance, depending on the type and severity of the event.
- At the end of each day, we will add your remaining Drive points to your Active Rewards Drive ring, until you complete your personalised Drive goal.
- You have from Saturday morning until midnight on the following Friday to achieve your weekly goal.
- The minimum goal for a week is 170 Drive points. This is the goal you will start with when you first opt into Vitality Active Rewards. If you meet your goal for the week by closing your Drive ring, your goal for the next week will increase by 35 Drive points. Your goal will continue to increase every time you achieve it.
- If you have the smartphone-enabled DQ-Track (Vitality Drive Sensor), the maximum goal you can achieve is 340 Drive points. If you have the standalone DQ-Track, the maximum you can achieve is 300 Drive points, since we will not be able to measure your cellphone use.
- You can only earn one Active Reward for driving well in a week.
- Find out more about the Drive goal.

iv If you are a Discovery Bank client, spend and save with Discovery Bank to achieve your Spend goal

Qualifying Discovery Bank clients have access to an enhanced Vitality Active Rewards through Vitality Money in the Discovery Bank app. Learn more.

V REWARDS

When you achieve your Exercise, Drive or Spend* goal, you will have the option to choose one of the following:

- Select an instant reward, like a coffee or donation to the latest MoveToGive initiative
- Wait to play the gameboard on Rewards Wednesday to earn Discovery Miles – our rewards currency that you can spend on a range of exciting items.

*Discovery Bank clients have access to an enhanced Vitality Active Rewards in the Discovery Bank app. Learn more.

i Instant rewards

- Your instant reward will be available as soon as you achieve your Exercise, Drive or Spend goal.
- You have the option to select an instant reward up until the gameboard play becomes available (midnight on the Tuesday after the goal cycle has ended). From Rewards

Wednesday, all unselected instant rewards from your previous goal cycle will be converted to gameboard plays.

- The instant rewards include coffee and MoveToGive donations.
- If you select an instant reward, you will not qualify for a gameboard play on Rewards Wednesday.
- If you have multiple instant rewards available, you can select some or all of them. You can select the others later in the same goal cycle or convert them to gameboard plays.
- Once an instant reward is selected, it cannot be reversed and / or exchanged.

ii Gameboard plays

- Once you've achieved your Exercise, Drive or Spend goals, you can either select an instant reward immediately or wait for Rewards Wednesday to play the gameboard. Instant rewards will be converted to gameboard plays if you do not use them by midnight on the Tuesday after the goal cycle has ended.
- You play the gameboard by picking a tile to reveal hidden Discovery Miles of varying values. You can spend Discovery Miles on a range of rewards.
- You have until midnight on the Tuesday after your gameboard play becomes available to earn Discovery Miles.
- Plays for late events will only reflect on the following Rewards Wednesday. This is because after you have used your week's plays, the gameboard tiles get revealed to you.
- Each gameboard is different and a new gameboard is released your app each week.

iii Get up to 15% off

As a Vitality Health, Vitality Drive or Vitality Money member, you qualify for discounts on select Vitality Active Rewards redemptions in the Vitality Mall in the Discovery app. Most rewards worth 350 Discovery Miles or more qualify for these discounts. These will be shown on each qualifying reward in the Discovery app. These discounts can't be used in conjunction with another promotion.

Earn a 5% discount on rewards in the Vitality Mall for each qualifying Discovery product you have (Vitality Health, Vitality Drive and Vitality Money).

Discovery product	Discount
Vitality Health	5%
Vitality Drive	5%
Vitality Money	5%

If you're a Vitality 65+ member, when you complete a Vitality Health Check for 65+ or a Virtual Vitality Health Check-in, you'll qualify for up to 25% discount on select Vitality Mall redemptions. If you have not completed either of these checks, you'll still get an up to

15% discount on select Vitality Active Rewards redemptions in the Vitality Mall based on your qualifying Discovery products. You may not use the Vitality 65+ discount together with any other discounts or promotions offered by Vitality.

iv Discovery Miles

- You can choose to **spend or accumulate** your Discovery Miles:
    - **Spend** your Discovery Miles on a range of rewards (from coffees and smoothies to shopping and entertainment rewards).
    - **Accumulate** your Discovery Miles for a choice of bigger, better rewards.
- View the list of reward partners and rewards available in the Vitality Mall in the Discovery app.
- You can redeem your chosen rewards at the reward partner by scanning the QR code or manually entering the code on the reward pass.
- Rewards may vary depending on partner availability.
- Qualifying rewards may change at the discretion of the partners.
- The validity of the rewards varies and the expiry date is specified on each reward.
- You do not have to redeem your Discovery Miles immediately. You can save your Discovery Miles to accumulate and spend on a reward later.
- Discovery Miles which have not been redeemed towards a reward are valid for 5 years from date of issue.
- You can't redeem a Vitality Active Reward together with any other promotion that a Vitality Active Rewards partner is running online or in-store. For example, if a partner runs a promotion on a beverage on their own apps, social media platforms or in-store, you cannot redeem a Vitality Active Reward code on that beverage. You can check the qualifying rewards on your digital rewards pass or ask the cashier or manager at the partner store to check which items qualify for your Vitality Active Rewards.
- There are additional benefits for qualifying Discovery Bank clients.
    - Qualifying Discovery Bank clients are defined as Discovery Bank primary accountholders with a qualifying Discovery Transaction Account, Discovery Bank Card Account or Discovery Bank Suite.
    - These qualifying Discovery Bank clients can spend the Discovery Miles they earn through Vitality Active Rewards outside of the Vitality Active Rewards platform. This is regardless of whether they earned them through meeting their Vitality Active Rewards Health, Drive or Spend goals.
    - Their Discovery Miles can be:
        - Spent at partners online and in-store
        - Used to pay for flights and accommodation
        - Converted to other partner loyalty programme points

        - Transferred to a friend or family member with a Discovery Bank account
        - Monetised to spend as they wish.
    - Vitality Health and Vitality Drive clients who do not have a qualifying Discovery Bank account or who are only Discovery Bank secondary cardholders can only spend their Discovery Miles within the Vitality Active Rewards platform. For the ability to spend your Discovery Miles in more ways, join Discovery Bank today.

v Vitality Centurion shirts

Reach an Exercise goal streak of 100 and all multiples of 100 to earn a Vitality Centurion shirt with your century streak number printed on the back. When you achieve your Vitality Centurion Award, you will receive a code to redeem your shirt and qualifying badge at a participating Sportsmans Warehouse.

Members will receive one Vitality Centurion shirt per year.

Example: Sandra has achieved 300+ consecutive Exercise goals and will receive a 300 Centurion shirt. If she continues to achieve her Exercise goals, the next shirt she receives will be a 400 Centurion shirt.

Members can choose to have their shirt customised with their name at their own cost. Please check in-store for more information about the costs of customisation.

Find participating Sportsmans Warehouse stores.

VI FAIR USAGE LIMITS

To make sure everyone has fair access to rewards, there will be a daily, weekly or monthly limit on certain rewards. When applicable, these limits will be specified on the rewards you choose. Limits can change at any time.

i Add friends in the Discovery app

You can invite an unlimited number of friends to join your friends list in the Discovery app. This will let you track each other's Exercise and Drive (but not Spend) activity and goal achievement. To invite a friend, send your 10-digit invite code to your Vitality friends and ask them to enter the code in their Discovery app to add you. You can then accept their invite through your Discovery app. You can delete someone from your friends list at any stage.

VII PRIVACY

Your privacy is important to us. To take part in the Vitality Active Rewards programme, we will ask you to agree to certain privacy settings. You can control who can see your Vitality Active Rewards profile. Information you can agree to share through the Vitality Active Rewards programme includes your name, profile picture, goal achievement and performance

metrics. If you choose not to share your information, your personal and performance data will not be shown. You can update your Discovery app privacy settings at any time.

VIII LIMITS

Yearly limits for fitness points only apply to your Vitality Health status, but not to Vitality Active Rewards. This means that all fitness points (depending on the daily points rules) will count towards reaching your weekly Vitality Active Rewards Exercise goals, whether you have reached the yearly limit for Vitality fitness points or not. This is to keep you motivated to earn Vitality Active Rewards for exercise all through the year. You will only be awarded points for one fitness event a day. If you complete two fitness activities in one day, we will award you with the higher points between the two.

IX ENDING THIS BENEFIT

- If you are no longer a Vitality Health member, your Exercise goal will no longer be available.
- If you are no longer a Vitality Drive member, your Drive goal will no longer be available.
- If you are no longer a Discovery Bank client with Vitality Money, your Spend goal will no longer be available. You will no longer experience the enhanced Vitality Active Rewards in the Discovery Bank app.
- If you are no longer a member of Vitality Health, Vitality Drive or Vitality Money, this Vitality Active Rewards benefit will no longer apply. Find out more.

X VITALITY ACTIVE REWARDS FOR TEENS

Vitality Active Rewards for Teens is an app-based programme that tracks physical activity and incentivises teens to exercise to earn rewards.

i Who qualifies

- All teens who are on their parents' or guardians' full Vitality policies and who are aged from 14 to 17 years qualify. The benefit is not available to members on Vitality Active, KeyFIT, GlencoreFIT or Balance.
- Teens taking part in Vitality Active Rewards for Teens will not have access to Vitality Drive.

ii How to activate it

- The main member must first give consent for their teen to take part in the programme from their Vitality Active Rewards dashboard.
- Their teen can then download the Discovery app on their phone, register a Discovery profile and activate Vitality Active Rewards for Teens.

iii How to use it

- We will set a weekly personalised Exercise goal for your teen. They can achieve goals through activities like device workouts (steps or heart rate), partner workouts (at Virgin Active or Planet Fitness gyms and parkrun), outdoor race events and playing a round of golf with Handicaps Network Africa.
- We will adjust their goal based on their activity level and goal completion over previous weeks.
- Every time your teen achieves their weekly Exercise goal, they will get a option to choose one of the following:
    - Select an instant reward like a coffee.
    - Wait to play the gameboard on Rewards Wednesday to earn Discovery Miles – our rewards currency that you can spend on a range of exciting items.
- Teens qualify for a maximum 5% discount on select Vitality Mall purchases of 350 Discovery Miles or more, based on Vitality Health as the qualifying Discovery product.
- Teens will only be able to spend their Discovery Miles on rewards offered within the Vitality Active Rewards for Teens programme.

iv The terms

The terms and conditions relating to the Vitality Active Rewards for Teens benefit set out the rules of use of the programme and create a binding contract between you and Discovery Vitality. Please read these terms and conditions carefully.

v Parent and legal guardian's consent

- As the parent or legal guardian, you must consent to the following before your teen can start taking part in Vitality Active Rewards for Teens:
    - Your teen is allowed to register a profile with Discovery.
    - Your teen may take part in Vitality Active Rewards for Teens.
    - You will decide how your teen can earn and spend rewards on Vitality Active Rewards.
    - Neither Discovery nor Discovery Vitality are responsible for any injury, allergic reactions or other conditions your teen may develop while on the Vitality Active Rewards programme.
    - Discovery Vitality may share with its contracted third parties the data obtained from our fitness devices and partners to manage the benefit.
    - Discovery may communicate with your teen for transactional and marketing purposes.
- You can monitor your teen's Vitality Active Rewards for Teens profile. In keeping with our privacy statement rules, you must be the main member on your policy to access their profile. You will be able to see the exercise activities they are taking part in, the rewards they choose and their Discovery Miles balance. Your teen will not be able to add friends to their profile.

- You can call 0860 99 88 77 to get access to your teen's data.
- If you're a legal guardian on the policy, you will need to call 0860 99 88 77 to conduct any servicing interactions on behalf of your teen.
- You can view your teen's activity history by logging in to the points monitor on the Discovery website.
- You can revoke your consent (access to Vitality Active Rewards for Teens) by logging in to the Discovery app and going to your teen's Vitality Active Rewards for Teens profile.
- **Important to note:** If you revoke access, your teen will no longer be able to take part in Vitality Active Rewards for Teens. If you decide to grant them access to Vitality Active Rewards for Teens again at a later stage, they will need to activate their profile again in the Discovery app. They will then need to start from the beginning, losing all previous achievements and historically earned or saved Discovery Miles.
- Learn more about the terms and conditions.

vi Self-service tools

Discovery Vitality servicing will not be able to service minors. If your teen needs to contact Discovery Vitality for some reason, they will need to ask the main member to do so on their behalf.

vii Tracking activity with a fitness device

Teens can use fitness devices to track their steps, speed and heart-rate workouts. However, you as the parent or guardian must check the device manufacturer's rules on whether a child aged younger than 18 years may register a profile. Discovery Vitality will not be held responsible if the device manufacturer does not allow a teen to register a profile. Please visit the website of your desired fitness device manufacturer to find out the relevant rules.

viii Enjoying the rewards

- Vitality Teens have access to the same rewards as adults. Get a full breakdown of the rewards you can earn and their rules.
- The main member on the policy will be notified within an hour of a teen selecting a reward with the details of the reward partner. The main member can cancel the redemption of this reward by calling 0860 988 77, Monday to Friday from 08:00 to 17:00 if it has not already been redeemed. The cancellation can take up to 4 working days.
- Once the teen turns 18, they will have access to the adult version of Vitality Active Rewards and normal processes will follow. As a result, the main member will no longer receive the notification when the teen selects their chosen reward.

ix Privacy

For your teen to take part in the Vitality Active Rewards programme, we will ask you to agree to certain privacy settings. You can control who views their Vitality Active Rewards profile.

Information you agree to share through the Vitality Active Rewards programme includes their name, profile picture, goal achievement and performance metrics. If you choose not to share their information, their personal and performance data will not be shown. You can view our Privacy Statement on our website.

By using the benefit, you agree that Discovery Vitality (Pty) Limited, Vitality's fitness partners and Vitality's rewards partners may share your teen's personal and payment information to administer the benefit effectively.

x Ending the benefit

- Once a teen turns 18, they will gain access to full Vitality Active Rewards. All accumulated Discovery Miles and goal achievements will be carried over to Vitality Active Rewards. Teens can remove themselves from the Vitality Active Rewards programme at any time after they turn 18 by calling 0860 99 88 77.
- If the main member on the policy is no longer a member of Vitality Health, this Vitality Active Rewards for Teens benefit will no longer apply.

XI FIND OUT MORE

Limits, terms and conditions apply. If you have any questions or need more information about the Vitality Active Rewards benefit, please visit www.discovery.co.za. If there is a conflict between the rules in this benefit guide and the Main Rules for Vitality Health or the Main Rules for Ancillary Discovery Vitality Programmes, the Main Rules will always apply.

Appendix E: Discovery Vitality Physical Activity Points Earning Activities

		Points earned						
		50	**100**	**200**	**300**	**600**	**1500**	**3000**
Activities available at the time of the field experiement	**Workouts**	Home workout through a recognised channel	myrun (2.5km) Health clubs Round of golf Run/Walk For Life		myrun (5km) parkrun Run/Walk For Life 5km+			
	Steps	5000-9999	10000+					
	Speed workouts		30+ minutes					
	Heart rate workouts		Light workout for 30+ minutes	Moderate workout for 30-59 minutes	Moderate workout for 60+ minutes Vigorous workout for 30+ minutes			
	Sporting events				5 – 9km walking/running event 0,5 – 1km swimming event 25 – 49km cycling event	10 – 20km walking/running event 1,1 – 3km swimming event 50 – 99km cycling event	21 – 41km walking/running event 3,1 – 5,9km swimming event 100 – 179km cycling event	42km+ walking/running event 6km+ swimming event 180km+ cycling event

Where:

- Maximum heart rate is calculated by subtracting the individual's age from 220
- A light workout is one where the individual's heart rate is 60-69% of max heart rate
- A moderate workout is one where the individual's heart rate is 70-79% of max heart rate
- A vigorous workout is one where the individual's heart rate is 80%+ of max heart rate

Appendix F: Supporting Theories

The introductory section of this thesis introduced self-determination theory(Ryan & Deci, 2000) as a foundational theory of motivation to explain elements of the study. The following sections provide additional information as well as briefly discussing social cognitive theory (Bandura, 1991, 2004) in the context of this study.

I SELF-DETERMINATION THEORY

The following sections introduce self-determination theory and provide some additional background.

i Background and definitions

Ryan and Deci (2000) introduced self-determination theory (SDT) as a needs-based theory of motivation that specifies three psychological needs that are essential for optimal functioning and growth.

- Autonomy – internally perceived ability to control a situation.
- Competence – belief in one's ability and the ability to engage in behaviour that aligns with one's beliefs and values.
- Relatedness – the feeling of support and security.

When these are satisfied, it leads to an increase in motivation, performance, and wellbeing.

External or social factors can influence these primary needs, and it is possible to engineer an environment that maximises these needs. This dynamic is closely related to the reciprocal relationship between personal, behavioural and environmental processes introduced in social cognitive theory below (Schunk & DiBenedetto, 2020). Autonomy in self-determination theory is related to the concept of agency in social cognitive theory, where individuals strive for the ability to impact their environment or act in meaningful ways (Schunk & DiBenedetto, 2020). In a gamification context this manifests as task volition where a user may choose how to engage in the various game features as opposed to being prescribed how to engage.

Two key elements of self-determination theory are intrinsic motivation and self-regulation (how people translate environmental factors into personal values). Self-determination theory seeks to explain what facilitates or undermines these aspects (Ryan & Deci, 2000). Self-determination theory consists of two sub-theories, namely, cognitive evaluation theory and organismic integration theory (Ryan & Deci, 2000). Cognitive evaluation theory applies when individuals are already intrinsically motivated and focus on understanding how external factors can influence this intrinsic motivation. Organismic integration theory focuses on the continuum of motivation introduced in the introductory section of this thesis and expands on what supports or hinders internalisation and integration of external factors.

ii Cognitive evaluation theory

Intrinsic motivation is an inherent feature of all individuals – it is something we are born with – and is about curiosity, learning and a desire for challenges (Ryan & Deci, 2000). External factors can impact intrinsic motivation, either cultivating or hindering it. External factors can include social-contextual events such as feedback, deadlines, threats, imposed goals or rewards. For external factors to support intrinsic motivation, they need to foster feelings of competence, autonomy and relatedness in individuals (Ryan & Deci, 2000). Any processes that introduce choice will further enhance intrinsic motivation.

In social cognitive theory (introduced shortly), we see that other personal processes, e.g. self-efficacy, may also be impacted by external factors, including feedback (Schunk & DiBenedetto, 2020). Since internal processes are both inputs and outcomes of motivation, it is intuitive that the same environmental factors can impact both motivation and self-efficacy. Feedback plays an important role in both goal setting theory and gamification – it is important to keep these principles in mind for successful interventions since the type of feedback can either foster or diminish motivation and self-efficacy.

For an individual to be intrinsically motivated, they need to have an inherent interest in the task or behaviour in the first place (Ryan & Deci, 2000). If there is no interest or intrinsic motivation, then these cognitive evaluation theory principles will not apply. If the individual is not intrinsically motivated to start with, then external factors will not foster intrinsic motivation even if they do increase feelings of autonomy, competence, or relatedness; this is where extrinsic motivation plays a role. However, integrated regulation (which is still extrinsic) may be very close to generating outcomes similar to true intrinsic motivation.

Organismic integration theory

If motivation relies solely on external regulation, when the external elements are removed then the motivation also ceases – this is not sustainable and poses a risk to interventions that rely heavily on such techniques (Sullivan & Strode, 2010; Thibault Landry et al., 2017). The value of an activity is the perceived importance of an outcome; individuals will be more motivated to achieve goals that align with their values (Schunk & DiBenedetto, 2020). It is still possible to foster autonomy, competence and relatedness in scenarios where motivation is extrinsic; it requires individuals to internalise and integrate external elements which are where the second sub-theory of self-determination theory focuses (Ryan & Deci, 2000).

If we refer to the motivation continuum introduced previously; individuals can move along the continuum (Ryan & Deci, 2000). The extent to which motivation falls into each of the categories can vary (Edmunds et al., 2006). Although it is not realistic for everyone to be intrinsically motivated for all behaviours, it is possible to focus on moving them towards identified and integrated regulation.

If we focus on the range of extrinsic motivation (Ryan & Deci, 2000), gamification and goal setting theory might have adverse outcomes in the following scenarios:

- External regulation
  Individuals engage in satisfying an external demand or reward contingency. There is no autonomy or perceived choice, but individuals feel competent enough to comply. This type of regulation is, typically, what is referred to as extrinsic motivation and contrasted directly with intrinsic motivation.

- Introjected regulation
  Individuals have not fully accepted the control as their own and engage in order to increase feelings of self-worth or in avoiding appearing incapable within a relevant group. This regulation is defined as "extrinsic" since the individual is engaging due to externally perceived esteem. Individuals often display poor coping mechanisms when the situation becomes too challenging.

In contrast, gamification and goal setting theory is likely to succeed when motivation is self-determined (i.e. competence, relatedness and autonomy are satisfied):

- Identified regulation
  Individuals value the action and have accepted it. Individuals exhibit a greater ability to cope when the situation becomes challenging.

- Integrated regulation
  Action has been fully assimilated and accepted as part of one's self. This type of motivation is comparable to intrinsic motivation but is still referred to as extrinsic since the motivation is not due to an inherent sense of joy or satisfaction. It is still being done for a separable outcome. In this scenario, the individual accepts the behaviour as essential and may lead to improvements elsewhere (Sullivan & Strode, 2010).

It is possible to get similar results from extrinsic motivation by increasing internalisation and integration, but it is necessary to understand what social-contextual effects support or hinder integrated motivation. The three core psychological needs play a significant role in maintaining the self-determined state of extrinsic motivation that has been internalised and integrated (Ryan & Deci, 2000).

If an individual is required to participate in an activity that they are not ready for yet (e.g., due to insufficient skill), then the extrinsic motivation will likely fall under external or introjected regulation (Ryan & Deci, 2000) and will have suboptimal outcomes. This scenario is similar to what we see in goal setting theory where individuals will display lower levels of success with performance goals when they do not display the required skill levels (Seijts & Latham, 2005). Introducing learning goals to increase ability before progressing to performance goals is in line with both goal setting theory and self-determination theory.

The effect of incentives on motivation

A hotly debated topic in literature is whether or not rewards undermine intrinsic motivation (Lohmann et al., 2018; Ryan & Deci, 2000; Thibault Landry et al., 2017). It is necessary to

understand the impact of incentives as so many interventions implement them, including within gamification contexts.

According to self-determination theory rewards or incentives "conduce towards an external perceived locus of causality" (Ryan & Deci, 2000, p. 70), and they may harm feelings of autonomy. There is also concern that by assigning a monetary value to an activity, one devalues the intrinsic motivation and moves attention away from the underlying behaviour (Thibault Landry et al., 2017). A key element of sustainable health behaviour change is intrinsic motivation (Johnson et al., 2016) – sustainability of interventions is particularly vital in behaviours like physical activity which needs to be repeated in order to unlock the inherent health benefits. As illustrated in the previous section, it is possible for extrinsic motivation to be self-determined and for external influences (including incentives) to support motivation – this depends on the design of the intervention (Lohmann et al., 2018).

There are challenges to implementing incentive schemes correctly, and if done incorrectly, it can lead to unintended consequences (e.g. unethical behaviour) (Lohmann et al., 2018). Since motivation differs between individuals and what may be intrinsically motivating for one might not be intrinsically motivating for another(Lohmann et al., 2018; Ryan & Deci, 2000; Seaborn & Fels, 2015) this makes implementing incentive structures for a range of individuals even more challenging. When done correctly, incentive structures may support and even sustain motivation (Thibault Landry et al., 2017). It is unlikely to design an incentive programme that will work for all individuals exposed to it, but there are strategies to mitigate some of the negative impacts of incentive structures, e.g. allocation of incentives perceived as fair and autonomy supporting structures (Lohmann et al., 2018; Thibault Landry et al., 2017).

The success or failure of financial incentives is mainly dependent on how they are implemented and perceived (Thibault Landry et al., 2017). If individuals believe that effort will lead to fair compensation, this will increase motivation – this is consistent with SCT where perceived outcomes can impact behaviour. When incentives are perceived as unfairly distributed the individual may feel that the incentive is out of their control leading to reduced autonomy and competence – this is again consistent with SCT where attribution has an impact on motivation and behaviour. When an incentive is positioned as a feedback mechanism (i.e. to reward performance or progress), it is more positively perceived that when it is used as a control mechanism.

It is important to reiterate that external elements, e.g. incentives, will only undermine intrinsic motivation if it existed in the first place (Edmunds et al., 2006; Ryan & Deci, 2000).

II SOCIAL COGNITIVE THEORY

The following sections introduce and discuss social cognitive theory (Bandura, 1991, 2004).

i Background and definitions

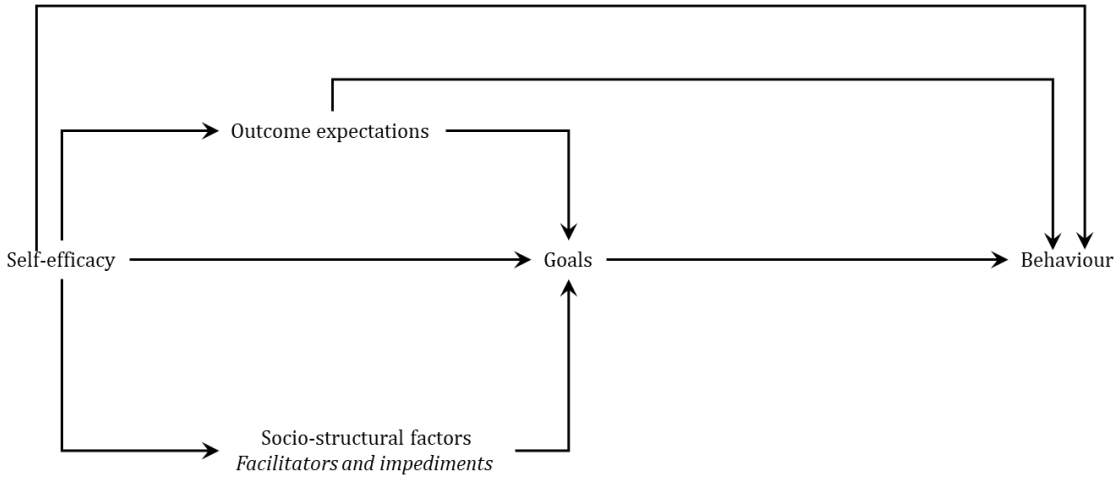
Social cognitive theory is centred on understanding the impact of social cognitions on motivation (Armitage & Conner, 2000) where social cognition refers to how individuals

process, store and apply information about other people and social situations (Smith et al., 2019). It is clear from both social cognitive theory and self-determination theory (introduced previously) that external influences, e.g. our environment or interactions with other people impact behaviour and motivation (Ryan & Deci, 2000; Smith et al., 2019; Sullivan & Strode, 2010).

Social cognitive theory is an extension of Bandura's original social learning theory (Schunk & DiBenedetto, 2020) which introduced that motivation could be fostered by observing or learning from an outside party (i.e., a model example of the behaviour). This motivation because of observation depends on the perceived competence of the model, perceived similarity between the individual and the model and the model's status. Outcome expectancies also impact this motivation.

Social learning theory has subsequently been broadened to social cognitive theory where the core determinants are knowledge, self-efficacy, outcome expectations, goals and perceived facilitators (including social support) or impediments (both personal and environmental) (Bandura, 2004; Smith et al., 2019). Self-efficacy impacts behaviour directly as well as through its impact on other determinants (Bandura, 2004), illustrated in Figure 96 below.

Figure 96 Determinants of social cognitive theory

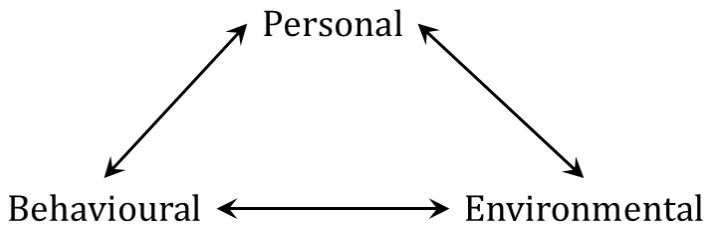


An alternative way of illustrating the relationship, highlighting the role of cognitive processes is a framework discussed by Dzewaltowski (1994), describing the cognitive process as a reciprocal relationship between self-efficacy, outcome expectations and goals. Since an individual's outcome expectations have an impact on the level to which their motivation is self-determined (e.g. if the expectation is a reward, then their motivation is more extrinsic than if the expectation is to learn from the process), one may refer to motivation as opposed to outcome expectations in this relationship.

In later iterations of social cognitive theory, Bandura refined this by reframing the relationships as a "triadic reciprocity" between personal, behavioural and environmental processes that may be illustrated as below in Figure 97 (Schunk & DiBenedetto, 2020; Smith et al., 2019); which introduces a dynamic and bidirectional relationship between these

processes (i.e. personal processes can be impacted by and have an impact on behavioural processes). These processes are both outcomes of and inputs for motivation (Schunk & DiBenedetto, 2020). Previously, as part of self-determination theory, we explored how environmental processes can impact intrinsic motivation (a personal process), and social cognitive theory expands on this stating that personal processes, in turn, can impact the environment as well as behaviours.

Figure 97 Triadic reciprocity between personal, behavioural and environmental processes



Self-regulation is a cyclical process, and it is how an individual aligns external and internal processes with their personal goals and values. Self-regulation plays a vital role in social cognitive theory since this is how individuals exercise control on their behaviour and environments – this manifests through processes such as goal setting, planning towards their goals and monitoring goal progress (Schunk & DiBenedetto, 2020). This process is what helps to narrow the gap between intention and activity. For these goals set during self-regulatory processes to lead to behaviour change, they need to adhere to Locke and Latham's goal setting theory. That is to say that the goals must be specific, challenging and attainable (Schunk & DiBenedetto, 2020).

There are some challenges in social cognitive theory research:

- Traditionally social cognitive theory has been positioned as generalisable and applies to a range of cultures – this assumption needs to be cautiously applied since some studies are showing that self-efficacy may be culture-dependent (Schunk & DiBenedetto, 2020).
- Long term effects of interventions are not well-researched (Schunk & DiBenedetto, 2020). This idea of sustainability of interventions was discussed previously under gamification and is a broader concern than just in social cognitive theory. Especially for ongoing behaviours like physical activity it is necessary to understand how best to foster motivation over a prolonged, sustainable period.
- Traditionally studies of social cognitive theory focus on between-individual analyses (Smith et al., 2019) and tend to assess variables at the start and end of an intervention (Schunk & DiBenedetto, 2020). Studies have shown that fluctuations of cognition, behaviour and motivation can occur frequently and rapidly – an improved understanding of these fluctuations can help create tailored, sustainable interventions (Schunk & DiBenedetto, 2020; Smith et al., 2019).

Appendix G: Survey Instruments

I BANDURA'S SELF-EFFICACY FOR EXERCISE SCALE

Below is a reproduction of the original research instrument from (Bandura, 2006, p. 321), with descriptions of how the questions were adjusted to make the survey more concise.

The research instrument consists of descriptions of situations that can make it hard to stick to an exercise routine. Users were asked to give a rating from 0 to 10 where 0 is "cannot do at all" and 10 is "highly certain can do".

1. When I am feeling tired

2. When I feel under pressure from work

In the original research instrument, there is an additional question relating to work pressure: "When I have too much work to do at home". In the interest of reducing answering fatigue, the decision was made not to differentiate between "work pressure" and "work at home". This was justified as the experiment took place in 2021 shortly after many individuals shifted to a work-from-home or hybrid work structure due to COVID-19 (Balbontin et al., 2021).

3. During bad weather

4. After recovering from an injury or illness that caused me to stop exercising

In the original research instrument "After recovering from an injury that caused me to stop exercising" and "After recovering from an illness that caused me to stop exercising" are two separate questions. As both questions relate to physical health and wellness, these questions were combined into a single question.

5. During or after experiencing personal or family problems

In the original research instrument "During or after experiencing personal problems" and "After experiencing family problems" are two separate questions. Due to the similarity between the topics, these questions were combined into a single question.

6. When I am feeling anxious or depressed

In the original research instrument "when I am feeling depressed" and "when I am feeling anxious" are two separate questions. Due to the high correlation between depression and anxiety, these questions were combined into a single question (Koutsimani et al., 2019).

7. When I feel physical discomfort when I exercise

8. After a vacation

9. During a vacation

10. When visitors are present

11. When there are other interesting things to do

12. If I don't reach my exercise goals

13. Without support from my family or friends

14. When I have other time commitments

The adjustments to the research instrument reduced the number of questions from 18 to 14.

II THE BEHAVIOURAL REGULATIONS IN EXERCISE QUESTIONNAIRE (BREQ-3)

The below is reproduced from:

http://exercise-motivation.bangor.ac.uk/breq/breqdown.php

With descriptions of how the questions were adjusted to make the survey more concise.

The research instrument consists of descriptions of reasons underlying peoples' decisions to engage or not engage in physical exercise. Users were asked to select the option most applicable to them from a four-point scale where 0 was "not true for me" and 4 was "very true for me". The below summary classifies the questions based on the underlying regulation that it is associated with.

Question	**Associated motivation field**
I don't see why I should have to exercise	Amotivation
I can't see why I should bother exercising	Amotivation
I don't see the point in exercising	Amotivation
I think exercising is a waste of time	Amotivation
I exercise because other people say I should	External regulation
I take part in exercise because my friends/family/partner say I should	External regulation
I exercise because others will not be pleased with me if I don't	External regulation
I feel under pressure from my friends/family to exercise	External regulation
I value the benefits of exercise	Identified regulation
It's important to me to exercise regularly	Identified regulation
I think it is important to make the effort to exercise regularly	Identified regulation
I get restless if I don't exercise regularly	Identified regulation
I exercise because it's fun	Intrinsic regulation
I find exercise a pleasurable activity	Intrinsic regulation

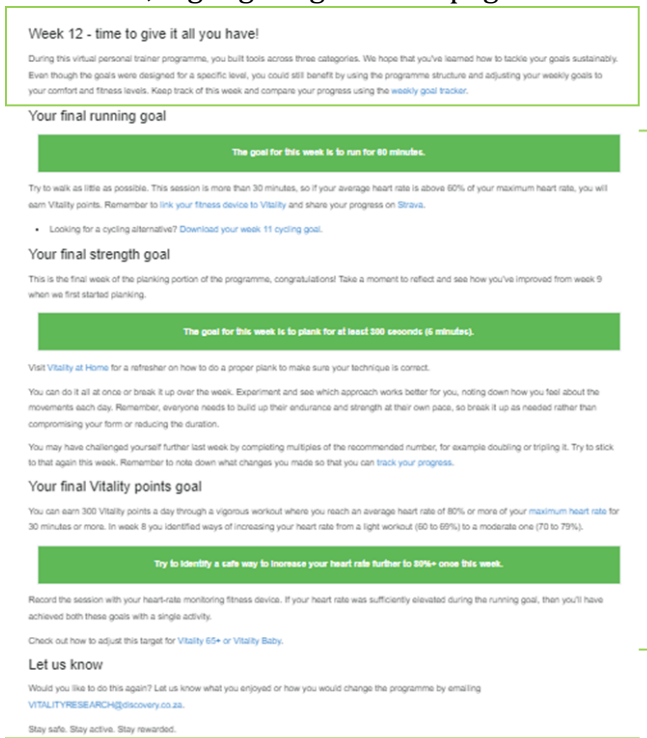
I get pleasure and satisfaction from participating in exercise	Intrinsic regulation
I feel guilty when I don't exercise	Introjected regulation
I feel ashamed when I miss an exercise session	Introjected regulation
I feel like a failure when I haven't exercised in a while	Introjected regulation

To reduce the questions from 24 to 18, the following questions were excluded due to overlapping themes, or since they would be less relevant in a gamification context where the member has already committed to the game goal by virtue of opting into the programme:

- I exercise because it is consistent with my life goals
- I enjoy my exercise sessions
- I consider exercise part of my identity
- I consider exercise a fundamental part of who I am
- I would feel bad about myself if I was not making time to exercise
- I consider exercise consistent with my values

Appendix H: Example of Additional Framed Content

Study participants had access to a bespoke webpage with additional framed content each week. The below is an example of one such week, highlighting how the page was structured.

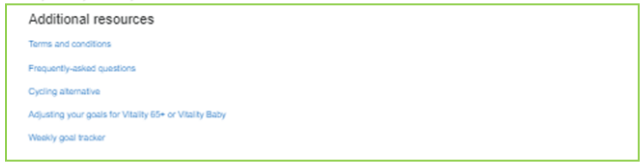


Introduction for each week to set the tone

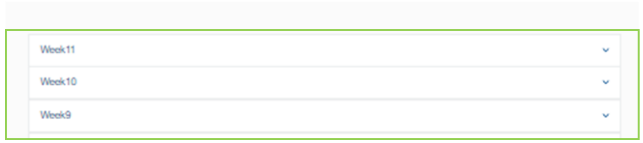
Three pieces of goal content each week focused on running, strength training and Vitality points earning. Framing for each goal based on the underlying group:

- Performance: all goals are performance framed
- Learning: all goals are learning framed
- Hybrid with a Performance bias: two of the goals are performance framed
- Hybrid with a Learning bias: two of the goals are learning framed

The hybrid goals cycle each week so that it is not always the same goal content that receives the alternative framing approach



Participants have access to additional resources such as goal trackers or scaled goals



Participants can access the previous weeks' content

Appendix I: Results for Combined Performance Group

As presented in the Discussion section (on p. 114) four groups were identified as having high levels of self-efficacy and motivation, as summarised in Table 38 below. All these groups have higher levels across both self-efficacy factors, and it is only the motivation factors that differ.

Table 38 Groups with higher self-efficacy and motivation

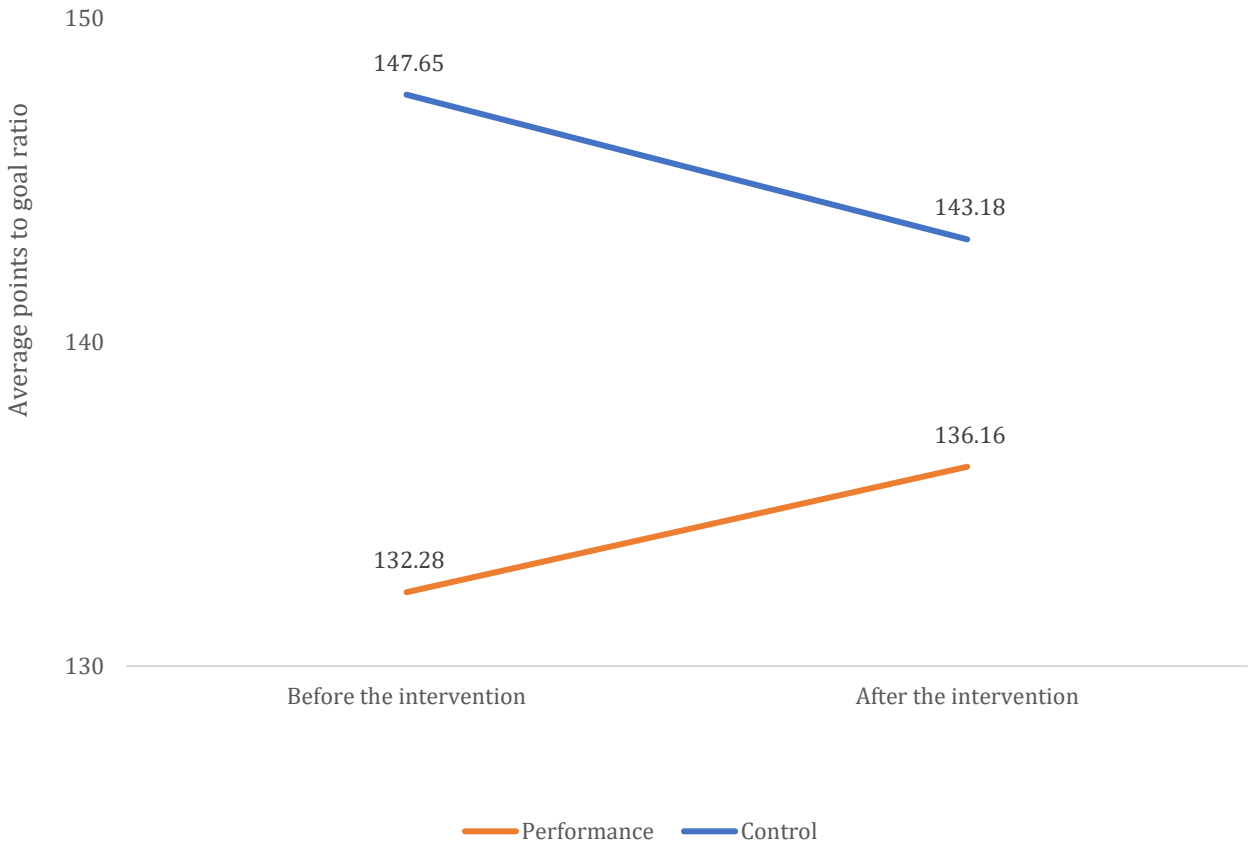
Group	Variables that influence the psychological construct			
	$M_{intrinsic\ and\ identified}$	$M_{introjected}$	SEI	SEE
3	High	High	High	High
6	High	Low	High	High
7	High	Moderately low	High	High
8	Moderately high	Moderately high	High	High

Focusing on only the self-efficacy factor to define framing condition, extant literature indicates that performance framing is the most likely to be successful (Locke & Latham, 2002, 2019; Seijts & Latham, 2005). Figure 98 below shows the average points to goal ratio in the population receiving pure Performance framing in the period 5 weeks before compared to 5 weeks after the intervention.

The magnitude of the D-I-D coefficient is 8.34 and is significant at the $\alpha = 0.1$ level ($p = .06$), indicating that the slopes of the two groups are not parallel and that exposure to the additional Performance framed content affected the outcome of the exposed group differently than the underlying background trend, captured by the control group. Based on the coefficients from the linear model, exposure to the Performance framing increased the average points to goal ratio by 3.88%, however, this was not significant ($p = .31$), compared to the unexposed group which had a decrease in the average points to goal ratio of 4.47% (significant with $p = .05$).

A positive effect is expected under Performance framing for the combined population since this population has higher levels of self-efficacy. The focus of this research is on the interaction between self-efficacy and motivation and therefore this result only serves to highlight the current approach to goal framing.

Figure 98 Average points to goal ratio in the 5 weeks before the intervention compared to the 5 weeks after the intervention for the combined group under Performance framing



Appendix J: Qualitative Interview Discussion Guide

The qualitative study included in-depth interviews with financial advisors. The interviews followed a semi-structured format and were largely conversational in nature. The researcher updated the discussion guide iteratively following the initial discussions. Each interview was 30-45 minutes in length.

I PURPOSE OF THE DISCUSSION

- Get first-hand descriptions from advisors regarding Vitality Active Rewards and changes over time.
- Establish how the brokers and their clients felt about each of the changes.
- Establish if any of the changes occurred too rapidly or took too slow to change.
- Did any of the changes lead to more queries or complaints than others (what were they).
- Did any of the changes have a particularly positive impact (e.g., was it easier to service the clients, or did they have any positive feedback).

II BROAD DISCUSSION STRUCTURE

The researcher initially approached each section broadly, for example: "can you tell me about how you and your clients perceived Vitality Active Rewards when it initially launched in 2015". If any of the sub-bullets are not discussed during the advisor's response, only then did the researcher ask it explicitly, for example: "in your experience, did you see an impact on sales or retention due to the introduction of Vitality Active Rewards?".

Where appropriate, the researcher probed respondents further to gain more insights or to get to the underlying concerns.

i Introduction

The researcher confirmed that the interview may be recorded and provided a brief overview of the purpose of the interview. Advisors provided an initial introduction, focusing on their experience and the general composition of their client base.

ii First impression of Vitality Active Rewards

- How did you and your clients feel about Active Rewards when it launched?
- Did it have an impact on your exercise habits or did any of your clients have comments about it?
- Were there any servicing concerns, questions?
- Has it helped as a retention or sales tool with clients?
- Did you or your members get bored of the original VAR game?

iii Vitality Active Rewards changes over time

Asked explicitly:

What would you describe as the biggest change(s) to the Vitality Active Rewards platform based on both your experiences and client feedback?

Prompted based on response regarding changes to the platform:

- Prompt about points changes (are these seen as part of the game or external).
- Prompt about partner changes (are these seen as big changes or "business as usual").
- What were your thoughts on the changes – positive or negative.
- How did the changes impact your motivation to keep playing the game.
- Did any of the changes result in increased service load compared to the others.
- Did your behaviour return to normal after the changes or did any of the changes increase or decrease motivation to exercise.

iv Frequency of changes

- Was there a period between any of the versions where members got tired of the game?
- Were there any iterations where they happened so fast that members perceived it negatively (prompt points changes, prompt currency change)?
- In your opinion, based on how you expect your clients would react, is there an optimal frequency with which changes should occur?
- In your opinion, based on your experiences and client feedback, which changes have been most vs least successful (what types of changes)?

v Communication of changes

Explicit questions:

- Do you think the changes to the game are communicated sufficiently to members?
- Is there an alternative channel or approach to communicating changes that you think would better resonate with your clients?

vi Closing remarks