

Relationships between Outdoor and Classroom Task Settings  
and Cognition in Primary Schoolchildren

Jamie McKenzie Hamilton

Submitted for the degree of Doctor of Philosophy

Heriot-Watt University

School of Energy, Geoscience, Infrastructure and Society

October 2017

This copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that the copyright rests with its author and that no quotation from the thesis and no information derived from it may be published without the prior written consent of the author or of the University (as may be appropriate).

## ABSTRACT

While recent studies suggest an association in early years' children between outdoor classrooms and predictors of achievement (Davis & Waite, 2005), here termed *cognitive factors* (affordances, attention, motivation, memory, social interaction, positive affect, physical activity and positive teacher feedback), support for performance impacts remains weak. The thesis predicts that due to a predisposition for natural affordances (Kahn Jr. & Kellert, 2002), children's performance on a school task will be better outdoors than in a classroom, and associated with natural richness. Employing a systems-based theoretical framework informed by the Santiago Theory of Cognition (Maturana & Varela, 1992), field experiments were undertaken with 3 Scottish primary schools. Participants were mainly school starters (n=57), average age 5½ years, but included an 'experienced' group with 4-5 years' regular exposure to woodland learning, average age 9½ years (n=14). Classes were split into matched groups and performed a curriculum task outdoors – in either a wood or playground – and then in a classroom, or vice versa. Settings were categorised for 'natural richness' using a checklist of affordances and biodiversity. Data were video recordings and, administered 6-7 months post-task, teacher interviews and a questionnaire which recorded recollections, and preferences related to performance and perceived restoration. Greater social interaction, creative diversity and movement outdoors were general task observations. Outdoor tasks were recalled more readily and in richer detail, and were preferred for all criteria, with the experienced group returning the strongest preferences. Underachievers recalled more outdoors than peers, and returned higher perceived restorativeness scale task ratings. Setting preferences exhibit a two-factor structure: perceived 'autonomy' outdoors is the dominant component, and 'creative compatibility' is associated with 'natural richness' and hinges on perceived compatibility, discovery and resourcefulness outdoors. A causal loop analysis of interview data implies the enabling and regulating impacts of the outdoor settings on individuals and groups, with environmental novelty, non-prescriptiveness and immersiveness implicated. Discussion suggests stronger empirical support for all cognitive factors outdoors, best summarised as a *virtuous systemic interrelationship between affordance richness, functional motivation and positive interdependence, with significant implications for task performance*. The research contributes new measures and approaches, and informs the case for embedding outdoor learning in the Scottish early years' curriculum, particularly, through support for transition and underachievement.

## ACKNOWLEDGEMENTS

I am indebted to my supervisors, Dr Caroline Brown, and Professors Jenny Roe and Pete Higgins. Their support, direction and patience over the last five years has been invaluable in realising this project. I also warmly thank Professor Peter Aspinall for his kind and essential assistance with the statistical components.

For three years this research was funded by Heriot Watt University and the Forestry Commission Service, and I give particular thanks to Sally York and Kevin Lafferty (Forestry Commission) for their ongoing belief in the project. I am also very appreciative to the organisers of three annual Outdoor Learning PhD seminars at the Universities of Edinburgh (2014), Copenhagen (2015) and Munich (2016). The conversations with, and feedback from, fellow candidates and tutors in the field at these events played an integral role in determining the final architecture of this thesis.

Many have made a meaningful pro bono contribution to my research, both helping to shape my understanding of outdoor learning policy, practice and thinking in the exploratory stages, and providing ongoing support, insights and feedback on my methodology and findings. Of these, special recognition should be given to Chris Miles, Juliet Robertson (Creative Star), Caroline Standring (Grounds for Learning), Julie Wilson (Education Scotland), Karen Boyd (Forestry Commission), Penny Martin and Mike Brady (Forest School Scotland), Rosa Murray (General Teaching Council of Scotland), (the real!) David Cameron, Scott Christie (OWLS), Cathy Bache (The Secret Garden), Sallie Harkness (Storyline), Dr Mandy Nioi, Dr Alison Stewart, Lesley Creevy, Audra Buist, Joyce Gilbert (Scottish Royal Geographic Society), Margaret McDonald (former Prof. Edinburgh University), Prof. Nancy Wells (Cornell University), Dr Erik Mygind (Copenhagen University), Dr Ulrich Dettweiler (Munich University), and Dr Beth Christie, Dr Simon Beames, and Dr Clare Nugent (Moray School of Outdoor Education, Edinburgh University). For ethical reasons, the anonymity of participating schools is maintained but, collectively, I thank all the Head teachers, staff, parents and pupils who have made this research possible. Above all, recognition should be afforded to the teachers who supervised the field experiments. They enabled experiments which combine control and ecological validity, and their deep insights and understanding provide the foundations for the main thesis argument.

Last but not least, I thank my fiancée, Janine Finlay for always believing in me, and bearing with me, on what has been a very long and challenging journey.

ACADEMIC REGISTRY  
Research Thesis Submission

Name:	Jamie McKenzie Hamilton		
School:	School of Energy, Geoscience, Infrastructure and Society		
Version: <i>(i.e. First, Resubmission, Final)</i>	Final Submission	Degree Sought:	Doctor of Philosophy

**Declaration**

In accordance with the appropriate regulations I hereby submit my thesis and I declare that:

- 1) the thesis embodies the results of my own work and has been composed by myself
- 2) where appropriate, I have made acknowledgement of the work of others and have made reference to work carried out in collaboration with other persons
- 3) the thesis is the correct version of the thesis for submission and is the same version as any electronic versions submitted\*.
- 4) my thesis for the award referred to, deposited in the Heriot-Watt University Library, should be made available for loan or photocopying and be available via the Institutional Repository, subject to such conditions as the Librarian may require
- 5) I understand that as a student of the University I am required to abide by the Regulations of the University and to conform to its discipline.
- 6) I confirm that the thesis has been verified against plagiarism via an approved plagiarism detection application e.g. Turnitin.

\* Please note that it is the responsibility of the candidate to ensure that the correct version of the thesis is submitted.

Signature of Candidate:		Date:	13 <sup>h</sup> October 2017
-------------------------	---	-------	------------------------------

**Submission**

Submitted By <i>(name in capitals)</i> :	
Signature of Individual Submitting:	
Date Submitted:	

**For Completion in the Student Service Centre (SSC)**

Received in the SSC by <i>(name in capitals)</i> :			
<i>Method of Submission</i> <i>(Handed in to SSC; posted through internal/external mail):</i>			
<i>E-thesis Submitted (mandatory for final theses)</i>			
Signature:		Date:	

# CONTENTS

<b>CHAPTER 1: INTRODUCTION.....</b>	<b>1</b>
1.2 Research Issue .....	9
1.3 Research Aim and Objectives .....	9
1.4 Methodology .....	10
1.4.1 Philosophical Position and Theoretical Framework .....	10
1.4.2 Research Design and Methods.....	11
1.5 Thesis Structure .....	12
<b>CHAPTER 2: ENVIRONMENT AND CHILD COGNITION .....</b>	<b>14</b>
2.0 Introduction .....	14
2.1 Educational and Developmental Considerations.....	16
2.2 Biophilia and Natural Affordances.....	21
2.3 Cognitive factors .....	25
2.3.1 Academic Attainment .....	26
2.3.2 Motivation.....	27
2.3.3 Attention .....	32
2.3.4 Memory.....	35
2.3.5 Positive Affect .....	39
2.3.6 Social Interaction .....	43
2.3.7 Physical Activity.....	47
2.3.8 Positive Teacher Feedback .....	48
2.4 Summary of Main Findings and Research Hypotheses.....	49
<b>CHAPTER 3: METHODOLOGY AND DESIGN.....</b>	<b>51</b>
3.0 Introduction .....	51
3.1 Philosophical Position .....	53
3.2 Theoretical Framework .....	54
3.3 Methodological Considerations.....	62
3.3.1 Field Experiment Design .....	62
3.3.2 Mixed Methods Research .....	64
3.4 Recruitment .....	66
3.4.1 Participants.....	67
3.5 Field Experiments.....	68
3.5.1: Urban playground: ‘Build a Den’ .....	68

3.5.2 Urban Wood: ‘Make a Toy’ and ‘Puppet Tour’ .....	69
3.5.3 Rural Wood: ‘Alien Adventure’ .....	69
3.6 Pilot Study: ‘Autumn Leaves’, Urban Playground .....	70
3.7 Setting and Task Assessment Tools .....	72
3.7.1 Setting Assessment: Richness Index (RI) .....	72
3.7.2 Task Assessment: Design ‘Open-endedness’ .....	74
3.8 Stage 1 Methods: Experimental Observation and Outcomes .....	75
3.8.1 Stage 1: Participatory Observation .....	75
3.8.2 Stage 1: Task Outcomes for ‘Build a Den’ and ‘Alien Adventure’ .....	77
3.8.3 Stage 1: Interactions Analyses for ‘Make a Toy’ and ‘Puppet Tour’ .....	79
3.9 Stage 2 Methods: Follow-up Questionnaire .....	80
3.9.1 Stage 2: Questionnaire Pilot .....	81
3.9.2 Stage 2: Recollections .....	82
3.9.3 Stage 2: Measurement Criteria for Preferences and Ratings .....	84
3.9.4 Stage 2: Measuring Setting Preferences and Task Ratings .....	88
3.9.5 Stage 2: Statistical Analyses .....	90
3.10 Stage 3 Methods: Focused Teacher Interviews .....	91
3.10.1 Stage 3: Methodological Considerations .....	92
3.10.2 Stage 3: Thematic and Systems Analyses .....	93
3.10.3 Stage 3: Summary of Focused Interviews .....	96
3.11 Trustworthiness .....	96
3.12 Ethics .....	97
3.13 Conclusion .....	98
<b>CHAPTER 4. TASK OBSERVATIONS AND OUTCOMES .....</b>	<b>99</b>
4.0 Introduction .....	99
4.1 Differences and Similarities between the Tasks .....	99
4.2 Playground: ‘Build a Den’ .....	102
4.2.1 ‘Build a Den’ Findings .....	104
4.2.2 ‘Build a Den’: Summary of Findings .....	109
4.3. Urban Wood: ‘Make a Toy’ and ‘Puppet Tour’ .....	109
4.3.1 ‘Make a Toy’ Findings .....	113
4.3.2 ‘Make a Toy’: Summary of Findings .....	121
4.3.3 ‘Puppet Tour’ Findings .....	122
4.3.4 ‘Puppet Tour’: Summary of Findings .....	126
4.4 Rural Wood: ‘Alien Adventure’ .....	127

4.4.1 ‘Alien Adventure’ Findings .....	129
4.4.2 ‘Alien Adventure’: Summary of Findings .....	133
4.5 Summary of Task Observations and Outcomes .....	133
<b>CHAPTER 5: TASK RECOLLECTIONS AND PREFERENCES .....</b>	<b>135</b>
5.0 Introduction .....	135
5.1 Questionnaire Design, Participants and Procedure .....	135
5.2 Recollections .....	137
5.2.1 Recollections: Results.....	138
5.2.2 Recollections: Three Examples .....	141
5.3 Setting Preferences and Task Ratings .....	145
5.3.1 Children’s Setting Preferences and Task Ratings.....	146
5.3.2 Setting Preferences: Conceptual Underpinnings .....	153
5.3.3 Setting Preferences: Association with Natural Richness.....	157
5.3.4 Teachers’ Setting Preferences and Task Ratings.....	160
5.4 Impacts of Variables other than Setting and Experience .....	163
5.5 Summary of Task Recollections and Preferences .....	164
<b>CHAPTER 6: ANALYSES OF THE TEACHERS’ PERSPECTIVE .....</b>	<b>166</b>
6.0 Introduction .....	166
6.2 Findings: Environment .....	169
6.2.1 Prescriptiveness .....	169
6.2.2 Dynamic Novelty.....	170
6.2.3 Immersiveness .....	172
6.3 Findings: Child’s Experience .....	175
6.3.1 Empowerment.....	175
6.3.2 Resourcefulness .....	180
6.3.3 Absorption .....	181
6.4 Findings: Socio-Linguistic Domain .....	183
6.4.1 Democracy.....	183
6.4.2 Generative Conversation.....	185
6.4.3 Self-sustenance .....	187
6.5 Findings: Teacher’s Experience .....	188
6.5.1 Management Burden.....	188
6.5.2 Enjoyment.....	190
6.5.3 Positive Teacher Feedback .....	192

6.6 Summary of Qualitative Variables .....	195
6.7 Systems Dynamics .....	196
6.7.1 Closed Loops (CL): Diagramming Conventions .....	197
6.7.2 Closed Loop 1: ‘The Cognitive Engine’ .....	199
6.7.3 Closed Loop 2: ‘Regulatory Aspects’ .....	202
6.7.4 Closed Loop 3: Teacher Feedback Effects .....	206
6.8 Summary of Analyses of the Teachers’ Task Perspective .....	208
<b>CHAPTER 7: DISCUSSION OF ENVIRONMENTAL FACTORS .....</b>	<b>210</b>
7.0 Introduction .....	210
7.1 Novelty .....	213
7.1.1 Relationships between the Richness Index, and Discovery and Ideas .....	214
7.1.2 Novelty, ‘Discovery’ and ‘Ideas’ .....	216
7.2 Utilitarian Complexity and Experienced Group Preferences .....	219
7.3 Extent.....	223
7.4 Environment and Affordances: Summary of Main Points .....	223
<b>CHAPTER 8: DISCUSSION OF EXPERIENTIAL FACTORS .....</b>	<b>225</b>
8.0 Introduction .....	225
8.1 Motivation .....	225
8.1.1 Motivation, Autonomy and Behaviour Setting ‘Pressures’ .....	226
8.1.2 Affordance Motivation .....	231
8.1.3 Responsive Affordances .....	232
8.1.4 Motivation and Self-Produced Effects.....	233
8.1.5 Motivation and Graduated Challenge .....	238
8.1.6 Underachiever Motivation .....	244
8.1.7 ‘Autonomy’ and Natural Richness .....	246
8.1.8 Motivation: Summary of Main Points .....	246
8.2 Attention .....	247
8.2.1 Classroom Distractions .....	248
8.2.2 Fascination and Extent.....	249
8.2.3 Fascination and Directed Attention in a Task Scenario.....	252
8.2.4 Motivation and Attention.....	253
8.2.5 Underachievers and Attention .....	253
8.2.6 Attention: Summary of Main Points.....	255
8.3 Positive Affect.....	256



8.3.1 ‘Compatibility’: Experienced vs Early Years’ Children.....	257
8.3.2 ‘Compatibility’: Early Years Boys vs Girls.....	258
8.3.3 Underachievers and Classroom Stressors .....	259
8.3.4 Eudaimonic Wellbeing and Motivation .....	260
8.3.5 Implications of Adapting the PRS Scale.....	262
8.3.6 Positive Affect: Summary of Main Points.....	262
8.4 Physical Activity .....	263
8.4.1 Affordances and Movement.....	263
8.4.2 Movement and Cognition in the Wild Settings .....	264
8.4.3 Physical Activity: Summary of Main Points .....	265
8.5 Summary of Relationship between Environment and Experience .....	266
8.5.1 Two Perspectives on the Relationship.....	269
8.5.2 Conclusion .....	271
<b>CHAPTER 9: DISCUSSION OF SOCIO-LINGUISTIC FACTORS .....</b>	<b>272</b>
9.0 Introduction .....	272
9.1 Social Interaction.....	272
9.1.1 Behaviour Settings.....	273
9.1.2 Mutual Affordances and Social Development.....	274
9.1.3 Social Motivation, Play and Implicit Rules .....	277
9.1.4 Affordances, Positive Interdependence and Process Gain.....	283
9.1.5 Statistical Inconsistencies .....	286
9.1.6 Social Interaction: Summary of Main Points.....	287
9.2 Positive Teacher Feedback.....	289
9.2.1 Teacher Enjoyment and Child Performance.....	289
9.2.2 Management Burden and Teacher Participation.....	291
9.2.3 Teachers’ Affinity with Natural Settings.....	294
9.2.4 Positive Teacher Feedback: Summary of Main Points.....	295
9.3 Summary of Relationships involving the Socio-Linguistic Domain.....	295
<b>CHAPTER 10: DISCUSSION OF MEMORY .....</b>	<b>299</b>
10.0 Introduction .....	299
10.1.1 Environmental Compatibility .....	300
10.1.2 Cognitive Change and Underachievers.....	302
10.1.3 General Impacts and Cognitive Change .....	306
10.1.4 Memory: Summary of Main Points .....	308

<b>CHAPTER 11: DISCUSSION OF EDUCATIONAL IMPLICATIONS.....</b>	<b>309</b>
11.0 Introduction .....	309
11.1 Summary of Discussion Outcomes and their Curricular Relevance .....	309
11.1 General Model of Task Environment and Cognition .....	311
11.3 Curriculum Environments, Experiences and Outcomes.....	312
<b>CHAPTER 12: CONCLUSION.....</b>	<b>314</b>
12.0 Introduction .....	314
12.1 Key Findings and Conclusions.....	316
12.1.1 Research Hypotheses .....	316
12.1.2 Underachievers .....	319
12.1.3 Experience of Outdoor Learning .....	319
12.1.4 Teachers .....	320
12.1.5 Educational Implications .....	320
12.2 Limitations.....	321
12.3 Recommendations .....	324
12.4 Suggestions for Future Research .....	325
12.4.1 Performance .....	325
12.4.2 Outdoor Teaching Expertise and Practice .....	327
12.5 Original Contribution .....	328
12.6 Concluding Thoughts .....	329
<b>APPENDICES .....</b>	<b>331</b>
Appendix A: Questionnaire Materials.....	331
Appendix B: Parental Information and Consent Forms .....	335
<b>REFERENCES .....</b>	<b>337</b>

## LIST OF TABLES

### CHAPTER 2: ENVIRONMENT AND CHILD COGNITION

Table 2.1 Key Stages from Four Theories of Child Development .....	20
Table 2.2 Experience of Language Use at Home and School (Wells, 2009, Table 5.1).	46

### CHAPTER 3: METHODOLOGY AND DESIGN

Table 3.1 Overview of Study Schools, Tasks and Participants.....	68
Table 3.2 Design for the Study Pilot: ‘Autumn Leaves’ .....	70
Table 3.3 Richness Index: Items and Setting Scorings .....	73
Table 3.4 Task Open-endedness: Categories and Scoring .....	74
Table 3.5 Task Open-endedness: Scorings for Experimental Components.....	75
Table 3.6 Summary of Measurement Criteria.....	88

### CHAPTER 4. TASK OBSERVATIONS AND OUTCOMES

Table 4.1 Non-Setting Similarities and Differences between the Tasks.....	100
Table 4.2 Design for Urban Playground Task: ‘Build a Den’ .....	103
Table 4.3 Design for Urban Wood Tasks: ‘Make a Toy’ and ‘Puppet Tour’ .....	110
Table 4.4 ‘Make a Toy’ Interactions Analysis: Social Interaction .....	115
Table 4.5 ‘Make a Toy’ Interactions Analysis: Productions and Projects.....	118
Table 4.6 Design for Urban Rural Task: ‘Alien Adventure’ .....	127
Table 4.7 ‘Alien Adventure’: Comparison of Three Indoor and Outdoor Stories.....	130
Table 4.8 ‘Alien Adventure’: Remaining Indoor and Outdoor Stories.....	131

### CHAPTER 5: TASK RECOLLECTIONS AND PREFERENCES

Table 5.1 Questionnaire: Overview of Child Participants .....	136
Table 5.2 Recollections: Overview of Child Participants.....	138
Table 5.3 Recollections: Indoors vs Outdoors, Children and Teachers.....	139
Table 5.4 Setting Preferences and Task Ratings: Indoors vs Outdoors, Children .....	147
Table 5.5 Setting Preferences: Early Years vs Experienced .....	151
Table 5.6 Task Ratings: Early Years vs Experienced .....	151
Table 5.7 Early Years vs Experienced, ‘Wild’ Tasks Only .....	152
Table 5.8 Principal Components Analyses: Descriptive Statistics .....	154
Table 5.9 Principal Components Analyses: Rotated Component Matrices .....	154
Table 5.10 Logistic Regression: ‘Creative Compatibility’ and Natural Richness .....	157

Table 5.11 Logistic Regression: ‘Discovery’ and Natural Richness .....	158
Table 5.12 Preferences and Ratings: Teacher’s Assessments for Task / Children .....	161
Table 5.13 Preferences and Ratings: Teacher’s Personal Assessments .....	161
Table 5.14 Preferences and Ratings: Teachers (Personal) vs Children .....	163

## **CHAPTER 6: ANALYSES OF THE TEACHERS’ PERSPECTIVE**

Table 6.1 Qualitative Variables by Framework Category .....	196
---	-----

## **CHAPTER 7: DISCUSSION OF ENVIRONMENTAL FACTORS**

Table 7.1 ‘Complexity’ and ‘coherence’ (Kaplan & Kaplan, 1989).....	220
---	-----

## **CHAPTER 8: DISCUSSION OF EXPERIENTIAL FACTORS**

Table 8.1 The Bullerby Model (Kytä, 2006) .....	228
Table 8.2 Main Findings and Outcomes for Environment and Child’s Experience .....	267

## **CHAPTER 9: DISCUSSION OF SOCIO-LINGUISTIC FACTORS**

Table 9.1 Main Findings and Outcomes for Socio-Linguistic Domain .....	296
--	-----

## LIST OF FIGURES

### CHAPTER 1: INTRODUCTION

Figure 1.1 Outcomes of an Exploratory Focus Group with Teachers.....	5
Figure 1.2 Theoretical Framework.....	11

### CHAPTER 2: ENVIRONMENT AND CHILD COGNITION

Figure 2.1 Kolb's Experiential Learning Cycle (Kolb, 1983) .....	19
Figure 2.2 Functional Taxonomy of Children's Outdoor Environments .....	23
Figure 2.3 Model of the Aesthetic Response (Berlyne, 1971).....	30
Figure 2.4 Relationship between Arousal and Hedonic Value (Berlyne, 1971).....	30
Figure 2.5 Declarative and Non-Declarative Memory Systems (Squire, 2004) .....	36
Figure 2.6 Environmental Preference Theory Matrix (Kaplan & Kaplan, 1989) .....	41

### CHAPTER 3: METHODOLOGY AND DESIGN

Figure 3.1 Overview of the Thesis Methodology .....	51
Figure 3.2 Theoretical Framework.....	57
Figure 3.3 Definitions: Cognition, Behaviour, Knowledge and Structural Coupling.....	58
Figure 3.4 Definitions: Social Phenomena, Communication and Language .....	60
Figure 3.5 Theoretical Framework: Concepts and Definitions .....	61
Figure 3.6 Continuous Scale of Pragmatist Epistemologies .....	65
Figure 3.7 The Three Thinking Hat Questions used for 'Build a Den' .....	78
Figure 3.8 Performance Criteria.....	85
Figure 3.9 Focused Interview Guide with Theoretical Framework .....	92
Figure 3.10 Interview Analysis Approach .....	94

### CHAPTER 4. TASK OBSERVATIONS AND OUTCOMES

Figure 4.2 Urban Playground Task Settings .....	103
Figure 4.2 Comparison between Classroom and Playground Dens .....	105
Figure 4.3 Examples of Positive References to Teamwork in the Playground.....	106
Figure 4.4 Examples of Explicit Problem Solving on the 'Windy' Task .....	107
Figure 4.5 Possible Examples of Metacognition on Group 1's 'Windy' Task .....	108
Figure 4.6 Possible Examples of Playground Metacognition from Group 2 .....	108
Figure 4.8 Urban Wood Task Settings .....	111
Figure 4.9 'Make a Toy': Classroom 'Junk' Materials.....	112

Figure 4.10 ‘Puppet Tour’: Stick Puppets.....	112
Figure 4.11 ‘Make a Toy’ Indoor Interactions Analysis – Experimental Group.....	114
Figure 4.12 ‘Make a Toy’ Outdoor Interactions Analysis – Experimental Group .....	114
Figure 4.13 ‘Make a Toy’ Outdoor Interactions Analysis 2: Inherited Ideas .....	116
Figure 4.14 ‘Make a Toy’: Comparison of Indoor and Outdoor Toys .....	119
Figure 4.15 ‘Make a Toy’: Comparison of Indoor and Outdoor Toy Descriptions.....	120
Figure 4.16 ‘Make a Toy’: Conversation about a Worm.....	121
Figure 4.17 ‘Puppet Tour’ Outdoor Interactions Analysis (first 10 minutes).....	123
Figure 4.18 ‘Puppet Tour’ Indoor Interactions Analysis (first 10 minutes) .....	123
Figure 4.19 ‘Puppet Tour’: Exchange between Teacher and Pupil about Slugs.....	124
Figure 4.20 ‘Puppet Tour’: Indoor Affordances supporting Role-play .....	125
Figure 4.21 Rural Wood Task Settings .....	128

## **CHAPTER 5: TASK RECOLLECTIONS AND PREFERENCES**

Figure 5.1 Recollections: Location of Children’s First Recollection .....	139
Figure 5.3 Recollections: Boxplot of Underachievers vs Able, Wild Settings Only....	140
Figure 5.4 Recollections: Example 1 .....	141
Figure 5.5 Recollections: Example 2 .....	142
Figure 5.6 Teacher’s Comments on Tm’s Recollection of ‘Build a Den’ .....	143
Figure 5.7 Teachers’ Recollections: Example 3 .....	144
Figure 5.8 Procedure and Statements for Task Ratings and Setting Preferences .....	145
Figure 5.9 Setting Preferences: Graph of Indoor vs Outdoor Means, Children.....	147
Figure 5.10 Task Ratings: Graph of Indoor vs Outdoor Means, Children.....	148
Figure 5.11 Setting Preferences: Performance vs PRS Criteria.....	148
Figure 5.12 Task Ratings: Performance vs PRS Criteria.....	149
Figure 5.13 Setting Preferences: Indoor vs Outdoor % Split for Individual Criteria ...	149
Figure 5.14: PRS Task Ratings: Boxplot of Underachievers vs Peers, Outdoors.....	153
Figure 5.15 Principal Components Analyses: Percentage of Variance Explained .....	155
Figure 5.16 PCA Analyses: Component 1 - ‘Autonomy’ .....	156
Figure 5.17 PCA Analyses: Component 2 - ‘Creative Compatibility’ .....	156
Figure 5.18 Graph of Natural Richness and Experience against Preference Means....	159
Figure 5.19 Setting Preferences: Graph of Indoor vs Outdoor Means, Teachers .....	160
Figure 5.20 Task Ratings: Graph of Indoor vs Outdoor Means, Teachers .....	160
Figure 5.21 Urban Wood Teacher reflects on her ‘Puppet Tour’ Assessment .....	162

## **CHAPTER 6: ANALYSES OF THE TEACHERS' PERSPECTIVE**

Figure 6.1 Summary of Qualitative Variables with Theoretical Framework.....	168
Figure 6.2 'Puppet Tour' Exchanges between Teacher and Individuals .....	193
Figure 6.3 'Puppet Tour' Exchanges between Teacher and Groups.....	194
Figure 6.4 A Positive Relation (CLD) .....	197
Figure 6.5 A Negative Relation (CLD).....	197
Figure 6.6 A Reinforcing Loop (CLD) .....	198
Figure 6.7 A Balancing Loop (CLD) .....	198
Figure 6.8 Closed Loop 1a: 'Dynamic Novelty' and 'Resourcefulness' .....	199
Figure 6.9 Closed Loop 1b: 'Resourcefulness' and 'Generative Conversation' .....	201
Figure 6.10 Closed Loop 1: The 'Cognitive Engine'.....	202
Figure 6.11 Closed Loop 2a: 'Empowerment' and 'Democracy' .....	203
Figure 6.12 Closed Loop 2b: 'Absorption' and 'Generative Conversation' .....	204
Figure 6.13 Closed Loop 2: 'Regulatory Aspects'.....	205
Figure 6.14 Closed (Balancing) Loop 3a: Management Burden .....	206
Figure 6.15 Closed (Reinforcing) Loop 3b: Teacher Enjoyment .....	207
Figure 6.16 Causal Loop Diagram involving all Qualitative Variables.....	209

## **CHAPTER 7: DISCUSSION OF ENVIRONMENTAL FACTORS**

Figure 7.1 Effects of Natural Richness on 'Discovery' and 'Ideas' .....	212
Figure 7.2 'Dynamic Novelty' and 'Resourcefulness' .....	212

## **CHAPTER 8: DISCUSSION OF EXPERIENTIAL FACTORS**

Figure 8.1 The 'Autonomy' Component.....	227
Figure 8.2 'Non-Prescriptiveness' and 'Empowerment' .....	227
Figure 8.3 Kyttä's Interactive Cycle i: Accessibility (in Chawla, 2006).....	229
Figure 8.4 Kyttä's Interactive Cycle ii: Responsiveness (in Chawla, 2006) .....	231
Figure 8.5 'Prescriptiveness' (plasticity of meaning) and 'Resourcefulness' .....	236
Figure 8.6 Possible Example of Frustrated Withdrawal .....	237
Figure 8.7 Neuroscientific Model of Motivation (Kim, 2013) .....	240
Figure 8.8 'Immersiveness' and 'Absorption' .....	241
Figure 8.9 Kyttä's Interactive Cycle iii: Graduated Challenges .....	242
Figure 8.11 'Immersiveness' and 'Absorption' (distraction).....	249
Figure 8.12 'Immersiveness-Absorption' (fascination) Closed Loop.....	250
Figure 8.13 Early Years' Boys: Comments by the Rural Wood Teachers .....	258

Figure 8.14 Closed Loop: Affordance Richness and Functional Motivation .....	268
--	-----

## **CHAPTER 9: DISCUSSION OF SOCIO-LINGUISTIC FACTORS**

Figure 9.1 ‘Democracy’ .....	278
Figure 9.2 Closed Loop: ‘Resourcefulness’ and ‘Generative Conversation’ .....	284
Figure 9.3 Teachers: Environment, Positive Affect and Child Interactions .....	290
Figure 9.4 Teachers: Environmental Impacts on Management Burden.....	292
Figure 9.5 The Rural Wood Teacher’s ‘Dilemma’ .....	293
Figure 9.6 Closed Loop: Richness, Motivation and Positive Interdependence .....	296
Figure 9.7 Balancing Loop: Management Burden.....	298

## **CHAPTER 10: DISCUSSION OF MEMORY**

Figure 10.1 Excerpt from Iz’s ‘Puppet Tour’ recollections outdoors .....	300
Figure 10.2 Teachers’ Comments about Underachiever Recollections.....	304
Figure 10.3 Kolb’s Experiential Learning Cycle (Kolb, 1983) .....	306
Figure 10.4 Teachers’ Comments about Strength of Outdoor Memories.....	307

## **CHAPTER 11: DISCUSSION OF EDUCATIONAL IMPLICATIONS**

Figure 11.1 General Model of Task Environment and Cognition .....	311
---	-----

## **CHAPTER 12: CONCLUSION**

Figure 12.1 General Model of Task Environment and Cognition .....	318
---	-----



## KEY TO ACRONYMS AND ABBREVIATIONS

ADD	Attention Deficit Disorder
ADHD	Attention Deficit Hyperactivity Disorder
AOE	Affordance Open-endedness
ART	Attention Restoration Theory
CET	Cognitive Evaluation Theory
CfE	Curriculum for Excellence
CF	Cognitive Factor
CL	Closed Loop
CLD	Closed Loop Diagram
EEG	Electroencephalogram
EIC	Environment as Integrated Context
FSM	Free School Meals (UK Scheme)
HMIE	Her Majesty's Inspectorate
LtS	Learning Teaching Scotland
MoA	General Model of Aesthetics
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
P1	Primary School Year One
P2	Primary School Year Two
P4	Primary School Year Four
P5	Primary School Year Five
PISA	Programme for International Student Assessment
PRS	Perceived Restorativeness Scale
PRCS-C	Perceived Restorative Components Scale for Children
PVG	Protecting Vulnerable Groups (UK) Scheme
QV	Qualitative Variable
RCS	Restorative Components Scale
RH1	Research Hypothesis One

RH2	Research Hypothesis Two
RI	Richness Index or Richness Index Score
RPE	Reward Prediction Error
SD	Systems Dynamics Methodology
SDT	Self-Determination Theory
UA	Underachievers Group
ZPD	Zone of Proximal Development

### **Statistical abbreviations**

df	Degrees of freedom
H&L	Hosmer–Lemeshow test
KMO	Kaiser-Meyer-Olkin test
LR	Logistic regression
n	Number in sample
ns	Non-significant statistical result
p	Statistical significance
PCA	Principal Components Analysis
(P)	Performance Criterion
(R)	Perceived Restorativeness Scale Criterion
SD	Sample standard deviation
Sig	Significance
SE	Standard error
U	Mann-Whitney test statistic
Z	Wilcoxon’s test statistic
<	Less than
*	Denotes significant results in statistical tables

# CHAPTER 1: INTRODUCTION

## 1.0 Introduction

This chapter begins with some background to outdoor learning, particularly in a Scottish context. It then sets out the issue it seeks to address and the research design, including the overarching aims and objectives, and an overview of the theoretical framework and methodology. It ends on an outline of the subsequent thesis.

## 1.1 Background

Worldwide interest in outdoor learning has been fuelled in recent decades by growing empirical support for its benefits. Studies in Bangladesh (Khan, 2014), Denmark (Nielsen et al., 2016), Germany (Dettweiler et al., 2015), and the USA (State Education and Environment Roundtable, 2005) have all reported significant impacts of teaching outdoors on pupil achievement, motivation and social relations. Research in Spain (Dadvand et al., 2015) and Sweden (Fägerstam & Blom, 2013) suggest natural surroundings promote cognition in schoolchildren. In the UK (Waite, Evans, & Rogers, 2013) and Australia (Malone & Tranter, 2003), wild spaces have been linked to richer language use. Many researchers interpret these findings within the context of biophilia, a theory that humans have a general biological preparedness for the natural affordances, and which may be more conspicuous in young children (Kahn Jr. & Kellert, 2002; Kellert & Wilson, 1995; Wilson, 2007).

In the UK, research also suggests a trend towards an indoor culture for young children (Guldborg, 2007; Playday, 2010; Carrington, 2016), where the increasing attractiveness of technology is implicated, as well as growing perceptions of outdoor risk (Wooley, Pattacini, & Somerset-Ward, 2009). For example, while a Scottish study found the idea of woodlands to be popular with citizens, it also suggested that only around half visit woods annually (Edwards et al., 2009), despite 80% having sites within easy reach (Woodland Trust, 2010). Woodland experiences as a child have been found to be the strongest predictor of frequent visits as an adult (Ward Thompson, 2004). The lack of exposure to nature has been implicated in negative impacts on children which include poor physical fitness (in Higgins & Nicol, 2013), increased fear of natural spaces (Edwards et al., 2009), and a range of behavioural problems (Louv, 2010).

Scotland has been one of the pioneers of outdoor learning (Christie, Higgins, & Nicol, 2015), defined by Higgins and Nicol as “*education in, through, about and for the natural heritage*” (2013, p.621). Speaking of Scottish outdoor learning, Higgins stated:

*“Scotland’s geophysical and climatic factors, distinct cultural identity, and separate education system from the UK has fostered the development of the nation as a world leading location for outdoor education research and practice”* (2002)

When the 1944 Education Act and the 1945 Education (Scotland) Act encouraged the use of outdoor spaces for environmental and nature studies, Scotland became one of the first places in the world to introduce policy support for taking schoolchildren outdoors (Higgins & Nicol, 2013). Since 2010, the resurgence of interest in Scottish outdoor learning has been accompanied by an increasingly joined-up framework of national support.

The Scottish Curriculum for Excellence (CfE) has been an important enabling factor. Introduced in 2004 by Scottish Government, CfE aims to transform education for 3-18 year olds. CfE is underpinned by the principle of *lifelong learning*, and structured around the building of four capacities – *successful learning, individual confidence, responsible citizenship* and *effective contribution* (Education Scotland, 2004). This framework allows for a curriculum which is coherent, yet confers flexibility to explore interdisciplinary, experiential and student-centred approaches such as outdoor learning (Christie et al., 2015).

In 2010 Scottish Government published the “*Curriculum for Excellence through Outdoor Learning*” (Learning and Teaching Scotland, 2010). Argued by Christie et al to offer “*some of the strongest outdoor learning policy language, arguably anywhere in the world*” (2015, p.116), the document includes practical and policy guidance for schools on implementing outdoor learning in support of all eight CfE areas (Learning and Teaching Scotland, 2010; Christie, Beames, Higgins, Nicol, & Ross, 2014). The eight areas are expressive arts, health and wellbeing, literacy (including English, Gaidhlig, Gaelic learners and modern languages), mathematics, religious and moral education, sciences, social studies, and technologies, where *literacy, numeracy* and *health and wellbeing* are recognised as being of special importance (Learning and Teaching Scotland, 2010).

Outdoor learning is also central to Scottish Government's 'Learning for Sustainability (LfS)' agenda. LfS is a schools-based programme which aims to build capacities which promote a sustainable, equitable Scottish society (Scottish Government, 2012). Related Government recommendations include the opportunity for all children to have daily year-round learning and play in nature, in school grounds or other settings (Scottish Government, 2012), and for all schools to "*make outdoor learning a natural and normal part of practice*" and to recognise it as "*a key approach to learning within the curriculum*" (Scottish Government, 2013a) p.6).

In 2012 the General Teaching Council for Scotland, in support of LfS, also introduced outdoor learning opportunities, "*including direct experiences of nature and other learning within and beyond the school boundary*", as a provisional registration standard for student teachers (GTCS, 2012). Moreover, a number of Scottish organisations are actively supportive of outdoor learning, including NGOs (Field Studies Council, Royal Society for the Protection of Birds, John Muir Trust), government agencies (Forestry Commission, Scottish Natural Heritage) and specialist consultants (Grounds for Learning, Creative Star, Mindstretchers, Wild Things).

Nevertheless, despite this framework of national support, studies suggest a highly inconsistent pattern of provision (Mannion, Mattu, & Wilson, 2015), and significant barriers to general implementation. These include teachers' health and safety concerns, lack of confidence, and difficulties getting children out of the classroom (Christie et al., 2014; Dillon et al., 2006; Higgins & Nicol, 2013). The fieldwork and conversations with stakeholders in Scottish Education which took place in the earlier stages of this thesis also suggested a tendency to associate outdoor learning opportunities with only affluent or rural catchments.

The University of Edinburgh has argued that overcoming the barriers requires a more decisive policy commitment from Scottish Government:

*"Despite political support, there remains no national policy, statutory requirements, regulatory mechanisms, formal teaching qualifications, nor quality assurance to encourage, establish and maintain standards of outdoor learning experiences"* (Higgins et al, 2013, p.6).

One intervention considered vital to a sea change is the inclusion of outdoor learning in school inspection schedules, where it is currently rare (Christie et al., 2015; Higgins & Nicol, 2013). In this respect, Christie and colleagues recently argued:

*“Outdoor learning needs to become part of the comprehensive inspection process both within schools and outdoor centres in order to assure pedagogical rigour. Such formal regulation would motivate provision and regulate quality across Scotland”* (Christie et al., 2015, p.118).

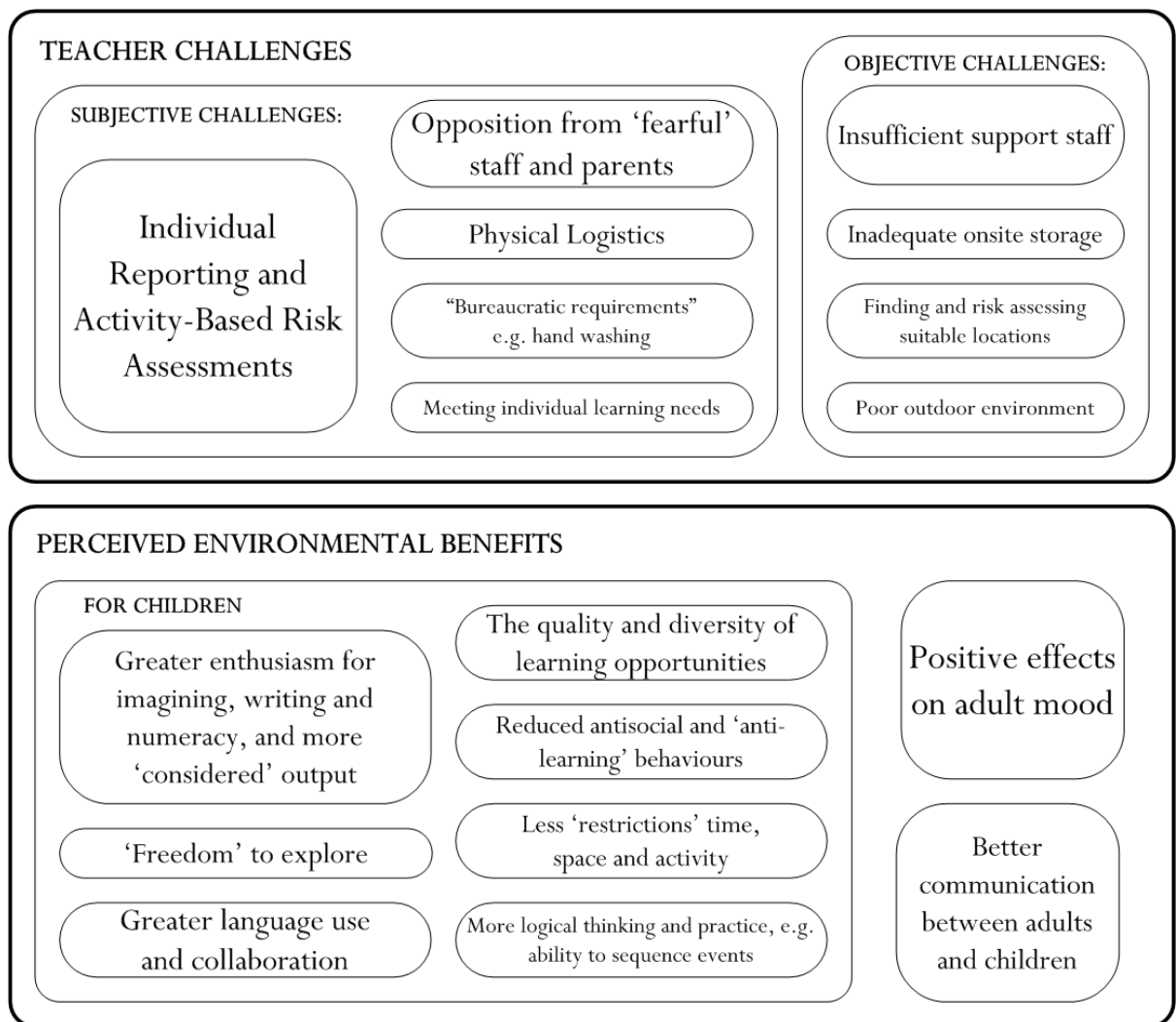
A significant impediment to such a commitment could be the implicit assumption that the benefits of outdoor learning are non-curricular. For example, a Scottish teacher study revealed the decision to take children outdoors was essentially an issue of cost and time weighed against curricular objectives (Ross, Higgins, & Nicol, 2007).

This ‘issue’ cropped up time and again during the exploratory stages of the thesis. For example, Figure 1.1 overleaf shows the outcomes of an exploratory focus group I held with nursery and primary schoolteachers who had trialled outdoor learning for formal learning objectives (n=7). Font size represents the strength of common themes. The overriding challenge for all was onerous reporting requirements (upper box). This was generally felt to be a tacit discouragement, underpinned by the orthodox view that outdoor lessons contributed little to core curricular objectives. For almost half the participants, the additional reporting workload required by the outdoor lesson outweighed their enjoyment and the learning benefits (lower box) to the extent that they would not be taking the initiative forward.

On two other fieldwork visits, I encountered situations where outdoor learning was being championed by one teacher against a culture which regarded it largely as a ‘nice-to-have’ diversion. Christie and colleagues imply similar cultural factors when they refer to the need within some Scottish schools for a *“cultural and philosophical shift from outdoor learning being positioned as a standalone ‘week’ in the school calendar to a fully integrated legitimate pedagogical approach that is woven in to the fabric of the school year”* (Christie et al., 2015, p.116).

Despite encouraging new approaches, CfE still emphasises academic attainment (Scottish Executive, 2004, 2004, 2006). Arguably, only one of the 50 indicators used by Scottish Government to track national performance (Scottish Government, 2011b) has an explicit link to the CfE - *“improve levels of educational attainment”*. This is

determined by the difference in the Programme for International Student Assessment (PISA) scores for literacy, numeracy and science between Scotland and averages from the Organisation for Economic Co-operation and Development (OECD) (Scottish Government, 2011a). While Scotland has maintained a largely static position in global rankings since the inception of CfE, roughly approximate to other UK members, its PISA scores remain below the OECD average, and considerably lower than the highest performers (Audit Scotland, 2014).



**Figure 1.1 Outcomes of an Exploratory Focus Group with Teachers**

While a 2014 analysis by the Office of National Statistics reported Scotland's working population to be the best educated in Europe (Herald Scotland, 2014), they also found it to have Europe's third highest proportion of people with no academic qualifications

(10.3%) (Herald Scotland, 2014). Government figures suggest around a third of the population face challenges and constrained opportunities on account of poor literacy and numeracy (Scottish Government, 2009).

Recent reports also suggest declining national performance for literacy and numeracy in Scottish primary schools (Scottish Government, 2014a, 2015). There are also substantial variations in attainment between council areas, schools and groups, with deprivation levels strongly implicated in underachievement (Audit Scotland, 2014).

Audit Scotland have argued that closing the ‘performance gap’ between underachievers and achievers is critical for improving national attainment, and that is developing pupil motivation and engagement is central to this (Audit Scotland, 2014). Scottish Government acknowledge the performance gap to be “*Scotland’s particular challenge*”, requiring “*outcomes of pupils from challenging backgrounds to improve*”, and services which are better tailored to vulnerable children’s individual needs.

To this end, the Scottish Government emphasise a focus on *early intervention*, as articulated in their ‘Early Years Framework:

*“The early years of a child’s life lay the foundations of skills for learning, life and work and have a major bearing on wider outcomes including employment. The Nobel Prize-winning economist James Heckman has set out an economic case that shows the rate of economic return on early years investment is significantly higher than for any other stage in the education system”* (Scottish Government, 2008, p.3)

The Scottish Government describe the transition from nursery to primary school as “*a critical period*” (Ibid 2008, p.3). Fabian and Dunlop call it, “*one of the most important (periods) in a child’s life (and) a major challenge of early childhood*”, one which imposes an artificial boundary and “*which demands that development has reached particular key markers*” (Fabian & Dunlop, 2007, p.1). There is substantial evidence to suggest starting school is a significant step for children worldwide, regardless of educational culture or system (Margetts, 1999; Fabian & Dunlop, 2007; Peters, 2000).

Initial successes at school, both socially and intellectually, are considered to lead to a “*virtuous cycle of achievement*” (Fabian & Dunlop, 2007). Conversely, children who have difficulty adjusting are less likely to progress effectively (Ladd & Price, 1987; Skarpness & Carson, 1987). Longitudinal educational studies consistently demonstrate the far-reaching effects of early educational interventions (Yeboah, 2002; Early, Pianta,



& Cox, 1999). One cross-cultural review concluded that they yield “*benefits at school entry, in adolescence, or for adults in virtually all studies*”, with the largest gains for disadvantaged children (Barnett, 1995, p.19).

In short, there is a strong implication that a child’s degree of school readiness at transition can set the mould for their subsequent long-term academic success or failure. Equally, it is argued that motivating and engaging disadvantaged children at this sensitive intervention point can deliver far-reaching academic benefits. On such bases, the Scottish Government state “*the impact of transitions in the early years can strongly influence a child’s future progress and development*” and consider transition between nursery and primary school as “*a key current policy priority*” (Scottish Government, 2010).

Nevertheless, austerity remains the economic context for all academic ambitions. Education services are the largest single area of Scottish council expenditure, costing a total of £4.8bn in 2012-13, 80% of which was attributable to primary and secondary education (Audit Scotland, 2014). The educational spend of Scottish councils have seen a 5% decrease in real terms between 2010-11 and 2012-13, largely borne by staff layoffs (Audit Scotland, 2014). Recent announcements of a further 3.5% cut in council budgets imply the likelihood of more to come (BBC News, 2015).

Higgins and Nicol summarise the overarching challenge:

*“In an uncertain financial climate it remains to be seen what priority will be given to supporting outdoor learning in the future, but clearly the growing curricular relevance provides a strong justification. Nonetheless, it remains the case that one common implicit theme of most of Scottish ‘education’ is that it takes place ‘indoors’”* (2013, p.626).

In spite of these challenges, however, there appears to be a growing grass-roots interest in using the outdoors for curricular learning, both corresponding to and reinforcing the support network. A recent survey by the University of Edinburgh found an increased use of natural spaces, particularly by Scottish primary schools. This was promoted by staff enthusiasm for teaching outdoors, as well as good school grounds and local environments. The authors attributed the findings to “*an increasing recognition among teachers and school administrators of outdoor learning as a legitimate approach to delivering the formal curriculum*” (Christie et al., 2014, p.58).

The objective of the aforementioned focus group (Figure 1.1) was to evaluate the success of the outdoors at achieving specific literacy and numeracy objectives. Without exception, the teachers' expectations were surpassed. Many of the schools with outdoor programmes visited during thesis fieldwork, were scoring well for attainment and took the more joined-up approach to learning enabled by the CfE. Typically, headteachers had also adapted the administrative requirements to encourage the teachers to take children outdoors.

However, Christie et al. (2014, p.50) also note that, despite "*a substantial body of literature surrounding (outdoor learning's) possible benefits and unexploited potential (and) the established significance of local contexts*", there remains a lack of high-quality UK research to provide empirical support. Of these, only a handful have investigated the performance implications of early years' outdoor learning (e.g. Waite, Evans, & Rogers, 2013). Worldwide, studies of cognitive impacts remains a tiny fraction of the literature on the human relationship with nature, much of it published over the course of this thesis. To date, a few have researched the academic benefits of greenspace for children in the final years of primary school (e.g. Khan, 2014; State Education and Environment Roundtable, 2005), and all reported positive impacts.

In summary, the last decade has seen a rising interest in outdoor learning, spurred on by empirical support for the benefits, and in the UK, concerns about an increasingly indoor and technology-oriented culture. Scotland has been at the forefront of innovation, attributable in part to an enabling framework of support and curriculum, and a commitment to education towards a sustainable economy. Nevertheless, barriers to adoption remain which may need decisive policy commitments to overcome.

It is proposed a significant barrier may be an implicit assumption that outdoor learning does not further curricular and national objectives for literacy, numeracy and science. National statistics indicate Scotland schools are underperforming globally, and attainment is declining nationally, with a growing performance gap between achievers and underachievers. The Scottish Government emphasises a remedial, evidence-based focus on early years intervention and transition from nursery to primary school, albeit against a background of public service cuts. While there is growing anecdotal support for the curricular benefits of outdoor learning in young children, empirical support remains weak, albeit promising.

## 1.2 Research Issue

The research issue which the thesis aims to address is the absence of research to suggest outdoor learning's curricular relevance for Scottish primary schoolchildren, sufficient to argue for a decisive policy commitment. Empirical support can be considered to have greater potency if it demonstrates a reduction in the performance gap between early years' achievers and underachievers, provides support for the transition from nursery, or contributes to CfE's four capacities: *successful learning, individual confidence, responsible citizenship* and *effective contribution*.

## 1.3 Research Aim and Objectives

### *Research Aim*

The overarching aim of this study is to evaluate the impacts of outdoor and classroom settings on the curricular task performance of primary schoolchildren, with a focus on school starters.

### *Objectives*

In fulfilling this aim the following objectives are proposed:

1. To review theory and empirical research relevant to the development and performance of young children, with a focus on cognitive factors linked to both academic achievement and exposure to natural settings.
2. To develop a theoretical framework, and toolkit for assessing task situations, suitable for comparing and analysing the general cognitive impacts of different outdoor and classroom task settings on young children with limited or variable competencies.
3. To gather a rich ecologically-valid dataset consistent with the theoretical framework, on the task performance of primary schoolchildren in outdoor and classroom learning settings, including data relevant to the transition from

nursery, underachievement, exposure to outdoor learning, and the perspective and experience of teachers.

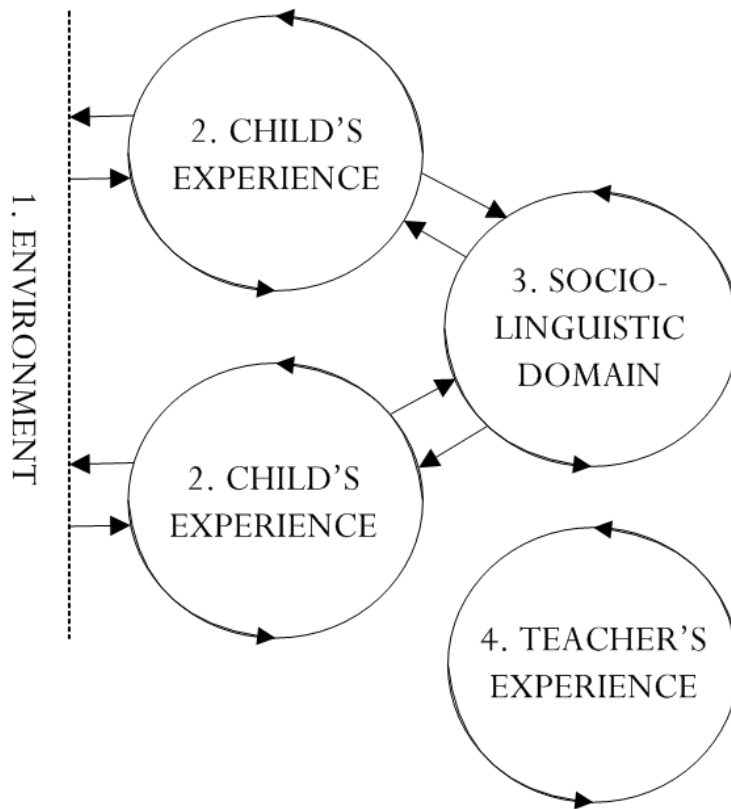
4. To analyse behavioural differences between outdoor and classroom groups and task settings, and their relationship to environmental factors.
5. To discuss findings and their relationship to cognitive factors and the theoretical framework.
6. To draw conclusions and recommendations regarding the value of outdoor learning to primary school educational and policy objectives.

## **1.4 Methodology**

### ***1.4.1 Philosophical Position and Theoretical Framework***

The thesis assumes a realist ontology with a post-positivistic epistemology, at once committed to establishing the reality of the relationship between environment and child cognition, while also acknowledging that knowledge of it is always interpretative, theory-laden and influenced by a particular perspective. The methodology was pragmatic, emergent and flexible, determined by a growing appreciation of the situation of interest and inspired by a view of grounded theory which emphasises abductive interplay between theories, insight and data (Creswell, 2013).

The framework for inquiry and analysis is based on the Santiago Theory of Cognition, a systems-based biological account of cognition in living systems (Maturana & Varela, 1992). This assumes a broader definition of ‘cognition’, here defined as *the experience and process of environmental adaptation, equivalent to action*, where cognition and emotion are inseparable and interdependent in environmental interaction. A systems-based perspective was chosen for being well-suited to the analysis of complex situations involving different levels, and for elucidating relations and dynamics between variables of interest.



**Figure 1.2 Theoretical Framework**

The framework is shown in Figure 1.2 above. This is held to represent a curricular task as discrete system, and the totality of cognitive interactions therein. Four categories (numbered 1-4) are proposed: environmental qualities and affordances (1), and cognitive phenomena associated with the individual children (2), or teacher (4), or social groupings, here termed the Socio-Linguistic Domain (3). Arrows represent the interactions between and within these categories. The Santiago Theory and the framework will be elucidated further in Chapter 3.

### ***1.4.2 Research Design and Methods***

The approach entails four field experiments, repeated measures, with the setting as the independent variable (i.e. indoors vs outdoors), and general performance as the dependent variable. The experiments were curriculum tasks chosen by teachers from their term plans, conducted across three Scottish primary schools with distinctive

contexts. Two of the schools were new to outdoor learning, and one which had an embedded programme. The participants (n=71) were predominantly 'early years' school starters (n=57), average age 5½ years, but included an 'experienced' group with 4-5 years' regular exposure to woodland learning, average age 9½ years (n=14). Thirteen were classified as underachievers. The sample also entails the four supervising teachers.

Children were split into matched groups, and performed the same task outdoors, in either a wood or playground, and then in a classroom, or vice versa. Settings were categorised for 'natural richness' using a checklist of affordances and biodiversity, and tasks were classified according to the degree of environmental interaction they permitted.

A mixed methods approach was taken to data gathering and analysis. There were three consecutive stages, each informed by the fieldwork which preceded it, yet seeking its own novel perspective on the experiments.

Stage 1 entailed qualitative task observations and outcomes, and related analyses. Stage 2 was a follow-up questionnaire 5-7 months post-task, which recorded recollections and preferences in relation to nine measurements. These comprise four performance criteria pertaining to the theoretical framework, four perceived restorativeness scale criteria adapted for early years' (Hartig, Mang, & Evans, 1991), and one baseline measure ('naturalness'). Questionnaire data were statistically analysed for differences between the settings, conceptual underpinnings and associations with setting richness. Stage 3, occurring 7-10 months post-test, involved the questionnaire and a 45 minute focused interview with the participating teachers. Interview data was subjected to a thematic and systems analysis structured by the four categories of the theoretical framework.

## **1.5 Thesis Structure**

The structure of the thesis is determined by the order of its objectives. Chapter 2 (objective 1) reviews literature regarding the cognitive development and performance of young children, with a focus on eight cognitive factors associated with attainment and

natural settings: affordances, motivation, attention, positive affect, physical activity, social interaction, positive feedback and memory. Chapter 3 (objectives 2 and 3) details the theoretical framework and 3 stage methodology devised to gather a dataset relevant to the task performance of primary schoolchildren in both classroom and outdoor task settings. Chapters 4-6 (objective 4) set out the findings of methodology stages 1-3, respectively, regarding behavioural differences between the settings. The main discussion takes place in chapters 7-10 (objective 5) where findings are reviewed in turn by theoretical framework categories and cognitive factors, and outcomes are used to construct a general systems model of relationships between task environments and cognition. Chapter 11 (objective 6) proposes conclusions and recommendations regarding the curricular value of outdoor learning in terms of Scottish educational and policy objectives, and present the completed general model. Finally, Chapter 12 provides an overarching thesis conclusion, including summary of main findings, suggestions for future research, and the limitations and contribution of the thesis.

## CHAPTER 2: ENVIRONMENT AND CHILD COGNITION

### 2.0 Introduction

This chapter addresses the first thesis objective, namely, *to review theory and empirical research relevant to the development and performance of young children, with a focus on cognitive factors linked to both academic achievement and exposure to natural settings.*

There are four sections. The first outlines an educational and developmental context for primary schoolchildren, with a particular focus on school starters. The second reviews literature which suggests a biological preparedness for natural environments, termed *biophilia* (Kellert & Wilson, 1995; Wilson, 1990), with a focus on the theory of affordances (Gibson, 1986). Affordances constitute the first of the eight cognitive factors (CFs), defined here as *factors relevant to child cognition for which there is empirical support for a positive association with academic performance and natural settings.* The chapter's third, and main, section explores theory and research pertaining to the seven remaining CFs: *motivation, attention, memory, positive affect, social interaction, physical activity, and positive teacher feedback*, and includes a brief account of studies which impacts of natural settings on attainment. The concluding section features a summary of main findings and research gaps, and proposes the study's two research hypotheses.

#### *Cognitive Factors*

Before the review, however, it is important to explain the concept of cognitive factors as employed for this thesis (CFs). Cognitive factors are typically defined as internal characteristics which affect performance and learning, and which serve to modulate performance such that it may improve or decline (e.g. Roy, 2013). While the factors described below do include two generally-assumed characteristics of cognition (memory and attention), others are perhaps not what one might immediately associate with cognition from the traditional, strictly-internal viewpoint (motivation; positive affect; social interaction; physical activity; affordances; positive teacher feedback).



Nevertheless, within the broader context provided by the theoretical framework, these factors are all considered to be integral to cognition, and to the modulation of performance. Moreover, in the review and discussion it is always their internal cognitive dimension which is emphasised. Furthermore, on the basis of their links with long-term attainment, it is argued that attainment-supportive experiences in pre-literature and pre-numerate children might be inferred from evidence of impacts on the CFs.

It should also be noted that this chapter has entailed some post-test restructuring. The concept of using CFs as an approach for breaking-up and exploring findings emerged largely during the analysis. Discussion of findings from the ecological perspective of the theoretical framework proved a challenge due to a research literature which often represents cognition as modular, 'in-the-head' and divorced from ecologically-valid environments. Moreover, the interpretation of the findings led into new areas of theory and research which emphasised cognitive factors which were linked, directly or by implication, to attainment and natural environments in the original review. The new reading also suggested the relative importance of these factors, and highlighted interesting interrelationships between them.

Thus I took the approach of discussing each cognitive factor discretely. This broke the challenge into manageable chunks, and enabled me to draw on theory and research related to each CF, while at the same time exploring those interrelationships relevant to the theoretical framework. The intention was that I would later synthesise these discrete discussions into one which focused solely on the ecological aspects. However, they ended up becoming the building blocks of the main thesis argument, and the architecture remained.

In the interests of the reader, the decision was then taken to reorganise the original literature review, and expand upon some areas, so as to complement the CF structure of the discussion. This was deemed important for two reasons. First, it allows for the reader to consider the findings in the context of the discussion to come. Second, it also prepares them for the complex theoretical perspectives and arguments they will encounter in the discussion, while allowing them to refer back easily to relevant sections in this Chapter if context is needed.

Therefore, while the review below emphasises the CFs, the reader should remember that they did not meaningfully inform the methodology and outcome measures, which rather

sought a rich general dataset relevant to performance through a grounded theory approach (Glaser & Strauss, 1967). It is rather the *general* empirical support for a human biological predisposition for natural affordances and the theoretical framework (detailed at the beginning of the next chapter) which underpinned the research hypotheses and methods for testing them.

## **2.1 Educational and Developmental Considerations**

The early years of a child's life are generally regarded as having long-term significance from both an educational and an economic perspective (Margetts, 1999; Fabian & Dunlop, 2007; Peters, 2000; Scottish Government, 2008). In the last chapter (see section 1.1) the transition between nursery and primary school was highlighted as a particularly sensitive period in this respect (Fabian & Dunlop, 2007), where initial successes or failures, both socially and intellectually, can have far-reaching effects on academic achievement (Yeboah, 2002; Early et al., 1999; Barnett, 1995).

Specific challenges children face making this transition include the lack of social, behavioural or academic skills required to deal with the new environment or working alone (Margetts, 1999), particularly for those from disadvantaged backgrounds (Oliver & Smith, 2000). Others are the move from autonomy to an environment of "*conformity, lack of choice and paucity of explanation*", and subjects which are presented in the abstract without any basis in the child's experience (Fabian and Dunlop, 2007). Fabian and Dunlop propose that school is a novel experience which a child can never fully imagine or prepare for beforehand, where the greater the departure from what they're accustomed to, the greater the risk they will fail to understand the new requirements (Fabian & Dunlop, 2007).

In many respects the sensitivity of this transition, and primary schooling, is attributable to this being a dynamic period in the cognitive maturation of children. Piaget's Cognitive Theory represents the most complete account of developmental stages. This proposes a child constructs their understanding of their world, bottom-up, by way of *schemas*: models of meaning and action derived from concrete interaction with the physical and social environment. Schemas are built through the dual processes of

*assimilation*, where new experiences are incorporated into existing schemas, and *accommodation*, where schemas must be adapted to deal with information that cannot be assimilated. Both are motivated by the need to achieve *equilibrium* between internal and external worlds (Piaget & Cook, 1998; McLeod, 2015).

Piaget proposed general cognitive development is always characterised by the same sequence of four stages, each entailing different capacities and experiences. The stages most relevant to the thesis are termed the *preoperational* and *concrete operational*. In the preoperational stage, between around 4-7 years, the infant emerges from building basic sensorimotor knowledge of objects and relations. While perception still hinges on concrete actions, objects and situations, they begin to exhibit primitive reasoning and generalisation skills. Characteristics of this stage include egocentrism and centration, or a tendency to see the world from their perspective only, or focus on a single aspect of a situation, respectively. The stage also features a growing interest and competency in language, symbolic play and social interaction, though these are typically mediated by concrete activities. Between 7-11 years, the age of the thesis's 'experienced group', the child enters the *concrete operational stage*, where thinking becomes less dependent on concrete situations, and more organised, logical and rational. However, the final *formal operations* stage, where abstract thought, reasoning and meaning operate truly free of situational demands remains untypical until around 11-12 years of age.

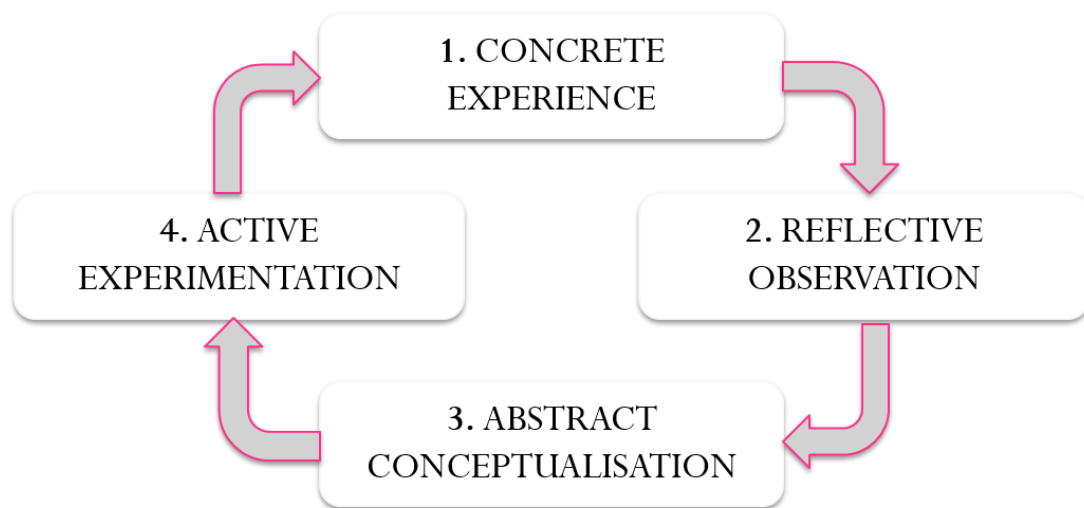
Vygotsky also envisaged a process of development whereby meaning becomes increasingly able to operate independent of immediate perception. Unlike Piaget, however, he viewed this as being mediated primarily through social interaction, which facilitated the internalisation of language and culture until it became the dialogue of thought. A key element in this process is the *zone of proximal development (ZPD)*, which proposes that in social situations, the least equipped children will advance the furthest as the result of being in a field of interaction –the ZPD– with others who have more advanced skills and strategies. Another is *play*. Pretending one object or action is another, Vygotsky argued, enables a new relation between fields of perception and meaning, which is the antecedent of all abstract thought (Vygotsky, 1978b; Vygotsky, 1986).

*Metacognition*, or the ability to think about thinking, is one of the strongest predictors of academic achievement (Lai, 2011; Schneider, 2008; Yilmaz-Tüzün & Topçu, 2009; Veenman, Kok, & Blöte, 2005; Veenman, Van Hout-Wolters, & Afflerbach, 2006).

This emerges at around 4-5 years as fragile capacities to consider the mental states and motives of others (Theory of Mind) (Schneider, 2008), and to introspect on and monitor memories (metamemory) and responses (inhibitory control). Relationships between these capacities, and improved language facility, suggest general developmental underpinnings (Schneider, 2008; Carlson & Moses, 2001). Exhibiting marked individual and situational variation, these develop in strength and accuracy over the course of primary school, consolidating at around 8-10 years. After this, there are dramatic improvements in planning, reflection and self-regulation (Lai, 2011). Classroom learning itself is argued to play a substantial role in metacognitive development, by conferring a conceptual and symbolic toolkit without which abstract thought may not be fully realisable (Bruner, 1986; Luria, 1990).

Another factor held to promote metacognition is experiential richness. The literature is in general agreement that the most successful reflective learning leverages the most personally meaningful and stable concrete experiences. This includes problem solving (Thornton, 1995), judgment and decision-making (Jacobs & Klaczynski, 2012), self-regulation (Bronson, 2002), moral development (Kohlberg, 1984) and cognitive task performance (Donaldson, 1986). Haywood and colleagues propose that mathematical concepts, such as categorisation and serial positioning, cannot be performed mentally until they have first been enacted with concrete objects and internalised (Haywood, Brooks, & Burns, 1992). In a comprehensive review of decades of brain research, McGilchrist paints a picture of a ‘master’ right hemisphere which experiences the world holistically and concretely, and an ‘emissary’ left hemisphere that re-presents this flow in abstract concepts, symbols and linear cause-effect processes, and where *“even those of the highest verbal, as well as spatial, ability probably rely to a greater extent on the experiencing right”* (McGilchrist, 2012).

This bottom-up right-left process is embodied in David Kolb’s Experiential Learning Cycle, shown in Figure 2.1 overleaf (Kolb, 1983). Kolb defines effective learning to be *“the process whereby knowledge is created through the transformation of experience”*, which he argues entails four stages of internal integrative cognition. These are (1) the concrete experience, (2) reflective observation of the experience, (3) abstract conceptualisation of the experience, and (4) the applied testing of related predictive hypotheses, which result in new experiences, and so forth.



**Figure 2.1 Kolb's Experiential Learning Cycle (Kolb, 1983)**

While the absence of metacognitive ability renders its application to early years' children problematic, a critique of the Cycle did find stages 1-3 to be consistent with developmental processes (Webb, 2008). As such, it illustrates how two fundamentals of primary schooling –metacognition and abstract conceptualisation– depend initially on concrete experiential referents.

This dependency may underpin an innate inclination in children towards learning through interaction with natural environments, such as is put forward by some developmental theorists. Three relevant theories are outlined in Table 2.1 overleaf alongside Piaget's, with which their stages approximate.

Bateson and Martin (2000) propose we are born with an innate attraction or connection to the natural environment which, over the stage where preoperational thought is evolving into concrete operations (McLeod, 2015), develops an emphasis on physical engagement. This continues until adolescence, when there is detachment from the natural world to pursue sociocultural interests.

David Sobel's theory resulted from an analysis of neighbourhood maps of hundreds of children across England, the US and the Caribbean (Sobel, 2013). Up to the age of around 7 years, these tended to focus on the detail of their home territory, with particular attention to and empathy for wildlife. However, from 7-12 years, boundaries expanded to include woods, parks and playgrounds, with a predilection for physical

exploration and construction. At around 12-15 years, favourite places began to shift from natural to town settings, and revolve more around socialising with peers.

Stages (approx)	Piaget (McLeod, 2015)	Bateson & Martin (2000)	Sobel (2013)	Cobb (1977)
2-7 years	<i>Preoperational</i> with primitive reasoning and generalisation skills, tendency to focus on one aspect of a situation, egocentric thought, rich symbolic play	<i>Natural attraction or direct felt connection</i> with the natural world	Focus on detail and connection with <i>home</i> territory, <i>empathy</i> with natural world	<i>Infancy</i> and dependency
7-12 years	<i>Concrete operations</i> involve more organised, rational and logical thinking, difficulty thinking abstractly or hypothetically	<i>Physical engagement</i> with natural environments	<i>Exploring</i> woods and parks, developing skills, extending territory, den-building	Latent <i>middle childhood</i> – mastery through ‘evocative’ experience of natural world
12+ years	<i>Formal operations</i> enable abstract reasoning and ability to manipulate ideas	<i>Detachment</i> from natural world, and interest in culture and socialisation	<i>Social gathering</i> places and peers interest moves to town	<i>Adolescence</i>

**Table 2.1 Key Stages from Four Theories of Child Development**

Lastly, in her influential theory of how creative imagination develops, Edith Cobb proposes that at around the age of 6, the child transitions from infancy, a stage concerned with problems of dependency, into the latent period (Cobb, 1977). Lasting till the onset of puberty and adolescence, the latent period, or middle childhood, is described by Cobb as:

*“A special period...when the natural world is experienced in some highly evocative way, producing in the child a sense of some profound continuity with natural processes and presenting overt evidence of a biological basis of intuition”* (Cobb, 1959, p.538).

For Cobb, a child in the latent period is gaining a sense of control over its body, language, thoughts and imagination, and seeks interaction with the natural environment as a route to self-mastery in all these things:

*“Their surroundings are not separated into nature and artifact. His (i.e. the child’s) environment consists of the information fed back to his own body by environmental stimuli. This responsiveness includes all levels of the child as a functioning organism. All relations of his body to his surroundings are in this sense natural. In natural science the mutual relations, the adaptive give and take between living organisms and their environment, represent the ecology of the individual organism. In this sense, life is a matter of mutual, functional interaction or intercourse with the environment. This mutuality is equally nourishing and productive of life and form to the mind and to the body“ (Cobb, 1977, p.29).*

Thus, all three theories share the common hypothesis of a middle childhood where our mental and physical self-competencies are honed through exploration of the natural world, before we move into a more sociocultural sphere of thought and interaction in early adolescence.

In summary, there is general agreement that the transition from nursery to primary school is a significant stage for a child, one which has far-reaching implications for educational achievement. The developmental psychological literature suggests that over the course of primary school, a child’s field of meaning becomes ever more able to operate independently of their concrete experiences. Central to this process is metacognitive ability, which both promotes and is promoted by formal learning, and may be underpinned by rich and stable experiential schemas. Some theories imply a developmental bias in preoperational children towards natural environments as a basis for rich experiential learning and self-actualisation.

## **2.2 Biophilia and Natural Affordances**

Biophilia is a biological theory which proposes humans have an unconscious urge to affiliate with other forms of life (Kellert & Wilson, 1995). Since Edward O Wilson ventured the original Biophilia Hypothesis in the early 1970s (Wilson, 1990), a substantial body of research has grown in support of an innate human predisposition for natural environments. At the level of fine-grained perception, there are correspondences between the behavior of the primate visual receptive field and the

fractal properties of natural scenes (Olshausen & Field, 2000). Eye-tracking analyses suggest natural scenes are easier for us to process than urban ones (Berto, Massaccesi, & Pasini, 2008). There is an association between preference for natural scenes and the congruence of accompanying sounds, but not for urban scenes, suggesting a default natural setting for visual and auditory modalities (Anderson, Mulligan, Goodman, & Regen, 1983). A Japanese study reported direct benefits of forest scents for the immune system (Li, 2009).

There is also a strong basis for psychological preparedness. As well as a general preference for natural environments, this also includes a common well-being response, enhanced cognitive functioning on non-urgent tasks, a sense of affiliation with animals, and innate 'biophobic' fears of snakes and spiders (Kahn Jr., 1997; Kellert & Wilson, 1995; Kahn Jr. & Kellert, 2002; Ulrich, 1993). A study of African-American elementary schoolchildren from inner-city Houston found a preoccupation with nature which belied their harsh urban surroundings, leading the authors to conclude, "*nature is not a mere cultural convention or artifact – as some cultural theorists might suggest – but a physical and biological reality that bounds children's cognition*" (Kahn & Friedman, 1995; p.54). Tuan cites feral children, who, while socially and culturally disadvantaged, have survived till maturity without human intervention. He also notes the tendency of children worldwide towards the same natural affordances, such as playing with water, clay and sand, climbing trees, and sliding down slopes (Tuan, 1978).

The idea of affordances bridges biophilia and cognition. Gibson conceived an 'affordance' to *be an invariant environmental property or entity, which is perceived directly by an organism as an 'action possibility'*, such as building, sitting, moving or feeding (Gibson, 1986). Affordances are not viewed to be a mental state, but rather an ecological and functional state of an organism moving through an environment for which it is biologically prepared. It is proposed that affordances enable environment to be experienced directly, without interpretation or higher processing, as patterns of meaning and action fundamental to survival, rather as fragmented perceptual features and cues. The total kit of affordances a particular species utilises to support life is termed its 'ecological niche', defined specifically as "*a setting of environmental features that are suitable for an animal, into which it fits metaphorically*" (Gibson, 1986, p.129). In the sense that affordances enable and regulate interaction with the



environment, Gibson regarded the relationship with them to be the very definition of psychological phenomena (Reed, 1996).

The philosopher Edward Reed describes cognition in relation to affordances as “*neither copying nor constructing the world (but) the process that keeps us active, changing creatures in touch with an eventful changing world*” (1996, p.13). In this context, he defined behaviour as “*an animal’s ability to change its relationship with its surroundings (and) inseparable from awareness*” (1996, p.97). Reed acknowledges Homo sapiens’ unique capacity for creating new affordances, and adapting habitats for its own purpose. However, he also argues that the structure of our daily life was, until the last few centuries, largely universal. Ordinarily, this revolved around small stable social groups, and was taken up with food production and preparation in fields, bogs, hillsides, near bodies of water or in forests, and entailed general agreement on which natural affordances were useful or valuable (Reed, 1996).

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Flat, relatively smooth surface, affords: <ul style="list-style-type: none"> <li>• walking, running</li> <li>• cycling, skating, skateboarding</li> </ul> </li> <li>2. Relatively smooth slope, affords: <ul style="list-style-type: none"> <li>• coasting down (e.g. on bike)</li> <li>• rolling, sliding, running down</li> <li>• rolling objects down</li> </ul> </li> <li>3. Graspable/detached object, affords: <ul style="list-style-type: none"> <li>• drawing, scratching</li> <li>• throwing</li> <li>• hammering, battling</li> <li>• spearing, crumpling, squashing</li> <li>• building of structures</li> </ul> </li> <li>4. Attached object, affords: <ul style="list-style-type: none"> <li>• sitting-on</li> <li>• jumping-on/over/down-from</li> </ul> </li> <li>5. Non-rigid, attached object, affords: <ul style="list-style-type: none"> <li>• swinging-on (e.g. tree branch)</li> </ul> </li> <li>6. Climbable feature, affords: <ul style="list-style-type: none"> <li>• exercise/mastery</li> <li>• looking out from</li> <li>• passage from one place to another (e.g. ladder)</li> </ul> </li> </ol> | <ol style="list-style-type: none"> <li>7. Aperture, affords: <ul style="list-style-type: none"> <li>• locomoting from one place to another</li> <li>• looking and listening into adjacent place</li> </ul> </li> <li>8. Shelter <ul style="list-style-type: none"> <li>• locomoting from one place to another</li> <li>• Microclimate</li> <li>• prospect/refuge</li> </ul> </li> <li>9. Mouldable material (e.g. dirt, sand), affords: <ul style="list-style-type: none"> <li>• construction of objects (e.g. pottery)</li> <li>• modification of its surface features (e.g. sculpting)</li> </ul> </li> <li>10. Water, affords: <ul style="list-style-type: none"> <li>• splashing</li> <li>• pouring</li> <li>• floating objects</li> <li>• swimming, diving, boating, fishing</li> <li>• mixing with other materials to modify their consistency</li> </ul> </li> </ol> |
|--|---|

**Figure 2.2 Functional Taxonomy of Children's Outdoor Environments** (Heft, 1988)

Some researchers have sought to assess the impacts of natural affordances on children’s behaviour. Harry Heft proposes a preliminary taxonomy of natural affordances (see

Figure 2.2) for assessing outdoor settings and environmental relationships over the course of development (Heft, 1988). Ingunn Fjørtoft found a strong relationship between Gibson's conception of natural affordances and types of play in nursery schoolchildren, using methods of landscape ecology and a global information system (GIS) to model outdoor sites for diversity of vegetation types and topography, (Fjørtoft, 2001; 2004). The potentiality of natural affordances, particularly loose materials, to afford richer cognitive play behavior opportunities, compared to manufactured ones, was reported by a recent study which mapped cognitive play behaviour in natural and traditional preschool playground settings (Zamani & Moore, 2013). Kirkby reported a strong preference for natural versus playground equipment in a study of nursery schoolchildren (n=80), with 68% of play being developmentally significant in natural refuges, compared with only 42% in built ones (Kirkby, 1989). A US study found an association between levels of vegetation and trees, and the creative play of inner-city children across 64 outdoor spaces ( $p < .05$ ) (Taylor, Wiley, Kuo, & Sullivan, 1998).

An evaluation of the impacts of four forest school programmes, found primary schoolchildren (n=59) rated the environment highly for imaginative play, and interpreted it for their own purpose, spontaneously and naturally (Waite & Davis, 2007). A study which compared the after-school and break-time behaviour of 7-9 year olds in playground and woodland settings, reported significantly greater use of affordances in the latter, including making dens, new paths and trails, and viewing locations, with heavy use of loose natural materials to elaborate constructions (Miller, 1984).

A longitudinal Swedish study reported significantly more creative and varied activity in an 'all weather' outdoor kindergarten in rich natural surroundings, versus another in a quiet urban setting with a high quality playground. For the latter, the principal activity observed was cycling, while in the outdoor kindergarten, play entailed "*complex procedures and roles, with the playground at times a battlefield, at times a space adventure, at time a mythical landscape with fairies and queens, at times a shopping centre*" (Grahn et al, 1997, p.2).

But how do classroom settings fit into a theory of affordances? Reed proposes that in the modern world, children's natural environments have been purposefully modified in a way that emphasises some action possibilities and downplays others (Reed, 1996). Kyttä's Bullerby Theory adopts a similar position, proposing and identifying four

categories of children's learning environments according to the richness and accessibility of their affordances (Kyttä, 2003).

One ecological psychological theory which has been researched in a school context is Barker's theory of *behaviour settings*. A behaviour setting is a concept, or milieu, which combines physical environmental features with standing patterns of behavior and ongoing patterns of activity. Examples include a school, church, shop, or sports field. Like affordances, a behaviour setting is proposed to entail a direct functional relationships between perception and environmental properties (Barker, 1990).

Based on their extensive empirical work at the Midwest Field Station, Barker and his team came to argue that human behaviour is 'radically situated', that is, predictable according to the behaviour setting in which it occurs. They observed less variation in behaviour between individuals within a particular setting, than in individual behaviour between different settings. They argued that an individual entering an unfamiliar setting –such as a school starter– will experience pressures, supporting and constraining, to conform to the behavioural norm, a relationship termed a behaviour-milieu synomorphy. One of Barker's team, Paul Gump, found strong support for the concept of synomorphy in schools, reliably identifying and describing behaviour settings which varied according to the subject taught. He argued these settings worked first by coercing the teacher, who then shaped the pupils' behaviour, where both were equally influenced by the 'pressures' (Gump, 1967; 1978).

In summary, there is growing empirical support for children's biological preparedness to perceive, and learn from, natural environments. Affordances may offer a theoretical bridge between biophilic affinity and cognition, and some studies imply an association between natural affordance richness, and physical and imaginative play in children. School 'behaviour settings' might be conceptualised as modern environments where affordances and behaviour are being managed towards specific cultural ends.

*Affordances* are the first of the thesis's eight CFs.

### **2.3 Cognitive factors**

This section investigates the thesis's seven remaining CFs. Each will be addressed in turn, including a definition, outline, review of related theory and research regarding

cognitive and outdoor learning impacts, and a summary of key points. The section begins with an overview of studies which link exposure to natural settings to primary school attainment.

### ***2.3.1 Academic Attainment***

A few studies imply general benefits of natural settings for primary school attainment. A Bangladeshi study which evaluated the performance of 8-10 year olds (n=30) taught in an outdoor classroom, found their mean on standardised academic post-test scores to be almost double that of a matched group allocated to an indoor condition (Khan, 2014).

In 2005, the State Education and Environment Roundtable studied the impacts of EIC programs on the academic achievement of 4 Californian elementary schools (i.e. the US equivalent of a primary school) in comparison to matched schools employing traditional programs. EIC stands for “*environment as integrated context*” and refers to an approach where natural surroundings and community provide a framework for student-guided experiential learning. The EIC schools outperformed, or scored as well as, control schools on over 96% of all tests, with significantly higher results for all reading assessments, 98% of the spelling, 95% of language, and 93% of the maths. In 42% of the cases the treatment schools scored significantly higher than the controls for all four tests (State Education and Environment Roundtable, 2005). The findings reinforced a previous 8 school study, where in 101 of 140 assessments EIC students scored higher than traditional counterparts (State Education and Environment Roundtable, 2000).

A Californian study of the impacts of three outdoor programs on 119 at risk students, aged 11-12 years, found their science scores improved significantly from pre-to-post-test surveys in relation to an indoor control group, with an average gain of 27% (AIR, 2005). Similar longitudinal studies of environmental or place-based programs in North America have consistently shown treatment schools, or groups, significantly outperforming indoor controls on maths, literacy, and science (Bartosh, 2003; Duffin et al, 2004; Lieberman & Hoody, 1998; NEETF, 2000; Simone, 2003), as well as noting greater transferability of learnings (NEETF, 2000) and higher averages for grade points

and scholarship awards (Bartosh, 2003). While most of these entail environmental programs with older children and a broader scope than the present study, the evidence does suggest links between outdoor experiential learning and academic achievement.

### **2.3.2 Motivation**

‘Motivation’ is here defined as *what moves us, literally and metaphorically, or how our desires and needs are made manifest in our environmental interactions*. Motivation to learn is a key goal of educators, and associated with optimal cognitive and academic performance (Deci, Vallerand, Pelletier, & Ryan, 1991; Klem & Connell, 2004).

Traditionally, psychologists have regarded motivation as an internal cognitive state, or mechanism, orienting the organism toward activities relevant to needs and goals. An alternative ecological position views motivation in terms of a functional relationship with environment. From this perspective, motivation is an innate non-unitary phenomenon, where, in the words of the philosopher, Edward Reed, “*efforts may be influenced by internal mechanisms, but not reduced to them*” (Reed, 1996, p.110).

There is a basic empirically-supported distinction between intrinsic and extrinsic motivation. *Intrinsic motivation* entails energised participation in an activity for its inherent interest or enjoyment, and *extrinsic motivation*, doing something because it leads to external outcomes or rewards (Ryan & Deci, 2000). A meta-analysis of the literature on school motivation found support for the hypothesis that performance goals had an undermining effect on intrinsic motivation, compared to mastery goals (Rawsthorne & Elliot, 1999). Children intrinsically motivated to learn, or who have developed autonomous regulatory styles, exhibit better academic achievement, conceptual understanding, school attendance and social adjustment than those who are extrinsically motivated, who are also associated with greater anxiety and poorer coping with failures (for review see Deci, Vallerand, Pelletier, & Ryan, 1991). In the words of Deci and colleagues,

*“Intrinsic motivation has emerged as an important phenomena for educators—a natural wellspring of learning and achievement that can be systematically catalyzed or*

*undermined by parent and teacher practices...(and which) results in high-quality learning and creativity”* (Deci et al., 1991, p.55).

The principal theory and research programme pertaining to intrinsic motivation is Deci and Ryan’s Self-Determination Theory (SDT), a component of which is Cognitive Evaluation Theory (CET). CET proposes there to be three universal needs relevant to situations inherently appealing for a child – *autonomy, perceived competence* and *relatedness* – and in so far that social and physical contexts do not satisfy these, intrinsic motivation and natural development processes will be inhibited (Deci & Ryan, 2000, 2000, 2002; Deci et al., 1991).

*Autonomy* is defined as the feeling one is the originator of one’s own actions, and the perception that these are an expression of one’s own self, interests and integrated values. Studies suggest autonomy is the cardinal need, in that the other two will only enhance intrinsic motivation if the context is also autonomy supportive (Deci et al., 1991).

*Perceived competence* is feeling effective in one’s environmental interactions, and the ability to exercise and express personal talents (Deci & Ryan, 2002).

*Relatedness*, added in a later refinement of the CET, is a sense of belongingness and secure connection with one’s social group, which is not necessarily related to goal or status attainment.

Deci and Ryan emphasise CET’s evolutionary underpinnings. They regard intrinsic motivation be a functional process where *autonomy* is preeminent, and described as “*perhaps, the most fundamental characteristic of (all) living things*” for (Deci & Ryan, 2000, p.253). While CET tends to focus on the impacts of the social environment over the physical, Deci and Ryan acknowledge that “*people can initiate and regulate their actions in different ways that are relatively independent of the social context*” (Deci & Ryan, 2002, p.13). Furthermore, neither of the primary cognitive processes by which CET proposes environment to influence intrinsic motivation – the *locus of perceived causality* of an interaction (i.e. internal or external), or its *effect on perceived competence* – are strictly dependent on a social context.

A theory which converges with CET, but takes a more moment-to-moment experiential perspective on intrinsic motivation, is Csikszentmihalyi’s Flow Theory (2000, 2008).

The theory pertains to the ‘flow state,’ which is argued to be the optimal human experience, and is articulated as follows:

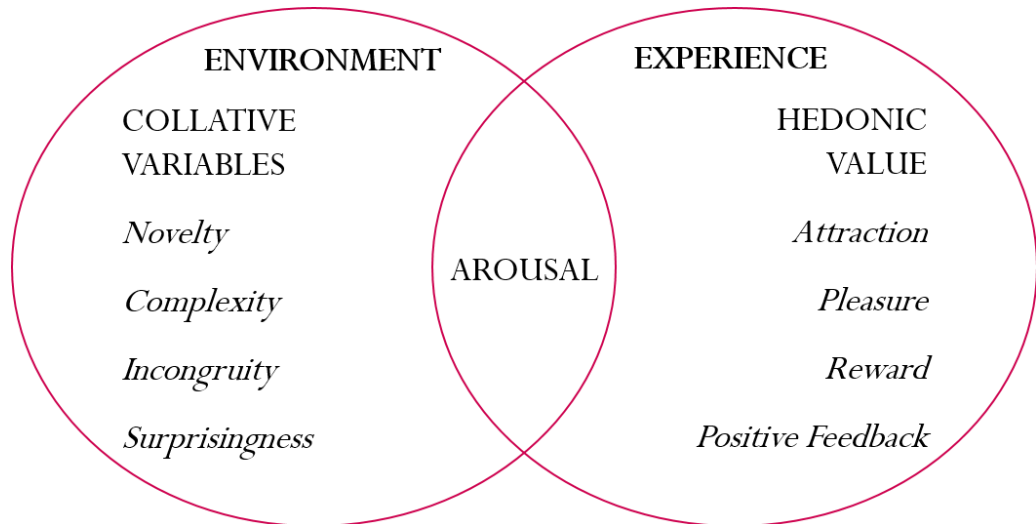
*“In the flow state, action follows upon action according to an internal logic that seems to need no conscious intervention by the actor. He experiences it as a unified flowing from one moment to the next, in which he is in control of his actions, and in which there is little distinction between self and environment, between stimulus and response, or between past, present, and future. Flow is what we have been calling “the autotelic experience” (Csikszentmihalyi, 2000, p.36)*

Deci and Ryan regard CET as providing a fuller, rather than an alternative, account of the autotelic experience (Deci & Ryan, 2000). While Csikszentmihalyi does not mention autonomy, control over self and environment is a defining feature of flow. Perceived competence is also implied by flow’s association with optimal challenge, described as *“going beyond the known, a stretching of one’s self toward new dimensions of creativity, skill and competence”* (Csikszentmihalyi, 2000, p.32). One distinctive feature of the autotelic experience is *the loss of the self-construct*, where it is proposed flow activity can lead to a *“transcendence of individuality (and) fusion with the world”*, where *“self-ish”* considerations become irrelevant (2000, p.43).

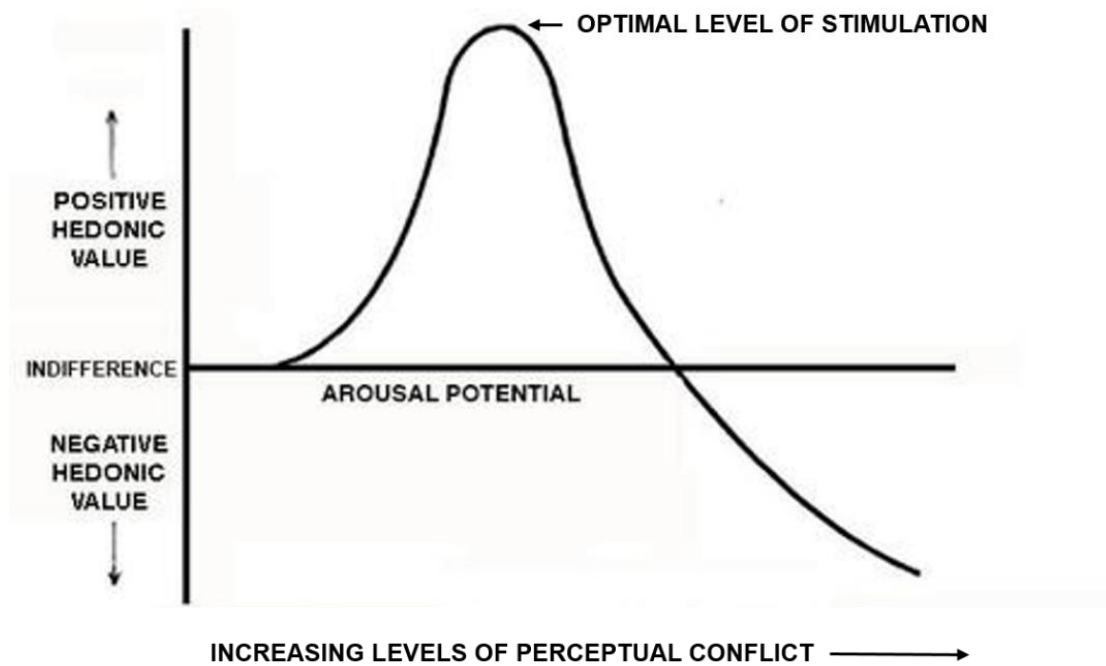
Csikszentmihalyi argues flow to be a functional state which serves to regulate environmental stimulation and challenge at individually-optimal levels. His research suggests autotelic experiences are associated with wellbeing, and flow deprivation, with negative cognitive and emotional consequences (Csikszentmihalyi, 2000). A recent neuroscientific model by Sung-il Kim gives support to the concept of flow, proposing sub-processes which make fine-grained predictions for action, and where motivation or demotivation depends on whether environmental feedback is better or worse than predicted, respectively (Kim, 2013).

Although it seeks to explain our appreciation of beauty, rather than environmental motivation, Berlyne’s General Model of Aesthetics (Berlyne, 1971) is cited by both Kim and Csikszentmihalyi for its convergence with their theories. Based on extensive laboratory research on what stimuli people find attractive or not, and related responses, Berlyne identified four properties of environment salient to an aesthetic response. Termed *collative variables*, these were levels of experiential *novelty*; *complexity*, or intrinsic variety; *incongruity*, or mismatch between an environmental element and its context; and *surprisingness*, or unexpected environmental elements.

He proposed we are motivated to seek out the collative variables in our environment through *diversive exploration*, or resolve them through *specific exploration* when they provoke *perceptual conflict* between our past and present experience, processes which Kim considers consistent with neurophysiological evidence (Kim, 2013).



**Figure 2.3 Model of the Aesthetic Response (Berlyne, 1971)**



**Figure 2.4 Relationship between Arousal and Hedonic Value (Berlyne, 1971)**



The graph in Figure 2.4 represents our affective response to the collative variables. This is expressed in the form of an inverted U-shaped curve comprising two related dimensions, *arousal* and *hedonic tone*. Berlyne proposed that the greater the *perceptual conflict* elicited by a stimulus (i.e. levels of the collative variables), the greater the *arousal* we experience (Y-axis). As levels of arousal and perceptual conflict increase (X-axis), the pleasure we derive from the stimulus, or its *hedonic tone*, grows, peaks, then declines, until eventually becoming unpleasant.

A growing number of studies suggest motivational impacts of natural environments on children. A key observation of the Bangladeshi primary school study outlined above was the children's enhanced enthusiasm for learning outside, compared with the indoor group (Khan, 2014). A main finding of Californian research into the effects of an outdoor program on 11-12 year old at-risk children was their significantly greater motivation to learn compared with a classroom control (AIR, 2005). A common theme of an evaluation of environmental education across five Washington schools was motivation stimulated by natural interest in the outdoors (NEETF, 2000). Engagement in learning was also a general finding of a survey of 338 educators from 55 US schools using place-based educational programs (Duffin et al., 2004). Heightened motivation and enthusiasm was also a generally reported outcome of qualitative research on school gardening in kindergarten and primary school (Blair, 2009).

Improved motivation and self-confidence were general findings of an 8 month UK study into the impacts of forest learning on nursery and primary schoolchildren (n=24). Additional benefits reported included enhanced physical skills, concentration, language, communication and language, although some changes took time to manifest (O'Brien, 2009). A Scottish study of 9-11 year olds' found that low motivation was not a barrier to physical activity in forest school, and males and females did not exhibit different motivational levels, unlike typical school environments (Lovell, 2009). The majority of parents completing a survey following a 6 week forest school study of 5 year olds (n=36), reported their children had become more confident as a result, including all but one of those considered quietest (Davis & Waite, 2005). Other UK research on the impacts of forest school programmes have returned similar findings, including schoolchildren seeming more spontaneous, expressing feelings and thoughts in uninhibited ways (Waite & Davis, 2007), and becoming more confident in conversations with adults (Massey, 2002).

A review of outdoor learning research reported greater student confidence among the most important impacts, as well as an enhanced motivation to learn, and sense of belonging and responsibility (Rickinson et al., 2004). A review of adventure education research proposed that underlying the strongest long-term impacts, was a common theme of personal *“independence, confidence, self-efficacy, self-understanding, assertiveness, internal locus of control and decision making”*. The authors concluded outcomes related to *“a sense of control over or regulation of the self, responsibility, or an assurance of self (and that) adventure programs appear to be most effective at providing participants with a sense of regulation”* (Hattie, Marsh, Neill, & Richards, 1997). Pupils’ increased sense of personal autonomy, competence and creativity were also common themes arising from a survey of the significant memories of outdoor teachers (n=334) of nursery and primary schoolchildren (Waite, 2007).

Regarding school settings, Gump found that primary school classrooms which conferred greater freedom of choice were associated with improved motivation to learn and attendance (Gump, 1978). Conversely, another influential study concluded an association between classroom settings and repeated denial, delay, interruption, and distraction, could be responsible for a steady decline in motivation over school life (Jackson, 1990).

In summary, motivation to learn is positively associated with attainment. Some ecological theories share a view of motivation as a functional adaptive process which serves to regulate environmental stimulation at personally-optimal levels. Child research also implies positive impacts of natural environments on motivation to learn, self-confidence and sense of autonomy, compared to other settings.

### **2.3.3 Attention**

‘Attention’ is defined here as *how cognition relates actively to environment* (Cherry, 2015a), *through orientating towards some sensory features and inhibiting others* (Smith & Kosslyn, 2013). Attention, while associated with empathy (i.e. attention to other

people's states) (Posner, 2008), has been shown to be conceptually distinct from other interpersonal behaviours (Duncan et al., 2007).

Research suggests attention to be among the most powerful of attainment predictors. A meta-analysis of 6 large-scale longitudinal studies of nationally representative groups of children in the US, UK and Canada, found that of a range of school readiness indicators, only attention-related skills consistently predicted attainment. This was the case after controlling for academic preparedness, cognitive ability, gender and socioeconomic status. Neither problem behaviour nor social skills were significantly implicated (Duncan et al., 2007). Another analysis of 20 years of UK survey data from 14,000 mothers in the former county of Avon found that capacity to control and sustain task attention was significantly associated with greater academic progression in primary and secondary schools (Gutman & Vorhaus, 2012). Other research suggests the negative performance effects of factors such as emotional stress (Evans, 1991) and environmental noise (Klatte, Bergström, & Lachmann, 2013; Glass & Singer, 1972) could be attributable to attentional impacts. Noise effects are more pronounced in young children, because they are less able to separate specific and background sound information, or use existing knowledge or contextual cues to decipher degraded input (Klatte et al., 2013).

Neurophysiological research suggests attention entails two functionally independent, yet interrelated, neural systems. These are the *voluntary* system, guided by executive functions; and the *ventral* system which deals with the detection of unexpected or novel environmental information (Corbetta & Shulman, 2002). The Theory of Integrated Competition model, which merges evidence from psychology and neuroscience, proposes the two may collaborate to resolve competition between exogenous and endogenous stimuli, respectively (Desimone & Duncan, 1995).

Attention's basic *psychological* distinction, originating with William James, also involves two categories: *directed attention*, which is effortful and under the will of the agent; and *fascination*, which is effortless and under control of the environment (James, 2012). Kaplan and Kaplan propose that modern life and work put heavy requirements on *directed attention*, and the resulting mental fatigue has negative consequences for our performance and well-being. Their Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989) suggests that natural environments can help restore attention through engaging our *soft fascination*. Soft fascination is held to be pleasurable and expansive

(e.g. “*clouds, sunset, scenery*” (Kaplan & Kaplan, 1989, p.192), as distinguished from *hard fascination*, where stimuli commands intense attention (e.g. in a violent incident).

In addition to (soft) *fascination*, ART proposes three other interrelated qualities of restorative environments. *Extent* is the perceived scale and connectedness of elements making up an environment, both physical and imaginative, and is built through *fascination*-driven exploration. *Compatibility*, which also contributes to *extent*, is the degree to which a setting is felt to complement personal goals and disposition. Last, is a sense of *being away*, both physically and psychologically, from demands on directed attention in a way which allows *fascination* to flourish.

Derived from ART, the Perceived restorativeness scale (PRS) is a measure of the restorative impacts of different environments (Hartig, Korpela, Evans, & Gärling, 1997). The PRS, and its offshoot, the Restorative Components Scale (RCS) (Laumann, Garling, & Stormak, 2001) have since provided robust validation of ART’s four components and their association with natural settings (Hartig et al., 1991). To date only one study has involved schoolchildren. It found that 8-11 year olds (n=112 boys, n=113 girls) perceived their playground to be more restorative than their school library (Bagot, 2004).

Other approaches also suggest the attentional benefits of natural settings. In the 4 month Swedish study, mentioned above, children at the outdoor kindergarten made significantly less mistakes on a weekly test of concentration, compared to the urban nursery, otherwise matched for reputation and staff quality (Grahn et al., 1997). US research which compared the directed attentional capacity of children (n=17), aged 7-12 years from low income families, before and after they moved house, found the core predictor of positive impacts to be the surrounding naturalness of their new home. The author speculated that this indicated a “*a partly genetic response, disposition to nature*” (Wells, 2000, p.126).

A major 12 month study of 36 Barcelona primary schools, found an association between their levels of natural surroundings (assessed using satellite data), and a significantly greater reduction in pupil inattentiveness (n=2,593) (Dadvand et al., 2015). A link between the greening of school grounds and performance was also reported in a study of 16 elementary schools in Ontario, which highlighted stronger impacts for socioeconomically disadvantaged children (Simone, 2003).

A study of inner city children, average 9.6 years, randomly allocated to identical high-rise blocks, found the more natural the view, the better girls performed on tests of concentration, impulse inhibition and delay of gratification (n=78) ( $p < 0.0001$ ). No effect was found for boys, which the authors attributed to a more outdoor lifestyle (Taylor, Kuo, & Sullivan, 2002). Finally, a recent study found cognitively-fatigued nursery and primary schoolchildren responded faster on an attention task after a walk in nature, than one in an urban area (Schutte, Torquati, & Beattie, 2015).

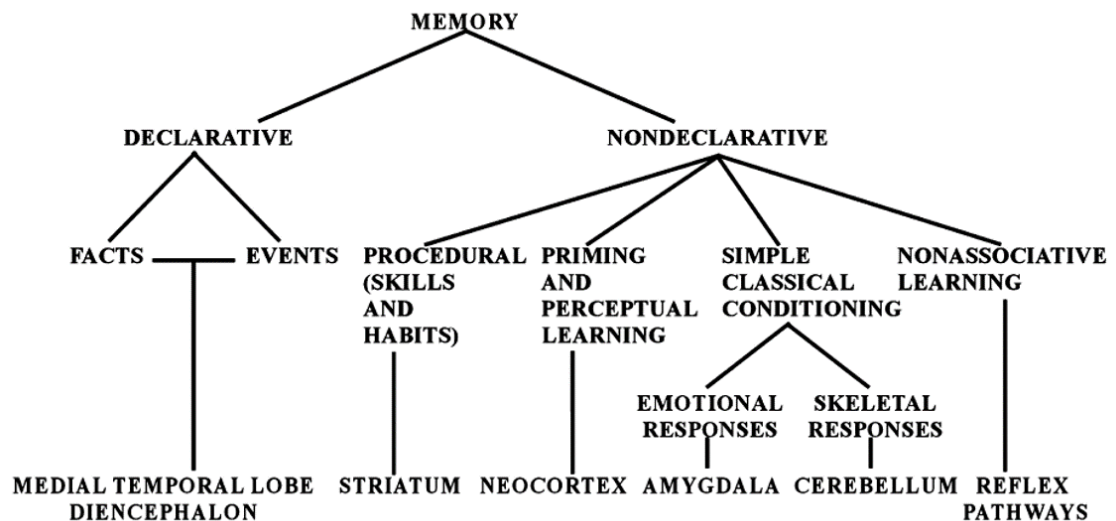
To summarise, attentional ability is perhaps the strongest of all predictors of long-term attainment. There is cross-disciplinary empirical support for a basic distinction between forms of attention which are determined by endogenous or exogenous conditions. In psychology, these are termed *directed attention* and *fascination*, respectively. Research implies that natural settings promote *fascination*, and have benefits for *directed attention*.

### **2.3.4 Memory**

‘Memory’ is defined here as *how we store, recall and apply past experience*. Theory and research suggest a fundamental role for memory in early years’ performance. Working memory is implicated in success at long-term memory coding and retrieval, knowledge and skill acquisition, and reading, mathematics and computation, all with far-reaching consequences for academic attainment (Alloway & Alloway, 2010; Engel de Abreu et al., 2014; Swanson, 1994). Effective long-term memory underpins educational achievement, and is thought to depend on a knowledge framework which enables relational structuring (Ceci & Bruck, 1993; Piaget & Inhelder, 2015; Roebers & Schneider, 2002; Kail, 1979) and the development of metamemory (Kail, 1979).

A convergence in neurophysiological and psychological research strongly suggests memory entails a *dual-processing system*, a representation of which appears in Figure 2.5 overleaf. The first system –*non-declarative*, or *implicit*, memory– constitutes an immediate and enduring record of the holistic multimodal patterns of phenomena we experience, often non-consciously. The second –*declarative*, or *explicit*– memory, is slow, linear and more prone to degrade, and represents our conscious and conceptual

knowledge of the world (Stolpe & Björklund; Squire, 2004). Evidence suggests an intimate interrelationship between the two, but where the non-declarative system is preeminent, determining the framework, meaning and pattern recognition upon which the declarative system depends (Stolpe & Björklund, 2013; McGilchrist, 2012)



**Figure 2.5 Declarative and Non-Declarative Memory Systems (Squire, 2004)**

There are proposed to be two types of declarative memory: *episodic* memory, or our autobiographical narratives, and *semantic* memory, or generalised facts, meanings and concepts we have abstracted about our world (Mastin, 2015c). Episodic memory is thought to underpin semantic memory, providing a basis for generalisation and enabling new concepts to be understood and to endure (Mastin, 2015a; McGilchrist, 2012).

While learning is largely viewed to be a distinct process –concerned with how we derive knowledge and how it alters our behaviour– there is general agreement that it is wholly dependent on memory for comprehension and storage (Mastin, 2015c). Nevertheless, Flavell argues that “*memory is in good part, just applied cognition*” (1971, p.273), and other theories view knowledge as a form of memory-in-action, including the Santiago Theory which underpins this thesis’s theoretical framework (Maturana & Varela, 1992).

In neurophysiological terms, a declarative memory, or *recollection*, entails the recreation of an event through the synchronous activation of neural connections formed during the original experience. Such memories are not encoded separately and

discretely, but are composed of traces from various brain areas. During recall, these traces are reconnected via the hippocampus to reconstruct and reprocess the ‘episode’ (Mastin, 2015b; Thelen, 1996).

The Levels of Processing Model ( Craik & Lockhart, 1972) proposes that the strength of traces and connections reflects the depth of mental processing associated with the original experience. They attribute depth to various factors including the amount of attention devoted to a stimulus, its compatibility with the analysing structures, processing time, as well as levels of sensory input and personal meaning (Craik & Lockhart, 1972).

In this sense, memory should not be viewed as a general ability or unitary trait, but rather a collection of cognitive processes, each with its own strengths, weaknesses, and course of development (Kail, 1979, p.3). Such factors mean there are typically greater individual inconsistencies and within group variation in early years’ memory performance, compared with older groups (Ceci & Bruck, 1993; Roebers & Schneider, 2002; Poole & Lindsay, 1995). Studies also imply the quality of their episodic memories are related to the development of metamemory, and the capacity to introspect on experiences and interpret them as past events (Perner, Kloo, & Gornik, 2007). Below 6-7 years, recollections are prone to interference, confusion and fantasy (Ceci & Bruck, 1993), and children exhibit negligible knowledge of how their own memory works or mnemonic strategies, which is not so for most 8 or 9 year olds (Kail, 1979).

Over course of primary school, the development of metamemory, working memory capacity (Gathercole & Alloway, 2007) and a framework of knowledge (Ceci & Bruck, 1993; Roebers & Schneider, 2002; Kail, 1979) leads to general memory improvements. However, findings on long-term retention during this period are conflicting. Some researchers regard recollection to be “*very accurate and stable over time...even for 3-6 year olds*” (Docherty & Sandelowski, 1999), while for others, it is “*disturbingly inaccurate*” (Poole & Lindsay, 1995, p.131). Other variables significantly associated with children’s memory performance include levels of motivation and encouragement (Roebers, Moga, & Schneider, 2001), physical activity (Raine et al., 2013) and incidental distractions (Uttal & Perlmutter, 1989).

Studies also suggest positive impacts of natural settings on memory. A longitudinal US study of children’s landscape perceptions, reported the remarkable detail of their recollections of physical qualities, and of familiar places for which they had no other

name or association (Hart, 1979). The study of Barcelona primary schools, mentioned above, found the greenness of school surroundings predicted the performance and progress of pupils' working memory over its 12 month duration (Dadvand et al., 2015).

UK research on outdoor learning memories (n=34) returned common themes which included multi-sensory experiences, active investigation and challenges, and specific details of the social and natural context. Participating teachers also frequently referred to real-life incidents outdoors, but rarely in relation to school-based learning (Waite, 2007). An evaluation of four Devon forest school programmes on primary schoolchildren (n=59) reported recollections characterised by environmental discoveries, and content which involved more than just visual and auditory description (Waite & Davis, 2007).

A comparison of the memory impacts of natural and classroom settings on teaching biology to Swedish 13-15 year olds (n=85), found the outdoor group better recalled activities and context (Fägerstam & Blom, 2013). While no significant differences were found on a standardised academic test, children used more course-related words ( $p<0.05$ ) and specific organisms to illustrate their understanding ( $p<0.05$ ) in interviews held 5 months post-task. A meta-review of outdoor learning literature also cites several studies which found associations between field trips and long-term memory retention (Rickinson et al., 2004).

In summary, effective working and long-term memory is regarded to be vital to academic success. There is cross-disciplinary support for a dual process model comprised of non-declarative (implicit) and declarative (explicit) memory, where declarative memory is further split into episodic and semantic components. Evidence suggests memory develops bottom-up, where non-declarative experiential memory supports linear event narratives (declarative-episodic) which, in turn, provide a basis and context for conceptual generalisation, language and reflective observation (declarative-semantic)– the domain of school learning. Developmental aspects and the non-unitary aspect of memory and other developmental aspects may have implications for early years' research. Finally, some studies imply natural learning settings may have positive effects on the strength and detail of children's memories.



### 2.3.5 Positive Affect

‘Positive affect’ is defined here *as the experience of positive emotion*. Historically, emotion and cognition have been regarded as conceptually distinct (Pessoa, 2009). In recent decades, debate has centred largely on which, or when, one precedes the other process-wise (Thelen, 1996). The contrasting position regards the two to be wholly inseparable and interdependent (Stein, Leventhal, & Trabasso, 1990; Thelen, 1996). Vygotsky proposed that “*behind every thought there is an affective-volitional tendency which holds the answer to the last why in the analysis of thinking*” (Vygotsky, 1986, p.252). Barnett and Ratner argue an integrated model of cognition and emotion would better inform understanding of child development (Ratner, 1997). Santostefano views cognition as a suite of processes which participate in coordinating our environmental relationships and entail degrees of affect. In his words, “*when the two systems are conceived as one, the debate over the relative dominance of cognition and emotion becomes meaningless and dissolves*” (1986, p.205). Indeed, most of the theories which appeared most relevant to this research assume emotion to be an integral aspect of cognitive processes, including of those of affordances (Reed, 1996), motivation (Csikszentmihalyi, 2000; Deci et al., 1991) aesthetics (Berlyne, 1971) and attention (Isen, 1990; Kaplan & Kaplan, 1989; Ulrich, 1979).

There is empirical support for the impacts of positive affect on attainment and performance, albeit weaker than those implied for prior CFs. However, research does suggest effects may be stronger for nursery and primary schoolchildren. Wellbeing was found to be a significant predictor of higher academic progression for UK 7 year olds, although not for older children (Gutman & Vorhaus, 2012). Positive affect has also been shown to enhance early years’ speed of task mastery (Fredrickson, 1998), and creative, relational and integrative thinking. A meta-review of related research reported that positive affect may facilitate cognitive organisation and categorisation, reasoning, problem-solving, and sensitivity to social aspects of task situations. The author concluded that “*(it) may play a very important role in the way children organize thoughts and come to see the world*” (Isen, 1990, p.85).

Conversely, negative emotion is associated with the narrowing and fixation of cognitive function, notably, in response to social or environment stressors (Evans, 1991). The stress response may occur when uncontrollable or unpredictable circumstances impinge

on what Evans terms, “*our strong need for environmental mastery and a sense of self-efficacy*” (Ibid, 1991, p.581). Stress entails a specific pattern of deficits involving working and incidental memory, and comprehension of complex or contextual information (Evans, 1991) and, if persistent, can be associated with deterioration in overall functioning (Glass & Singer, 1972; Hockey, 1983). Stressors interfere with tasks which entail rapid detection, sustained attention, or multiple information sources. They can also cause stereotyped thinking, premature closure in decision-making, and difficulties coping with novel information and approaches (Evans, 1991).

Worrying about failure has been linked to performance defects (Hockey, 1983), distractibility and attention selectivity in children (Easterbrook, 1959). Emotional frustration has been shown to impact negatively on the constructiveness of play, causing 5½ year olds to regress to the levels of 3½ year olds (Lewin, 1946). Stress is associated with increased antisocial behaviour, competitiveness, hostility and aggression, and with reduced altruism and cooperation (Evans, 1991). Classroom noise and overcrowding have also been linked to both stress and performance deficits (Crook & Langdon, 1974; Glass & Singer, 1972; Evans, 1991).

There is also a body of evidence to suggest stress reduction is a general response to viewing or experiencing natural landscapes (Ulrich, 1993). A US study revealed that levels of surrounding nature (n=337, mean age 9.2 years), predicted rural children’s capacity to deal with stressful life events ( $p < .05$ ), and their global self-worth ( $p < .001$ ) (Wells & Evans, 2003). Compared with a typical school day, Scottish research found that a day at a forest school significantly reduced stress and anger levels, and improved the hedonic tone, of inner city 11-13 year olds (n=18), particularly those with behavioural problems (n=5) (Roe & Aspinall, 2011). Another study reported that, following a stressful task, a group of students randomly-assigned to a nature walk reported more positive states than those allocated to an urban walk, reading magazines, or listening to music (Hartig et al., 1991).

A recent study which used a portable EEG recorder to measure real-time emotions of students walking through Edinburgh, found they became less excited and frustrated, and more meditative as they moved from urban into green areas, (Aspinall, Mavros, Coyne, & Roe, 2013). The researchers also returned a similar EEG pattern for participants rating photographs of natural versus urban scenes (Roe, Aspinall, Mavros, & Coyne, 2013), implying that stress reduction may share physiological underpinnings with the

other emotional factor strongly linked to natural settings: preference, or the liking or approach response.

The weight of cross-cultural empirical support for the liking or approach response to natural environments is regarded as sufficient to propose an innate bias (Ulrich, 1993). The seminal theory in this area is Environmental Preference Theory (Kaplan & Kaplan, 1989), which emerged from research which found preference for photographs of settings could be predicted by their levels of naturalness. That assessments seemed instantaneous, led to the suggestion that they may entail non-conscious calculation.

Statistical analyses identified four perceptual categories underpinning preference: *coherence*, or the overall organisation of the scene; *legibility*, or the ease of understanding or categorising its content; *complexity*, or the diversity of its elements; and *mystery*, or the promise of fruitful exploration beyond the visible area.

Properties of the Scene	Understanding	Exploration
Immediate	Coherence (overall orderliness)	Complexity ( <i>information richness</i> )
Inferred	Legibility ( <i>process-ability</i> )	Mystery ( <i>promise of new learning</i> )

**Figure 2.6 Environmental Preference Theory Matrix (Kaplan & Kaplan, 1989)**

These categories are represented in a theoretical matrix structured by whether information is *immediately* perceptible or *inferable* from a scene, and the basic human needs for *understanding* and *exploration*, as shown in Figure 2.6 above. In sum, the Kaplans argued the matrix to constitute an “*assessment of the environment in terms of compatibility with human needs and purposes*”, where preference is determined by the degree to which the setting is perceived to be conducive to effective functioning and learning (Ibid, 1989, p.10). The Kaplans findings have since been replicated across diverse groups and cultures. Scenic preference has been shown to vary relative to their levels of natural content, with even mediocre natural settings rating higher than urban ones (Ulrich, 1993).

Research also suggests the liking and approach response may be particularly prevalent in children, but may decline in early adolescence in favour of urban social settings

(Korpela, Kytta, & Hartig, 2002). Naturalistic observations of pre-adolescents in a small US town, revealed a general preference for unmanicured natural spaces, particularly involving woodland, ponds and brooks, which were primarily valued for their utility (Hart, 1979). Wells cites UK and Caribbean studies which reported a general preference for natural settings among urban children (Wells & Evans, 2003). A US study where urban 9-12 year olds drew their favourite place, found 96% depicted outdoor spaces, most often involving lawns, playgrounds, parks, trees or their own garden (Moore, 1986). Israeli research also found natural settings to be the most favourite or significant childhood places of almost all adults interviewed (n=198).

Kalevi Korpela's Theory of Environmental Self-Regulation proposes we are inclined towards natural environments, and other settings, because they help to regulate our self and wellbeing. This is viewed to be an adaptive process whereby positive emotions mediates associations with places compatible with our regulatory needs, so we are motivated to seek them out whenever we need balance. In this way, Korpela writes, *"the physical environment itself can become an essential part of the process of regulating the experience of self and emotions"* (2002, p.367). The hypothesis finds support in studies which found children most frequently associate their favourite places with feeling relaxed and comfortable (Korpela, 2002), or that a third report using them for emotional regulation (Korpela et al., 2002).

Wells argues natural environments may promote child resilience –i.e. the inner emotional strength and stability which enables effective coping with life changes and challenges– via their impacts on its strongest predictors: positive affect, intellectual functioning and social interaction (Wells, 2014). Adult research also suggests nature's capacity for emotional regulation. City dwellers have been found to seek out green space to alleviate urban stress or depression (Ulrich, 1993). After 2 days 'forest-bathing' –a popular Japanese approach to recreation and relaxation– a study found students' (n=45) personal mood, positive affect and feelings of restoration and vitality were significantly heightened compared to a group which took their leisure time in an urban setting (Takayama et al., 2014). A review of the literature on nature's health benefits, reported positive links with physical health, longevity, ability to cope with pain, and recovery from illness and surgery (Wells, Evans, & Yang, 2010). Another review of 50 studies found visual contact with nature to have general health and well-being impacts, leading the authors to conclude:

*“An environment devoid of Nature may act as a “discord” ...while the term mismatch is used for any difference between present living conditions and the environment of evolutionary adaptation, discords are mismatches with a potentially undesirable impact on health or quality of life.” (Grinde & Patil, 2009, p.2332).*

To summarise, from the perspective of environmental interaction, it may be invalid and impractical to view cognition and emotion as conceptually distinct. Research suggests positive emotion is linked to the flexibility and broadening of cognition, performance benefits, and the forging of beneficial environmental associations. Conversely, negative emotion and stress, is associated with a fixation and narrowing of functioning, performance deficits, and to regressive and antisocial behaviour. This may be aggravated by perceived loss of autonomy and competence, and environmental stressors such as noise and overcrowding. There is also substantial support for an innate affective response to natural settings, entailing stress reduction, preference and general regulation of self and emotion.

### ***2.3.6 Social Interaction***

Social interaction is generally regarded to play a fundamental role in development and learning (e.g. Piaget, 1951; Vygotsky, 1978). In union with continuity, the philosopher John Dewey considered social interaction to *“provide the measure of the educative significance and value of an experience”* and that *“the immediate and direct concern of an educator”* was to promote objective conditions which regulated *“the total social-setup”* (Dewey, 1997, p.44-45). In Cognitive Evaluation Theory, *relatedness*, or a secure sense of belonging to one’s peer group, is one of three basic needs supportive of intrinsic motivation (Deci et al., 1991).

Johnson and Johnson regard the performance impacts of cooperation and competition to be one of the longest-standing traditions in social psychology. They term cooperation in a task context, *positive interdependence*, which is held to arise when individuals recognise that accomplishment of their goals is furthered by the actions and goal fulfilment of their collaborators (Johnson, Johnson, & Smith, 2007). In a meta-review of 378 related studies, they found strong support for the premise that positive

interdependence results in greater task persistence, productivity and achievement than competitive or individualistic situations (Johnson & Johnson, 1989). The relationship was stronger, the more rigorous the methodology, and task duration and reward type exhibited no overall impact.

Positive interdependence is associated with intrinsic motivation and epistemic curiosity. It is proposed to be most effective when clearly perceived and involving face-to-face negotiation “(which) demonstrates motivation for mutual benefit and exhibits low anxiety and stress” (Johnson & Johnson, 1989) p.76). These effects occur, the authors propose, because “when group members perceive their potential contribution to the group as being unique...and required...they increase their effort” (Johnson & Johnson, 1989, p.58). Competitive and individualistic situations, on the other hand, are linked to extrinsic motivation, low epistemic curiosity, and only outperform positive interdependent situations when all participants have roughly approximate skill levels (e.g. a 100m final).

The meta-review also highlighted specific cognitive impacts of positive interdependence in children, including greater transference of cognitive strategies from one context to another, and higher quality reasoning strategies. One study revealed that 6-7 year olds working cooperatively on categorisation and retrieval tasks outperformed children two years older, with higher achievers demonstrating superior reasoning in groups than alone (Salatas & Flavell, 1976). Positive interdependence has also been shown to promote integration of new information with prior knowledge, retention, and ability to report higher thought processes (e.g. Larson et al., 1986). It is proposed this may be attributable to it being easier for children to monitor the verbal reasoning of others in group situations, than their own thought in individualistic ones (Johnson & Johnson, 1989).

Positive interdependence is also associated with *process gain*, or the generation of new ideas and solutions (Johnson & Johnson, 1989). For example, children aged 6-9 years have been found to generate and retain principles of fluid conservation when working in collaborative situations involving conflicting opinions, significantly outperforming individualistic conditions (42% vs 6%) (Ames & Murray, 1982). *Controversy* within a cooperative and heterogeneous task context is also associated with quality of problem solving and creativity, task involvement, achievement and retention. Johnson and Johnson suggest this may be on account of the synthesis of incompatible ideas requiring

participants to articulate their rationale and perspective, which, in turn, promotes higher levels of thinking, critical analysis, situational curiosity and conceptual conflict (Johnson & Johnson, 1989).

Research also suggests natural environments may have general benefits for social interaction. Several US studies have demonstrated the positive effects of greenspace on community interaction and ties in lower income urban areas (Wells, 2014).

Comparisons of indoor and outdoor classrooms also often cite impacts on social interaction. A study spanning 40 US schools concluded that outdoors children exhibited improved cooperation (98%), stronger communication skills (94%), more respectful interaction (93%), and better learned to share ideas, discuss reasoning and co-develop new concepts (Lieberman & Hoody, 1998). A three-year Danish study found pupils (n=19), aged 9-12 years, and teachers, rated statements about social relations significantly higher for forest days than typical school days ( $p < 0.001$ ) (Mygind, 2009). Californian research into the impacts of three outdoor programs on ‘at-risk’ students aged 11-12 years (n=119) found they and their teachers rated their experience significantly higher for cooperation and conflict resolution, compared with an indoor control (AIR, 2005). Decline of classroom discipline problems was a core finding of a study of the effects of environmental education programs on 5 Washington schools (NEETF, 2000).

Compared to the classroom, qualitative studies have found the outdoor teamwork of nursery and primary schoolchildren to be higher quality, more creative, (Blair, 2009; Davis & Waite, 2005; Lieberman & Hoody, 1998; Moore, 1989), more participatory (Fägerstam & Blom, 2013), and to exhibit different patterns of peer collaboration (Davis & Waite, 2005; Mygind, 2009). Some have noted the greater inclusion and contribution of disadvantaged individuals (Davis & Waite, 2005; Kaarby, 2004).

Levels and richness of outdoor language have also been highlighted by several studies. Constituting a quarter of over 1000 observations, verbal interaction was found to be the single most significant playground activity in a study of children, aged 8-10 years (n=50), across five Australian primary schools (Malone & Tranter, 2003). Observations at a Welsh Forest School, reported general positive impacts on children’s language, vocabulary and expressive skills of the children, who were “*stimulated by the environment and wanted to talk about their experiences (and) able to describe at greater length familiar situations that were represented pictorially*” (Maynard, 2003,

p.16). A Cornish forest school study reported general language improvements, while emphasising particular benefits for disadvantaged children, some of whom were seen to talk, share or write for the first time (Massey, 2002). A key finding of a 6 week study of three Devon forest schools which recorded the behaviour of 5 year olds (n=36), was that language was most significant for child-led tasks, and sustained when there was no adult intervention (Davis & Waite, 2005). A year-long case study of a Worcestershire forest school noted the rich opportunities to use language it afforded children, and how growing linguistic proficiency seemed driven more by experiential relevance, than teaching methods (Bower, Barclay, & Hawkey, 2002). An analysis of 2 years of verbal interactions of 5-6 year olds, captured using individual strap-on recorders, found forest settings to be “*rich in language*”, involving sustained shared narratives and less conventional forms such as “*non-verbal vocalisations: animal sounds, mechanical sounds, singing and humming*” (Waite et al., 2013).

<b>Feature of Language Use</b>	<b>Home</b>	<b>School</b>
<b>Absolute Values</b>		
No. of child utterances to an adult	*122.0	*45.0
No. of adult utterances to the child	153.0	129.0
No. of child speaking turns per conversation	*4.1	*2.5
No. of different types of meaning expressed by child	*15.5	*7.9
No. of grammatical constituents per child utterance	*3.1	*2.4
<b>Proportions (Child)</b>		
Initiates conversation	*63.6	*23.0
Questions	*12.7	*4.0
Requests	*14.3	*10.4
Elliptical utterances; fragments	*29.4	*49.4
References to nonpresent events	*9.1	*6.4
<b>Proportions (Adult)</b>		
Questions	*14.3	*20.2
Display questions	*2.1	*14.2
Requests	*22.5	*34.1
Extends child's meaning	*33.5	*17.1
Develops adult's meaning	*19.1	*38.6

*Note:* figures averaged over all 32 children in the study

\*Statistically significant differences

**Table 2.2 Experience of Language Use at Home and School (Wells, 2009, Table 5.1)**



While there appear to be no studies which compare linguistic interaction between outdoor and classroom settings, one longitudinal study has done so between home and classroom. This sampled conversations of Bristol children (n=32), randomly-selected from a substantial representative sample, over the course of their first year at primary school. Significantly poorer classroom statistics were returned for all but one measure (see Table 2.2), leading the author to conclude that schools were not providing an environment which fosters children's language development (Wells, 2009).

To summarise, it is generally agreed that early years' social interaction has cognitive and developmental significance, and also has school performance impacts which include enhanced motivation, higher-functioning and productivity. A growing number of studies also imply general benefits of natural settings for children's social and verbal interaction.

### ***2.3.7 Physical Activity***

A review of 50 years of research on physical activity and attainment found an overwhelming majority reported positive impacts, a general correspondence between levels of exercise and performance, and little to no evidence suggesting negative effects (Howie & Pate, 2012). The most consistent benefits were for executive function, notably, inhibitory control and working memory. Highly predictive of long-term attainment, both are associated with skills of attention, vocabulary and mathematical reasoning (Howie & Pate, 2012). Esther Thelen compiled a compelling evidence base for the argument that cognition and learning are not just promoted by perceptually-guided movement, but contingent upon it (Thelen, 1996). From her viewpoint, young children's physical activity should not be considered to benefit cognition indirectly, but that the two are in some sense equivalent.

Studies also suggest the increased impacts of natural settings on children's physical activity, compared with other environments (Wells & Donofrio, 2011). Grahn and colleagues' Swedish nursery comparison found the outdoor kindergarten outperformed the urban control on every periodic measure of motor function, and significantly so for balance, agility, and strength of hands, arms and trunk (Grahn et al., 1997). A Danish

accelerometer study reported the forest school activity levels of primary schoolchildren (n=19), mean age 10½, to be over twice as high as on typical school days, and equal to one involving two physical education lessons (Mygind, 2007). A Scottish study involving a similar approach and age group also found that, compared with a normal school day, primary schoolchildren (n=26) exhibited significantly more physical activity at forest school, with greater intensity, frequency of longer bouts, and similarity of levels between boys and girls (Lovell, 2009). Fjørtoft's Norwegian kindergarten study, already mentioned, reported significant impacts of natural affordances on levels and diversity of physical activity, compared with an indoor control (Fjørtoft, 2004). While the outdoor group scored lower for fitness on the pre-test, by the post-test, nine months later, they had caught up dramatically, demonstrating significant improvements on all but one of nine test items, compared with only three for the control.

In summary, there is strong empirical support both for a positive association between physical activity and attainment, and between natural settings and affordances, and physical activity.

### ***2.3.8 Positive Teacher Feedback***

US statistical research suggests the teacher may be the dominant factor in attainment, over and above school, class size and heterogeneity of pupil race, talents, cultures or strengths (Sanders, Wright, & Horn, 1997). Positive feedback from teachers has been shown to significantly influence pupils' achievement scores (Hughes, 1973), learning engagement (Klem & Connell, 2004), and levels of intrinsic motivation, perceived competence and self-esteem (Deci et al., 1991), particularly if the context is also autonomy-supportive (Ryan & Grolnick, 1986). Compared with pupils with typical levels of support, primary schoolchildren are 89% more likely to report learning engagement if they feel supported by their teacher, and twice as likely to report disaffection, if they don't (Klem & Connell, 2004).

Studies also suggest positive effects of natural settings on teacher-pupil relationships. Teachers report better working cooperation with children outdoors than in the classroom (Davis & Waite, 2005; Evergreen, 2000; Mygind, 2005), and reduced discipline and

management issues (AIR, 2005; Blair, 2009; Lieberman & Hoody, 1998). They have also been observed to exhibit improved mood (Szczepanski et al, 2007), morale, and enthusiasm for teaching (Evergreen, 2000; Lieberman & Hoody, 1998), and to use more child-centred approaches (Ernst & Monroe, 2004), highlighting pupil talents and “*making it less obvious who the best students are*” (SEER, 2005, p.518).

By contrast, classroom research suggests teachers may invest more attention in activity and behaviour management than instruction (Jackson, 1990). Studies suggest that only 30% of their time may be spent on teaching (Gump, 1978), and imply a vicious cycle between lack of direct supervision and levels of off-task behaviour and correction (Biddle & Adams, 1967). Gump remarks on the pervasiveness in the school research literature of *recitation* –where a teacher poses a question to the class, then responds to a pupil’s answer– in comparison to the relative rarity of pupils questioning or elaborating on material (see Table 2.2 above). Research suggests that between one and two thirds of total school time may be taken up by recitation (Gump, 1967).

In summary, research implies a positive teacher-pupil relationship could be a significant factor in primary school attainment, particularly in an autonomy-supportive setting. Recent studies also suggest natural settings may better support teacher-pupil relationships, in comparison to the classroom.

## **2.4 Summary of Main Findings and Research Hypotheses**

This chapter set out to provide a context for an assessment of natural and classroom setting impacts on the task performance of primary schoolchildren. Studies suggest early primary school is challenging for all children, and that experiences can set in motion cycles which determine academic success or failure through to adulthood, where the most significant gains are for the disadvantaged.

Primary school spans a dynamic period of developmental consolidation, one which has a complex relationship with formal learning. This period entails the honing of metacognitive and symbolic manipulation skills fundamental to long-term attainment. It is also characterised by a broader variation in cognitive competencies than older

groups, and may entail a qualitatively different experience of the world. A common theme was a ‘bottom-up’ developmental programme, where embodied experience provides the foundations for higher functioning and self-actualisation. One implication was that this may underpin an innate bias in middle childhood towards natural affordances as a rich workshop for honing mental and physical capacities.

Empirical support for a cognitive predisposition for natural settings was put forward, as well as the concept of natural affordances as a potential mediating factor. Research implying the benefits of naturally-rich settings for attainment and performance were also outlined. No study appears yet to have compared the cognitive impacts of natural and classroom settings in the context of a curricular task, or in early primary schoolchildren.

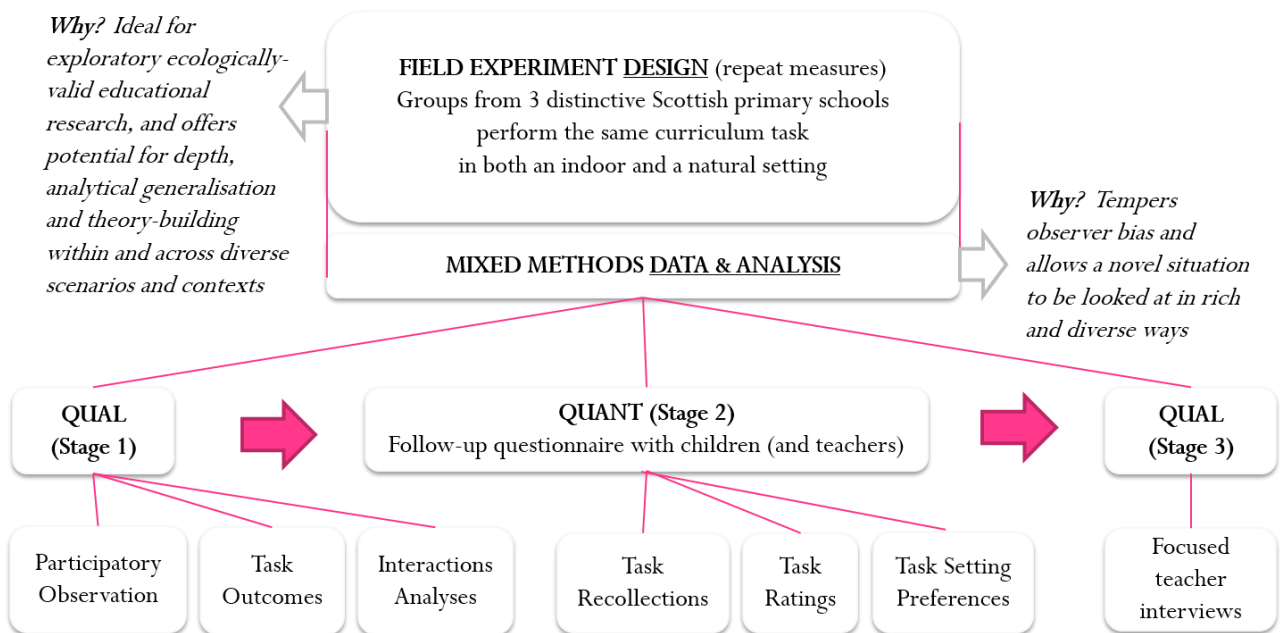
On this basis of findings which implies children’s cognitive predisposition for natural settings, and the theoretical framework set out at the beginning of the next chapter, the thesis ventures two research hypotheses, RH1 and RH2, to guide a methodology which can evaluate the research aim:

- ***RH1.*** *The performance of primary schoolchildren on a curriculum task will be better in a natural setting than a classroom.*
- ***RH2.*** *There will be a positive association between the natural richness of the task setting and the children’s performance.*

# CHAPTER 3: METHODOLOGY AND DESIGN

## 3.0 Introduction

This chapter details the methodology designed to assess the thesis’s two main research hypotheses. An overview of the methodology appears in Figure 3.1 below.



**Figure 3.1 Overview of the Thesis Methodology**

The chapter addresses the thesis’s second and third objectives, namely:

2. To develop a theoretical framework, and toolkit for assessing task situations, suitable for comparing and analysing the general cognitive impacts of different outdoor and classroom task settings on young children with limited or variable competencies.

3. To gather a rich ecologically-valid dataset consistent with the theoretical framework, on the task performance of primary schoolchildren in outdoor and classroom learning settings, including data relevant to the transition from nursery, underachievement, exposure to outdoor learning, and the perspective and experience of teachers.

The general approach was pragmatic, dynamic and exploratory, inspired by grounded theory, and informed by the general model of cognition extant in the theoretical framework. Four distinct field experiments were conducted across three diverse primary schools. These were quasi-experimental, repeated measures, with setting as the independent variable (i.e. indoors or outdoors), and performance as the dependent variable.

Participants were mainly *early years*' school starters (n=57), average age 5½ years, but included an *experienced* group with 4-5 years' regular exposure to woodland learning, average age 9½ years, and 13 *underachievers*, and the 4 supervising teachers. Children were allocated to matched groups, and performed a teacher-selected curriculum task outdoors, in either a wood or playground, and then in a classroom, or vice versa. Settings were categorised for 'natural richness' using a checklist of affordances and biodiversity, and tasks were classified according to the degree of environmental interaction they permitted.

A mixed methods approach was taken to data gathering and analysis. There were three consecutive stages, which correspond to the three results chapters that follow. Stage 1 relates to the qualitative data arising directly from task observations and outcomes, and will be dealt with in the next chapter. Stage 2 entailed a follow-up questionnaire, administered 6-7 months after the tasks, that recorded task recollections and preferences, the statistical findings of which appear in Chapter 5. The final Stage 3 took place 1-2 months later. This involved focused interviews and analyses which aimed to represent the task perspectives of the four participating teachers, and findings will be set out in Chapter 6.

It is important to emphasise upfront that early primary schoolchildren do not have literacy and numeracy skills adequate for formal attainment testing, least of all those underachievers most relevant to the performance gap. Additionally, the literature has suggested the age group may exhibit wide within-group variation in individual competencies, preferences and development (Fabian & Dunlop, 2007; Donaldson, 1986). which renders it "*impossible to find the ideal (research) methods*" (Punch, 2002, p.337). The developmental stage also renders factors that are minor methodological considerations with older groups, potentially confounding. These include demands on perception, verbal comprehension, memory and social understanding (Donaldson, 1986), and susceptibility to interference, confusion and fantasy (Ceci & Bruck, 1993).

In short, at the point in schooling most advantageous for demonstrating attainment impacts, measures by which attainment can be clearly measured are problematic or precluded. This has necessitated approaches to assessment which are largely qualitative, and emphasise general cognition and performance.

The remainder of this chapter expands on the research framework. It begins with setting out the philosophical position, theoretical framework, and providing some background to its methodological choices. It then proceeds with detailing recruitment and participants, the study pilot, and the field experiments and their context, including information on setting and task measures. Following this, it sets out the mixed methods approaches to data collection and analysis in stage order, before ending on its trustworthiness and ethics, and conclusion.

### **3.1 Philosophical Position**

The thesis takes a realist ontological position, being wholly committed to a view of an external reality separate from our description of it (Bryman, 2012). It's epistemological position might be termed post-positivistic under Crotty's knowledge framework (Crotty, 1998). This assumes that real-world phenomena is generalisable and knowable, but that knowledge is always constructed, interpretative, theory-laden and influenced by perspective (Creswell, 2013), and therefore open to critical evaluation. Thus while this is essentially a qualitative study, where even statistical components are largely perceived measures, its goal is always to grasp something of the real relationships between environment and cognition beneath the interpretation.

The overarching approach to the thesis is pragmatic. Pragmatism is a philosophical tradition which originated circa 1870 in the work of Charles Pierce (Hacking, 1983). It upholds that topics such as belief, language, meaning and science are best viewed from the perspective of their practical utility (Robson, 2011), and that the function of thought is not objective representation, but to learn through environmental interaction (Hookway, 2015).

Specifically, the thesis adopts what Hacking terms the ‘optimistic’ branch of Pragmatism, typified by the position of Pierce and Putnam, which considers it possible to discern enduring truths about the world through a programme of experimental intervention. This contrasts with a second branch, associated with James, Dewey and Rorty, which regards truth only as a social construction which answers the needs of a particular place, time and culture (Hacking, 1983). By allowing practical situational considerations to determine approaches, rather than principles of perfect design and philosophical consistency, optimistic pragmatism was considered ideally suited to the exploration of a novel, complex and naturalistic research situation.

Specific methods are inspired by grounded theory, particularly recent versions which emphasise abductive processes (Charmaz, 2011). Grounded theory is a systematic methodology which involves the construction of social scientific theory through data analysis (Glaser & Strauss, 1967). Abduction was another of Pierce’s concepts, who envisaged it as a knowledge-extending alternative to processes which seek conclusion through generalising data (induction) or satisfying hypotheses from existing theory (deduction). It is characterised by the open-ended interplay between observation, logical scientific inference, imaginative insight (Reichertz, 2004), and existing theory and research, allowing for the most plausible and practical explanation to emerge from the data (Charmaz, 2011). Where relevant, the thesis will highlight how decisions were reached through a combination of inductive and abductive processes.

### **3.2 Theoretical Framework**

This section outlines the systems-based theoretical perspective and framework which underpins the thesis methodology.

#### *Systems Perspective*

Systems thinking constitutes a set of general principles, tools and techniques, which have been developed and distilled over the course of the last half-century (Reynolds & Holwell, 2010), and relates to thinking about phenomena as ‘systems’ , defined by



Donna Meadows as “*an interconnected set of elements that is coherently organised around some purpose*” (Wright & Meadows, 2009, p.16).

The systems perspective sees the world as irreducible webs of interrelationships, all of which exhibit common dynamics and properties. This constitutes a radical alternative to the modernist perspective, which tends to conceive of entities and events as discrete, and connected by simple linear cause-effect relationships with beginnings and ends.

The tradition entails two main branches, hard and soft systems (Reynolds & Holwell, 2010), both implicit in the framework and methodology. Hard systems approximates with a realist epistemology, assuming systems to be real objective phenomena, and concerning itself with modelling and measuring these.

Soft systems, corresponds to a relativist epistemology, viewing systems as constructs which are always viewed from the inside (Checkland, 1978; Reynolds & Holwell, 2010). The approach seeks to understand the diverse, shifting and unquantifiable, personal motivations and perspectives governing complex situations (Christopher, 2005).

A systems perspective was decided upon for three reasons. Firstly, it is *ideally suited to the analysis of complex situations*, and offers helpful tools for their categorisation, modelling and measurement. Secondly, *it can encompass different levels in a single model*, allowing for behavioural phenomena at the level of the individual, to be assessed in relation to qualitatively different phenomena at the level of a social group. Lastly, *it supports the understanding and explanation of dynamics and processes*, which may be as important to understanding phenomena as related variables, and were deemed by Vygotsky to be the essential factors of psychological analysis (1978b, p.65).

### *Santiago Theory*

The systems-based theoretical framework which underpins the methodology is based on the Santiago Theory of Cognition. This is an overarching biological and philosophical account of cognition in all living things (Maturana & Varela, 1992). Despite its realist ontology, the Theory assumes a profoundly relativist epistemological position, proposing the world to be constructed anew through the unique perception and experience of each individual. Maturana and Varela describe this as, “*an ongoing*

*bringing forth of a world through the process of living itself*" (1992, p.11). The Theory's capacity to encompass realist-relativist and matter-mind dualisms appealed to me, as these seemed an implicit challenge to achieving and articulating this study at every step.

Of other theories reviewed in the last chapter, and which feature heavily in the subsequent thesis, only the Santiago Theory was uniquely able to all the criteria considered necessary for a suitable framework. Above all, it was able to provide an agnostic ecological perspective on general cognition, a requirement well summarised by Kurt Lewin:

*"In order to understand or to predict behavior, the person and his environment have to be considered as one constellation of interdependent factors"* (Lewin, 1946, p.792).

Nature-based studies frequently cite positive effects on multiple CFs (e.g. Dadvand et al., 2015; Grahn et al., 1997; Waite et al., 2013; O'Brien, 2009). This implies a common underlying psychological factor of which an understanding could be essential to making effective educational recommendations. The Santiago Theory offered a way of thinking holistically about interrelationships and interdependencies between discrete cognitive factors, which might be otherwise neglected or distorted by a narrower focus.

There were also other benefits of using the Santiago Theory over others. It was unbiased with regards to environmental or developmental context, and offered practical guidance for categorising and assessing behaviour, individual and group. Furthermore, its generality was also sufficient to encompass the discussion of diverse CFs, theoretical viewpoints and inquiry types.

### *Theoretical Framework*

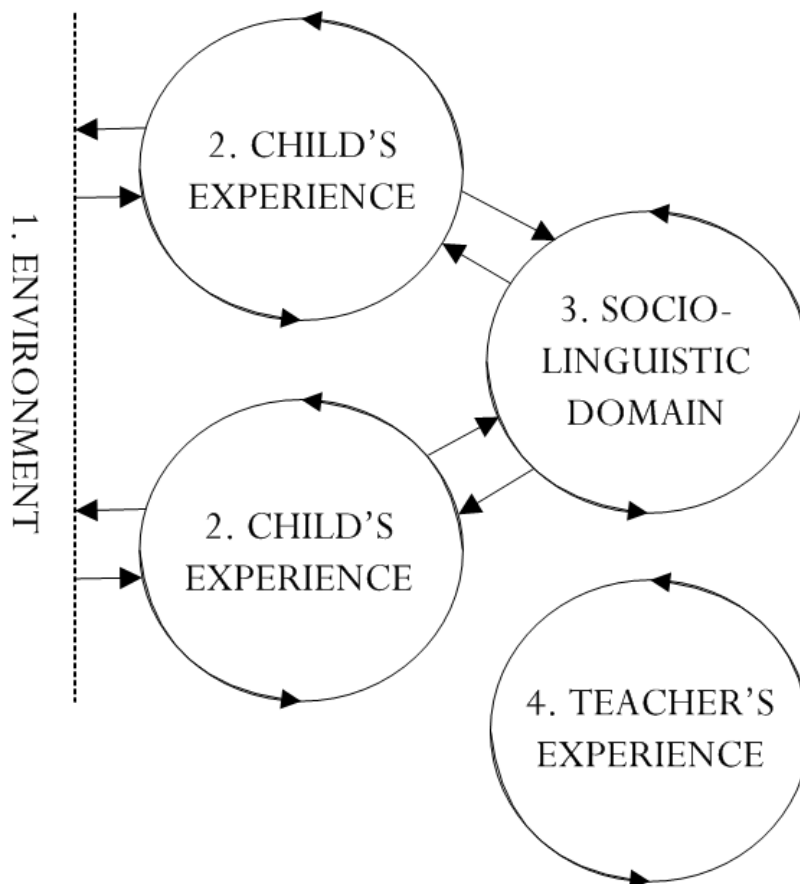
The thesis's theoretical framework is an adaptation of the basic categories and definitions of the Santiago Theory to a curriculum task.

The framework constitutes a general model of four categories (numbered 1-4) and interactions (arrows), shown in Figure 3.2 overleaf, which purports to represent the totality of cognitive interaction within a given curriculum task scenario. Interactions are

assumed to be measurable ‘hard system’ inputs, outputs or internal changes, where cognitive processes might be conceptualised in terms of different levels of flow.

The four categories are:

**1. Environment:** *Environmental affordances and qualities observed, or reported, to be relevant to task-related cognition.*



**Figure 3.2 Theoretical Framework**

**2. Child's Experience:** *Observed, or reported, individual behaviour associated directly or indirectly with task-related cognition.*

‘Cognition’ is here defined as *the experience and process of environmental adaptation, equivalent to action*, a broader definition which makes no distinction between cognitive and emotional components of interaction. Maturana and Varela summarise this as, “*all*

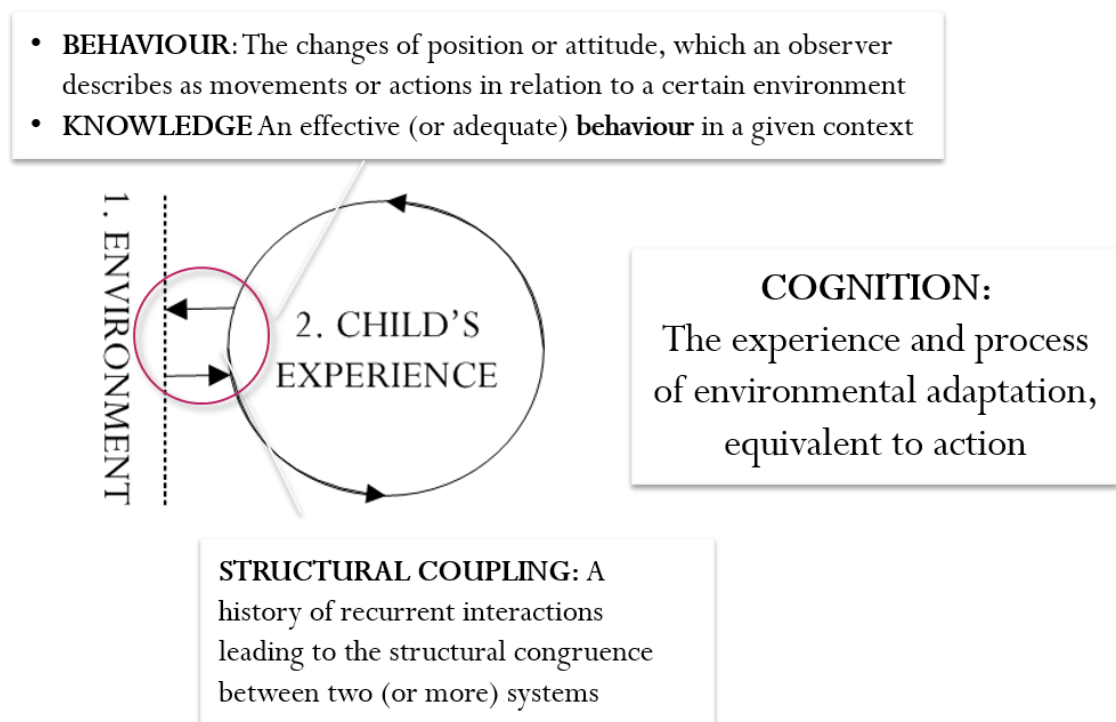
*doing is knowing and all knowing is doing*” (1992, p.27). ‘Behaviour’ is defined as any *movement or action observed in relation to the environment*.

Cognition is proposed to occur as a result of a child seeking *structural congruence* with the specific task environment (physical (1.) and socio-linguistic (3.)). What a child *can* cognise while fulfilling the task, and what behaviours are available to them, are deemed dependent on two interrelated factors: their biological ‘organisation’ inherited from their species and parents, and their relevant past experience, termed ‘structure’.

Structure, in turn, reflects the *history of stable recurrent interactions* arising from their past congruence-seeking, termed ‘structural coupling’, and which is reflected in the child’s ‘knowledge’, defined as *effective or adequate behaviour within a specific task context*.

Lastly, a task’s cognitive impact is conceived here to be the extent of specific ‘structural coupling’ or ‘knowledge’ arising specifically as a result of a child’s task experience.

Figure 3.3 below sets out these concepts and definitions in relation to the framework.



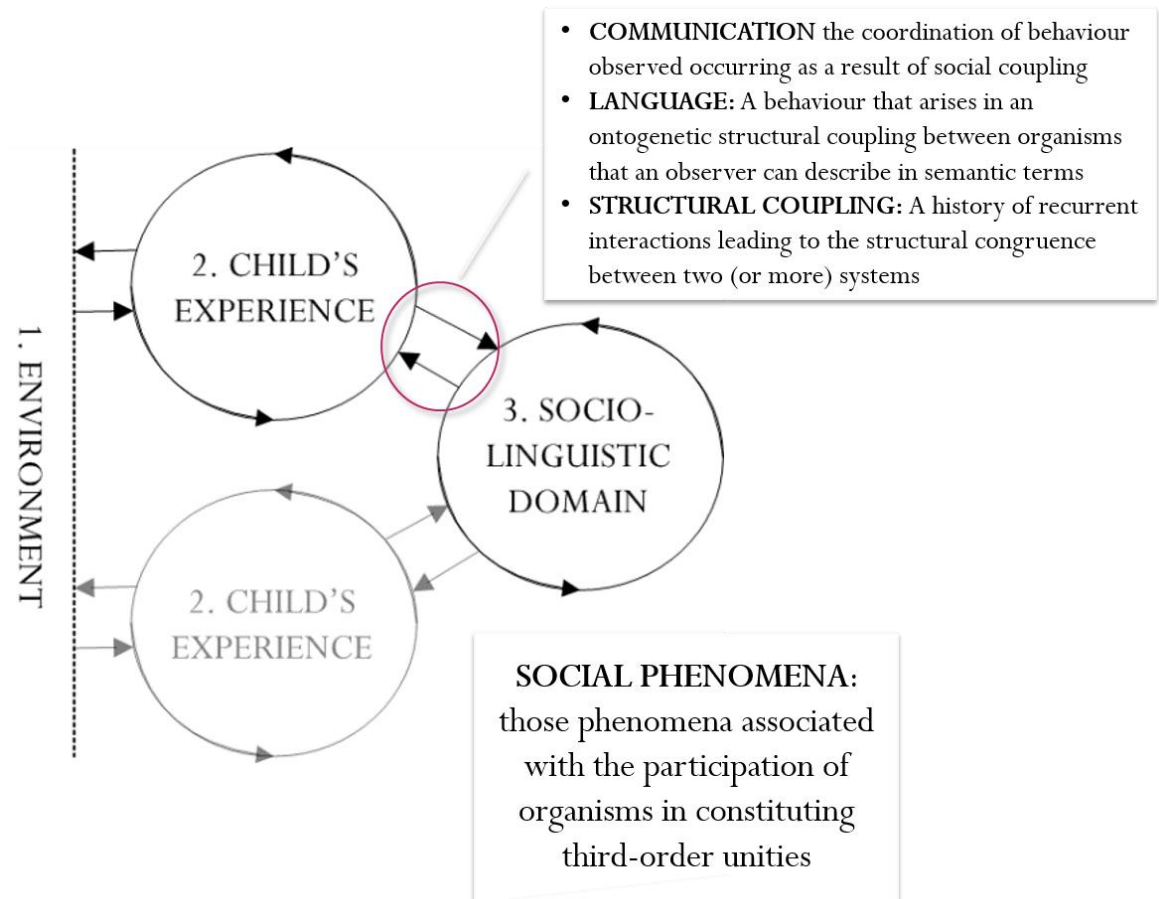
**Figure 3.3 Definitions: Cognition, Behaviour, Knowledge and Structural Coupling**

**3. Socio-Linguistic Domain:** *Observed or reported behaviour associated with task-related cognition, that is, which can be described in social or semantic terms.*

The Santiago Theory conceptualises cognition at both an individual and group level. These levels are termed ‘unities’. A *second order unity* is an individual interacting with their immediate physical environment. This, in turn, can be nested in a *third order unity*, or a purposeful social system, such as a school class or workgroup, which entails interaction with environment, and between its participants. A third-order unity within a task context is represented here as the Socio-Linguistic Domain

‘Social phenomena’ is defined as that associated with *the participation of individuals in constituting third-order unities*, and ‘communication’ therein, as *the discernible coordination of interpersonal behaviour*. ‘Language’ is *any communication which an observer can describe in semantic terms*, a broader conception which can incorporate *any communication within a field of meaning*: verbalisation, formal schooling, and behaviours such as mimicry, singing, dancing, role-play, creative activities and theatrics.

Maturana and Varela argue language to be a form of communication with a life and ontogeny of its own, both requiring adaptation from its participants and adapting to their requirements. They call *the totality of a unity’s linguistic behaviours* a ‘linguistic domain’, upon which the concept of the Socio-Linguistic Domain is based. Both ‘communication’ and ‘language’ can be seen as explicit forms of ‘structural coupling’, as individuals seek congruence with the field of meaning represented by Socio-Linguistic Domain. Figure 3.4 overleaf relates these social phenomena and definitions to the framework.



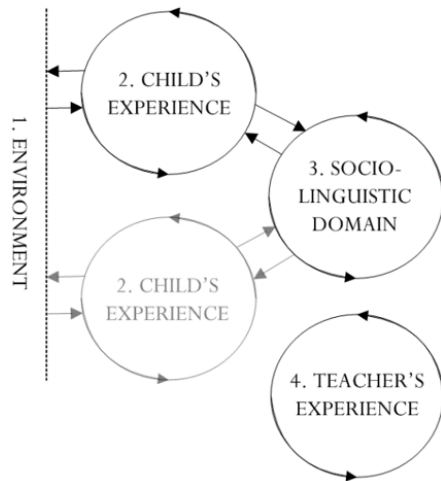
**Figure 3.4 Definitions: Social Phenomena, Communication and Language**

**4. Teacher's Experience.** *Observed, or reported, behaviour of teachers which may be associated directly or indirectly with children's task-related cognition.*

The same framework concepts and dynamics pertain to the teacher's task experiences, as to the children's. However, in the context of a school task, the teacher may constitute a qualitatively different element or role within the system, worthy of separate investigation. On this basis, they are treated as a distinct category, with an emphasis on how their interactions with the children influence task performance directly, or indirectly. They are shown as unconnected to the system because no presumption is made about the extent of their involvement in task-related processes.

#### SITUATIONAL CATEGORIES:

1. **Environment:** Physical affordances of the setting observed, or reported, to be relevant to cognition
2. **Experience:** Observed or reported indicators of the active cognition or cognitive change of individual children
3. **Socio-linguistic domain:** Aspects of group cognition that an observer can describe in social or semantic terms.
4. **Teacher's experience:** Observed or reported indicators of active cognition or cognitive change of individual teachers which may have feedback effects on the children's experience or the socio-linguistic domain



#### COGNITION and BEHAVIOUR:

- **Cognition:** The experience and process of living and environmental adaptation, equivalent to action
- **Behaviour:** Action observed in relation to a certain environment
- **Social phenomena:** Phenomena associated with participation in social groups (third-order unities)
- **Communication:** The coordination of behaviour observed to occur as a result of social coupling
- **Language:** Communication and behaviour that an observer can describe in semantic terms

#### DEVELOPMENT and LEARNING:

- **Organisation:** Our inherited biological architecture
- **Structure:** Internal changes resulting from world experience
- **Structural coupling:** A history of recurrent interactions leading to the structural congruence between two or more systems
- **Structural congruence:** A state of stable structural equilibrium between two or more systems
- **Knowledge:** An effective (or adequate) behaviour in a given context

### Figure 3.5 Theoretical Framework: Concepts and Definitions

The complete theoretical framework, together with concepts and definition, is summarised in Figure 3.5 above.

While both the Child's and Teacher's Experience (2. and 4.) are represented as separate from the Socio-Linguistic Domain (3.), it is important to clarify that in actuality they are conceived as nested within it during social interaction. In the Santiago Theory, second and third orders of unity –individual and social group, respectively– are embodied living systems viewed from different levels. While each unity is coupled to the same specific environment, it is assumed that the description of cognitively-relevant

behaviour and dynamics at one level may be qualitatively different to that at the other, and that both perspectives may have relevance to the thesis objectives.

For this reason the two levels are represented as separate in the framework. This also centres attention on the individual child and their cognitive interactions with the physical (1) and / or the socio-linguistic environment (3). The arrows might be conceptualised as the flow of cognition through the system relevant to individual task performance, which is the dynamic most relevant to the research aim.

### **3.3 Methodological Considerations**

#### ***3.3.1 Field Experiment Design***

The research design is best classified as a set of complementary field experiments, in that it seeks to apply a scientific approach in an actual school situation. The ‘real world’ context distinguishes a field experiment from a laboratory experiment, and is considered the approach’s major strength –for conferring ecological validity– and weakness –for the number of extraneous variables and consequent difficulties with replication (Shuttleworth, 2006, McLeod, 2012).

Experimental participants were not randomised in their group allocation and thus, strictly-speaking, all interventions are quasi-experimental. While purists argue quasi-experiments produce ambiguous tests of hypotheses, supporters consider them effective, providing that alternative explanations for effects can be ruled out (Pitts, Prost, & Winters, 2005; Trochim, 2006a). Pitts and colleagues propose the quasi-experimental approach can be strengthened by matching within-groups for key variables, and using a complementary between-groups design. They argue:

*“(While) no single study can be designed such that it rules out or addresses all uncertainty with respect to the effect of a given treatment, a consistent finding (...) across a range of studies and designs greatly increases our confidence in the robustness of the effectiveness of treatment”* (Pitts et al., 2005, p. 97).



Within-groups for these four experiments are well matched for age, gender and ability, and they can be considered complementary in that all entail a repeated measures design. Groups participate in both conditions of the independent variable –i.e. the same curriculum task performed indoors and outdoors– and the dependent variable is compared between them –i.e. the children’s task performance.

A criticism of the repeated measures design is the potential for order effects: because participant performance improves or declines on the second task due to repetition or boredom, respectively (Cozby, 2014; McLeod, 2007). To control for this, task setting order was varied for two of the three participating schools.

Thus, while specific school-related circumstances mean each task features a unique research design and no statistical control (Wikibooks, 2014), the repeated measures design allows for the four to be compared overall in the manner of a classical experiment. A significant majority of the participants completed a treatment in both conditions, and task assessment and test measures were consistent across the study. In these respects, the design can be considered adequate to support cross-task analytical generalisation.

The decision to use field experiments originated with the theoretical framework. By conceptualising a curriculum task as a discrete purposeful system, this deemphasised factors outside temporal and spatial boundary (Wright & Meadows, 2009, p.11). Moreover, the four categories also simplified a complex situation and suggested ways phenomena related to each and the interactions between them might be compared within and between tasks.

The original aim was that all would perform the same experimental task with a statistical control, but this proved non-viable due to marked differences between the size and approaches of the participating schools. Thus, it was decided to emphasise ecological validity over external validity.

The teachers were asked to select a particular task from their term teaching plan which they thought could work in an outdoor setting, and to approach it as they would ordinarily. I played no part in choosing any of the four tasks or determining their content. Other than the requirement that instructions should be consistent across settings, I believe they occurred as they would have done in my absence. In this sense, they also have qualities of a natural experiment (McLeod, 2012).

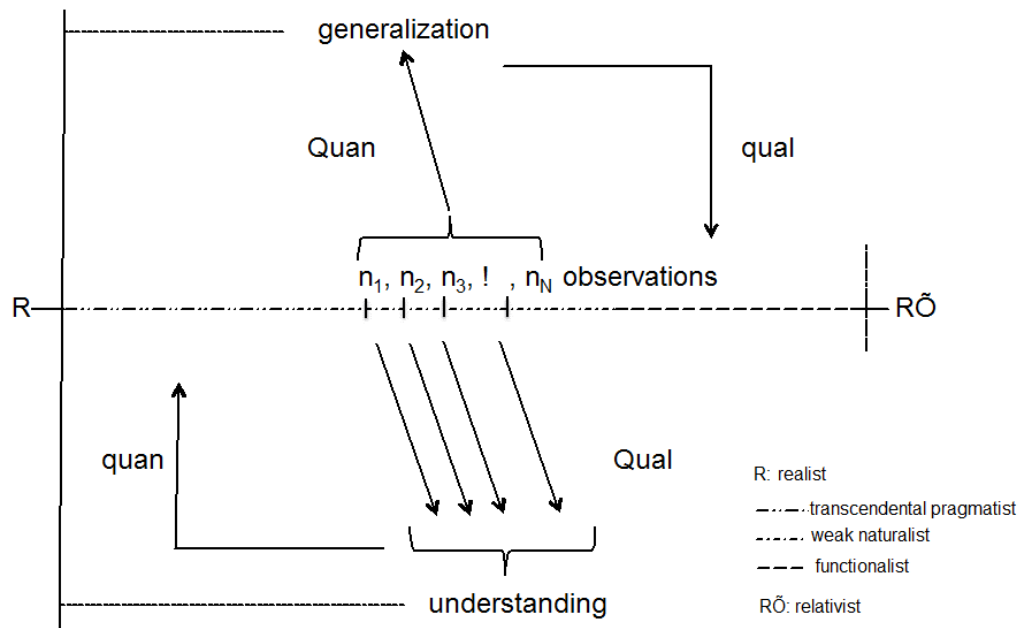
The result is a diverse set of tasks. This might be considered both a design strength, for enriching the dataset; or a weakness, for undermining external validity and a strong basis for analytical generalisation. Nevertheless, it is also argued here that diversity can be considered to reinforce the generalisability of any results found consistent across the tasks, on the same principle that underpins diverse extreme case selection in case study research (Flyvbjerg, 2006; Pettigrew, 1990).

### **3.3.2 Mixed Methods Research**

The data gathering approaches within the field experiments entail the two philosophical orientations in the social and behavioural sciences, the ‘realist / positivist / quantitative’ and the ‘relativist / constructionist / qualitative’ (Creswell, 2013). Although the two were once generally regarded as incommensurable (Tashakkori & Teddlie, 2010), the resurgence of support for Pragmatism in recent decades (Hacking, 1983) means mixed method approaches are now widely accepted (Bryman, 2008; Creswell, 2013; Eisenhardt, 1989). Based on a review of related literature, Johnson, Onwuegbuzie and Turner (2007, p.123) propose the following overarching definition of ‘mixed methods research’:

*“Research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration”.*

Providing researchers are explicit to the reader about their theoretical framework and rationale (Creswell & Clark, 2011; Eisenhardt, 1989; Gibbert et al., 2008), mixed methods are considered well suited for exploratory research (Yin, 2013; Bassey, 1999). This is because looking at the data “*in divergent ways*” helps reinforce validity (Eisenhardt, 1989) and provides a basis for effective convergence and corroboration of findings (Johnson et al., 2007; Creswell & Clark, 2011). A mixed methods approach also complements the thesis’s pragmatic position, which prioritises gaining practical insights about a novel situation, above philosophical consistency (Creswell, 2013).



**Figure 3.6 Continuous Scale of Pragmatist Epistemologies (Dettweiler, 2015)**

The way I conceptualise the thesis’s toolkit is well represented by the Figure 3.6 above (Dettweiler, 2015). Quantitative (quan) and qualitative (qual) methods are shown as points on an epistemological continuum intermediate between extreme realist (R) and relativist (RÕ) poles, each philosophically untenable. Between these poles, a researcher is free to move within and across datasets, seeking to generalise qualitative understanding (Qual to quan) and enrich statistics with qualitative context (Quan to qual). Particularly, this thesis emphasises the ‘Qual to quan’ strategy, in individual methods, and in an overarching sense, in that the thesis seeks to generalise multiple qualitative situations. Examples of within-method strategies include quantifying task observations in interactions analyses, and representing teacher interview data as variables in a causal loop analysis, detailed further below. While less prevalent, the ‘Quan to qual’ strategy can be considered extant in the main discussion, which seeks qualitative depth to statistical findings.

The overall toolkit might be classified as *a transformative strategy with a concurrent approach*: transformative, because it is structured by a theoretical framework, and concurrent, in that it focuses solely on the field experiments (Creswell, 2013). The general approach to methods therein has been dynamic, emergent and flexible. In line with principles of a grounded approach (Glaser & Strauss, 1967), the choice of tools

was not determined upfront. Rather, it was informed by the question ‘*what is happening here, and how might it best be recorded and measured?*’ and developed through roadtesting and a growing appreciation of pertinent variables and dynamics. Moreover, while each stage of data collection was informed by prior learnings, the goal was never to expand on these, but rather to introduce new perspectives which might enrich an understanding of the overall research situation.

### **3.4 Recruitment**

The principal recruitment routes were contacts made during exploratory fieldwork, and who were aware of the thesis focus. These included Education Scotland, local authorities, the Forestry Commission Service, Grounds for Learning and Creative Star. Via these routes, potential participating schools were sourced, then approached.

In addition to the broad aim of finding a diverse mix of primary schools relevant to the research situation, recruitment was guided by two criteria. Firstly, I sought schools who had never tried outdoor learning, as well as those with established programmes, to ensure a focus on one didn’t influence findings unknowingly. Two of the participating schools were novices.

Secondly, efforts were made to find some schools in urban or socioeconomically vulnerable areas. In part, this decision was due to the relevance of Scotland’s ‘performance gap’ to the research, but it was also due to a general tendency I had perceived of associating Scottish outdoor learning opportunities with affluent or rural catchments. To make a convincing case for outdoor learning at a national level, therefore, it seemed necessary for any findings to challenge any such assumptions. Consequently, none of the schools have affluent catchments and two have urban locations, one of them located in a deprived area within a large city.

As a measure of socio-economic context, the thesis employs the percentage of pupils registered for free school meals (FSM). FSM is a UK Government scheme which enables parents on benefits to apply for their children to have free school dinners (Scottish Government, 2013b). FSM has been criticised for being an imprecise and

oversimplified measure of educational disadvantage (Kounali, Robinson, Goldstein, & Lauder, 2008; Watson, 2011). Nevertheless, statistics still suggest that primary schools with a high FSM percentage are more likely to have concentrations of vulnerable pupils (DCSF, 2010) and it was considered a practical measure sufficient for purpose.

Moreover, purposeful selection, or choosing schools for theoretical reasons, rather than statistical or analytical ones, is held to support generalisation in educational case studies (Johansson, 2003; Yin, 2013). This principle might apply similarly here. Both criteria might be framed as defining ‘extreme’ cases (Flyvbjerg, 2006) which fulfil particular theoretical categories (Johansson, 2003; Eisenhardt, 1989), where, to quote Pettigrew, differences might be expected to be more “*transparently observable*” (Pettigrew, 1990).

### **3.4.1 Participants**

The experiments involve a total of 71 primary schoolchildren who participated in indoor and outdoor components of one experimental task, and the follow-up questionnaire.

There is an almost equal split of female (n=36) and male (n=35).

Predominantly, participants were in their first year, or P1 as it is referred to in the Scottish Education system, with a mean age of around 5 years (n=53). In one school, there is a mixed early years’ class which also included four second year (i.e. P2) pupils, average age 6 years, who for analysis purposes are allocated with the P1s to form a single *early years group* (n=57). The remaining 14 children are from P5 and P6 classes, average age 9 and 10 years, respectively. These are all from one school, and are termed the *experienced group* on account of their having 4-5 years exposure to regular woodland learning. Thirteen children across two of the schools were classified as *underachievers* by their class teachers (in private, as no formal assessment was available), a group which includes 8 boys and 5 girls.

Other than the children, the sample also includes 4 *teachers*, all female, of whom two had outdoor teaching experience (playground and urban wood), and two had none (both rural wood).

SCHOOLS				CHILDREN					TASK	
Name	FSM*	Teachers	School Yr	Sample	Av Age	m	f	UA**	Settings	Tasks
1. Playground	14%	n=1	P1	n=19	5yrs	10	9	6	Classroom / Playground	(1) Autumn Leaves*** (2) Build a Den
2. Urban Wood	72%	n=1	P1	n=29	5yrs	15	14	7	Classroom / Wood	(1) Make a Toy (2) Puppet Tour
3. Rural Wood	14%	n=2	P1/2	n=9	5.5yrs	4	5	0	Classroom / Wood	(1) Alien Adventure
			P5/6	n=14	9.5yrs	6	8	1		

\*FSM: Free School Meals

\*\*UA:

\*\*\*Pilot Study

**Table 3.1 Overview of Study Schools, Tasks and Participants**

Table 3.1 sets out the 3 participating schools together with their comparable features (Tripp, 1985), and the curriculum tasks each performed. Henceforward, these will be referred to by monikers which feature their location and / or their outdoor setting: *playground*; *urban wood*, the school in the socioeconomically deprived area; and *rural wood*, which had the established outdoor learning regime.

### 3.5 Field Experiments

This section will outline the four main field experiments and the three participating schools, including details of how settings and tasks were assessed.

#### 3.5.1: *Urban playground: 'Build a Den'*

Playground is a large public primary school, located in one of Scotland's biggest towns. It has approximately 250 pupils and a catchment of mixed socio-economic status.

Around 14% of its pupils are on the FSM scheme, which was under the Scottish national average of 21% in the year of the intervention (Scottish Government, 2014b).

Playground was the venue for the pilot, 'Autumn Leaves', and one task, 'Build a Den'. 'Build a Den' required children to build a den for 'teddy' to hide from a story character in a classroom and then a playground, and vice versa. This was the only main study experiment which featured a playground setting.

### ***3.5.2 Urban Wood: 'Make a Toy' and 'Puppet Tour'***

Urban wood is also a large primary school. It has around 200 pupils and is situated in a deprived area of a large city. Approximately 72% of its children are on the FSM scheme, three times the national average in the intervention year, and by far the highest in the study. Nevertheless, the school has a good reputation, and was recently awarded an 'excellent' grade in an inspection, one of only a handful to have achieved this.

Urban wood conducted two experimental tasks, 'Make a Toy' and 'Puppet Tour', in a classroom then a wood, or vice versa. For 'Make a Toy', children made a toy, and for the 'Puppet Tour', they took a stick puppet on a tour of the setting. The children and their supervising teacher had never taken an outdoor lesson prior to the interventions.

### ***3.5.3 Rural Wood: 'Alien Adventure'***

Rural wood is a small village primary. With about 80 pupils, it is located in the countryside of Scotland's Midland Valley. It has a catchment of mixed socio-economic status, and like 'playground', approximately 14% of its pupils are on the FSM scheme. The school takes a holistic and collaborative approach to CfE. This includes an outdoor learning programme entailing a weekly woodland lesson, weather-permitting. Thus all participants had some experience of outdoor learning to a greater or lesser degree.

Rural wood conducted one task, ‘Alien Adventure’. This required buddy groups – pairings of an ‘early years’ and an ‘experienced’ child – to invent a story about an adventure on an alien planet, first in the classroom and then in a wood. A second task, ‘Build a Farm’, designed to compare playground and woodland settings, was not completed due to the early abandonment of the woodland component on account of an extreme midge infestation.

### 3.6 Pilot Study: ‘Autumn Leaves’, Urban Playground

The pilot was conducted with the urban playground school. Beyond informing the methodology, it does not feature further in the thesis. This is on account of the fundamental design issues it highlighted rendering its model and findings incompatible with the main study.

The theme of the task was ‘sensory experiences of leaves’. All components took place over two days in November 2013. A one-shot independent measures design was employed, entailing the two P1 classes allocated to a different setting each –a classroom and playground– and their behaviour compared (see Table 3.2 below). There were 21 participants in total, closely matched for numbers, gender and ability. Each task was supervised by the class’s usual teacher, and an Education Officer provided playground support, it being that teacher’s first outdoor lesson.

	Children (Av Age 5yrs)				Pilot Study: Autumn Leaves Setting 1
	Total	m	f	UA*	
Group 1	11	6	5	3	Indoors
Group 2	10	5	5	3	Playground
Totals:	21	11	10	6	

*\*Underachievers: 1 boy & 2 girls in each group*

**Table 3.2 Design for the Study Pilot: ‘Autumn Leaves’**



The procedure varied between the classroom and playground tasks. In the playground, dustbin bags of leaves were emptied into a pile on the grass. Pupils took it in turns to pick and describe a “*special leaf*”, and then kick the pile and tell everyone “*how it felt*”. They then returned to the classroom to sit in a circle and state one-by-one “*something they did outside, something to do with the leaves*”. In the classroom, leaves were emptied into cardboard ‘feely’ boxes with hand-sized holes in one side. Children took it in turns to stick their hands into the box and state “*what they felt, using all their senses*”. On both tasks, the children’s statements were recorded and the next day, each drew a picture to represent their own. I observed and audio-recorded the playground task, but was not present for the indoor task, or for the drawing component.

### *Design issues and remedies*

The pilot highlighted five basic design issues. The first was the internal validity of the one-shot comparison. This rendered it impossible to assess whether impacts were attributable to setting, or to different participants, teachers and procedures. This led to the implementation of the repeated measures design, where groups, teachers and instructions were consistent across indoor and outdoor conditions.

Second, was the possibility that constraints on environmental interaction imposed by the task design could confound measurement of setting impacts. For the pilot’s playground condition, interaction was so narrowly prescribed that other available affordances seemed irrelevant to task execution. This led to a measure to assess the open-endedness of subsequent task designs, detailed in 3.7.2.

Third, was the challenge of establishing a reliable general cross-task outcome measure, which will be expanded upon in 3.8.2.

Fourth, was underestimating the importance of observation. Missing the classroom task highlighted the problem of accurately reporting setting impacts without observing both conditions. On the pilot, this was further emphasised by procedural differences between conditions and inadequate drawings. Detached observation of the playground task also revealed little of the content and richness of children’s experiences, compared with the rich insights I’d gained from participating in their activities during exploratory

fieldwork. Thenceforward, I adopted a participatory observational approach for all conditions, the pros and cons of which will be elaborated upon in 3.8.1.

The final issue related to the effectiveness of recording equipment. Due to concerns that a camcorder might distract, or alter performance (Webb, Campbell, & Swartz, 1999; Bryman, 2012), discreetly, I used a smartphone to record the playground task. The resulting data was very poor quality, much of it indecipherable. It was also impossible to identify individual speakers, the importance of which also became apparent. In debriefing with the teachers, it emerged that pupils were well accustomed to video recording, as it was now routine practice in school. Therefore, all subsequent tasks were filmed using camcorders.

### **3.7 Setting and Task Assessment Tools**

#### ***3.7.1 Setting Assessment: Richness Index (RI)***

To address RH2 in the main study, a Richness Index (RI) was developed to measure and compare the natural richness of the task settings. The RI was a refinement of checklists designed by the Forestry Commission Service to evaluate the quality of Scottish outdoor sites for educational purposes and development funding.

With the help of two outdoor learning specialists, and informed by Heft's taxonomy (see Figure 2.2 (Heft, 1988)), these checklists were distilled down to two categories of natural richness: biodiversity and affordances, each comprised of 8 items and scoring one for each.

RICHNESS INDEX (RI) BIODIVERSITY:	Case	Playground		Urban Wood		Rural Wood	
	Study: Setting:	play-g	class	wood	class	wood	class
1. Mix of Animal and Bird Life		0	0	1	0	1	0
2. Mix of Insect Life		0	0	1	0	1	0
3. Mix of Trees of Different Species and Ages		0	0	1	0	1	0
4. Mix of Shrubs or Hedges		0	0	1	0	0	0
5. Mix of Other Flowers, Plants and Fungi		0	0	1	0	1	0
6. Logs and Deadwood on the Ground		0	0	1	0	1	0
7. Areas of Meadow or Grass		1	0	1	0	1	0
8. Water features such as Puddles, Ponds, Streams or Wetland		0	0	0	0	1	0
<b>Total:</b>		<b>1</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>7</b>	<b>0</b>
<b>AFFORDANCES:</b>							
1. Soil, Mud or Sand for Creative Manipulation		1	0	1	0	1	0
2. Loose Materials for Creative Manipulation or Den Building		1	1	1	1	1	1
3. Slopes and Dips for Running, Rolling or Hiding		0	0	1	0	0	0
4. Water for Paddling and Splashing		0	0	0	0	1	0
5. Upright and Fallen Trees, and Stumps		0	0	1	0	1	0
6. Other features for Climbing, Balancing, Jumping Off or Hiding		1	1	0	0	0	1
7. Pathways for Walking, Running or Hiding		0	0	1	0	1	0
8. Open Spaces, or Mix of Cover and Glades for Walking or Running		1	0	1	0	1	0
<b>Total:</b>		<b>4</b>	<b>2</b>	<b>6</b>	<b>1</b>	<b>6</b>	<b>2</b>
<b>GRAND TOTAL</b>		<b>5</b>	<b>2</b>	<b>13</b>	<b>1</b>	<b>13</b>	<b>2</b>
<b>RICHNESS CATEGORY SCORE</b>		<b>2</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>1</b>
<b>CATEGORY:</b> <i>I=Indoors; P=Playground; SW=Semi-Wild; W=Wild</i>		<b>P</b>	<b>I</b>	<b>W</b>	<b>I</b>	<b>W</b>	<b>I</b>

#### RICHNESS CATEGORIES and CATEGORISATION CRITERIA

**INDOORS ONLY:** Relevant Affordances criteria

**PLAYGROUND:** Scoring <5/16, *including* <6 for 'Biodiversity' and <5 for 'Affordances'

**SEMI-WILD:** : Scoring <10/16 and >5 overall

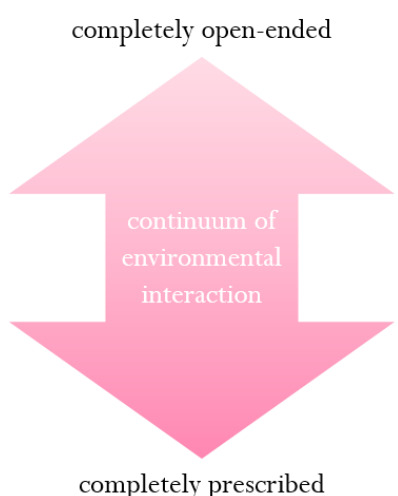
**WILD:** : Scoring >10/16 on SITE CRITERIA, *including* >5 for 'Biodiversity' and >4 for 'Affordances'

**Table 3.3 Richness Index: Items and Setting Scorings**

After calibrating the RI against a range of learning environments, 4 setting categories were proposed with threshold scores. In order of natural richness, these are *indoors* (scoring relevant affordances), *playground* ( $\leq 5$ ), *semi-wild* ( $\geq 6$  and  $\leq 9$ ) and *wild* ( $\geq 10$ ). The experiments include four *indoor* classrooms (RI=1 or 2); one (urban) *playground* (RI=5); and two *wild settings* – urban and rural wood, which despite markedly different characters, both returned an identical score (RI=13). The study includes no *semi-wild* settings, which approximates to a well-equipped playground with some natural features. Table 3.3 sets out the full RI together with scorings for all task settings.

### 3.7.2 Task Assessment: Design ‘Open-endedness’

Following learnings from the pilot study, a tool was developed to evaluate the design open-endedness of all subsequent field experiments. Presuming a theoretical continuum between minimum and maximum autonomy, and access to available setting affordances, the tool scores each task component according to the degree to which it prescribes task outcomes, affordances (i.e. materials) and environmental interaction. Open-endedness categories and scoring criteria for these are set out in Table 3.4 below, and the scores for all task components are shown in Table 3.5.



category	score	interaction	affordances
<i>open-ended:</i>	4	...allows a large degree of freedom for environmental interaction	...can be anything available to the child in the environment
<i>open-ended with stated outcome:</i>	3	...as above only has a specified outcome to work towards	...as above only must be worked towards a specified outcome
<i>closed:</i>	2	...prescribes <i>how</i> children are to interact with the environment	...are prescribed or limited by the teacher or task
<i>closed with stated outcome:</i>	1	...as above only has a specified outcome to work towards	...as above only must be worked towards a specified outcome

**Table 3.4 Task Open-endedness: Categories and Scoring**

Case Study: Experiments: Setting:	Playground				Urban Wood				Rural Wood	
	<i>*Autumn Leaves</i>		<i>Build a Den</i>		<i>Make a Toy</i>		<i>Puppet Tour</i>		<i>Alien Adventure</i>	
	play-g	class	play-g	class	wood	class	wood	class	wood	class
<b>Task Requirements:</b>										
Open-ended							4	4		
Open-ended with Stated Outcome			3	3	3	3			3	3
Closed										
Closed with Stated Outcome	1	1								
<b>Materials:</b>										
Open-ended							4	4	4	
Open-ended with Stated Outcome					3					
Closed										
Closed with Stated Outcome	1	1	1	1		1				1
<b>TOTAL:</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>4</b>	<b>8</b>	<b>8</b>	<b>7</b>	<b>4</b>

*\*Pilot Study*

**Table 3.5 Task Open-endedness: Scorings for Experimental Components**

### 3.8 Stage 1 Methods: Experimental Observation and Outcomes

The four tasks took place between February and June 2013. Stage 1 of qualitative data gathering and analysis related directly to the tasks, and included participatory observations, task outcomes and video analyses of task interactions.

#### 3.8.1 Stage 1: Participatory Observation

Bryman defines a participating observer as one who is “*involved fully in principal (group) activities*” (Bryman, 2012). Participatory techniques fall within the interpretative methodological tradition, and are a growing trend in the research of young children (O’ Kane, 2008). They are held to confer a richer grasp of children’s “*worlds of understanding*” (Mayall, 2008), particularly, of those with competencies other than talking, writing or drawing (James, Jenks, & Prout, 1998). Many consider them well suited to contexts where children are actively engaged, and that related dialogue can be

a richer source of interpretation and meaning than the activities themselves (O' Kane, 2008). Relating to the researcher via real-life events, rather than directly and passively, is also thought to promote openness and familiarity (Punch, 2002; O' Kane, 2008).

The main criticism of participatory techniques is *reactive effect*, or the researcher's intervention influencing behaviour (Webb et al., 1999). Reactive effect can be exacerbated by perceived power imbalances and the adult's failure to appreciate the child may have a qualitatively different experience of the activity (O' Kane, 2008; Punch, 2002). To mitigate reactive effect, child researchers emphasise the importance of remaining critically aware and reflexive (Punch, 2002), paying "*attention to personal style and facilitation skills*", and cultivating relationships where "*respect, openness and a genuine intent to listen is evident*" (O' Kane, 2008, p.143).

Corsaro and Molinari argue a core aim of the interpretative method in school research is to establish group membership status and an insider's viewpoint (Corsaro & Molinari, 2008). Towards this aim, they recommend the strategy of acting the 'incompetent adult', which resembled my personal approach. I endeavoured always to treat the children as leaders and experts, and to engage with their perspective, positively and supportively, without proposing or interrogating actions. I was also mindful of maintaining a consistent approach across tasks and settings, and distributing time equally among all participants. While my participation must have influenced behaviour and imaginings, I believe the combination of my approach and the large group sizes meant it can only have resulted in a negligible impact overall.

Moreover, without participation, it is argued that study observations may have proved largely worthless. The pilot highlighted how much of a child's behaviour and its influences are unfathomable from pure observation alone, where only engaging in their activity shows the stick to be a wand, sword, Hoover, gear lever or baby, and reveals its imaginative context. Although ultimately observations serve largely to inform and frame the more generalisable findings from stages 2 and 3, they did play an integral role in the development of the methodology and measures which underpin these.

For 'Alien Adventure', 'Make a Toy' and the Setting 1 components of 'Build a Den' my observations and interactions were recorded with a handheld camcorder. For 'Puppet Tour' and the Setting 2 components of 'Build a Den', a three camera set-up was employed, including a discreet Flip™ camera for the teacher and I, and a tripod-mounted camcorder recording a wide shot of the task area. While this generated an

unwieldy volume of data, it also enabled a much more complete task record, such as is represented in the ‘Puppet Tour’ interactions analyses, described shortly.

### ***3.8.2 Stage 1: Task Outcomes for ‘Build a Den’ and ‘Alien Adventure’***

Originally, it was envisaged that all experiments would share a common outcome measure. Two options were investigated. The pilot trialled the idea of recording individual verbal summaries of the children’s experiences, and having them depict these in drawings. However, outcomes were variable and often incomprehensible. As Punch highlights, “*it should not be assumed that drawings are a simple, ‘natural’ method to use with children as it depends on children’s actual and perceived ability to draw*”, where the inhibited or less competent may reproduce set images rather than use their imagination (Punch, 2002, p.331).

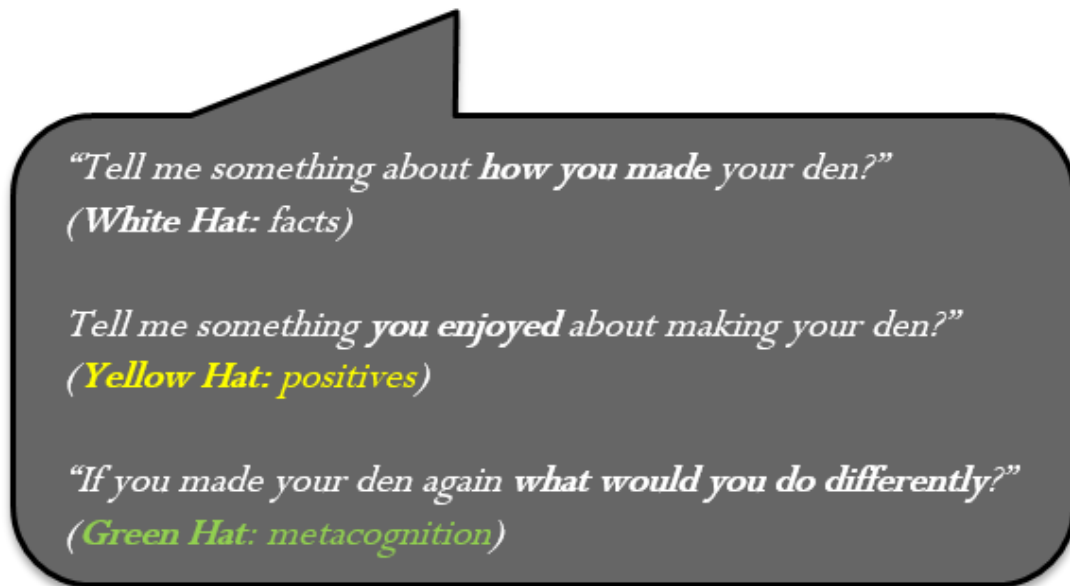
The second option, trialled for ‘Build a Den’, entailed children outlining their experience in verbal response to three structured questions based on De Bono’s Thinking Hats (De Bono, 2009), described below. However, these were time-consuming to administer, and the responses of some individuals seemed to inadequately reflect their observed task engagement and contribution. Consequently, the method was not extended to the other three experiments, and the idea of a cross-task outcome measure was abandoned in favour of observations and the Stage 2 and 3 post-test interventions.

Nevertheless, two of the tasks do feature analysable outcomes: the children’s Thinking Hat responses to ‘Build a Den’, and their stories for ‘Alien Adventure’.

#### *‘Build a Den’ (urban playground): De Bono’s ‘Thinking Hats’*

At the end of each ‘Build a Den’ component, each participant presented the den they had worked on to their classmates via responses to three of Edward De Bono’s Thinking Hat questions posed by the teacher (De Bono, 2009). These aimed to evaluate personal

task-related schemas (White Hat: ‘facts’); valued experiences (Yellow Hat: ‘positives’) and metacognition (Green Hat: ‘metacognition’), and appear in Figure 3.7 below.



**Figure 3.7 The Three Thinking Hat Questions used for ‘Build a Den’**

De Bono’s Six Thinking Hats is a framework for reflection and assessment, designed to direct thinking onto one situational aspect at a time and capture individual perspectives. The six aspects are facts (White Hat); emotions (Red Hat); challenges (Black Hat); positives (Yellow Hat); metacognitive thinking (Green Hat); and control measures related to the Thinking Hat process itself (Blue Hat). The method was chosen because it is used routinely in primary schooling, and would be familiar to participants. The Red and Blue Hats were excluded because at that time they seemed less relevant to cognition, and the Black Hat (‘challenges’) was missed by the teacher on two components, precluding comparative analysis.

*‘Alien Adventure’ (rural wood): Stories*

The ‘Alien Adventure’ task required children to imagine a story about an adventure on an alien planet. At the end of both components, all assembled in the primary one classroom, and a selection of buddy groups were chosen by the teacher to present their stories. For the indoor component, the ‘experienced’ child read out their written story



first, and then their ‘early years’ counterpart described the picture they’d drawn to accompany it. For the outdoor component, there were neither written nor picture outcomes, and the two children verbally presented their story together. This analysis rests primarily on three buddy groups who presented in both components. The reader should remain cognisant of the potential impacts on story style of the differing presentation formats (i.e. sequential writing / drawn vs collaborative verbal).

### *Outcomes Analyses*

A similar thematic analysis approach was taken for both the stories and Thinking Hat responses. This was inductive, focused on task-specific details, and did not venture deeper than the semantics of what was said (Braun & Clarke, 2006). Themes were rather the outcomes of a straightforward comparison of indoor and outdoor data for similarities, differences and repetitions (Ryan & Bernard, 2003).

### ***3.8.3 Stage 1: Interactions Analyses for ‘Make a Toy’ and ‘Puppet Tour’***

The final Stage 1 approach entailed video analyses of children’s activities and collaborators during both components of the two urban wood experiments. Those for ‘Make a Toy’ assessed the productions each child led or worked on, and their collaborators. ‘Puppet Tour’ recorded individual behaviour and activity categories over the first 10 minutes of the task, broken down into 30 second slots, to give a picture of how settings influenced initial responses. These analyses’ quantification of qualitative interactions is an example of the epistemological move from understanding to generalisation embodied in the ‘Qual to quan’ approach, already outlined.

The interaction analyses were the last and most successful attempt at producing an objective, general outcome measure of video data. An initial textual analysis –e.g. themes, and numbers and types of words– was curbed by transcription challenges, varying data volumes and highly task-specific content. Next, I sought to code discrete exchanges of ideas according to which interaction between categories of the theoretical framework they seemed to most represent (e.g. from Environment, or Socio-Linguistic

Domain, to Child's Experience). However, I felt these interpretations were subjective, contrived, and misrepresented the mutuality of interactions, and this led directly to the simpler approach described.

However, it was not possible to apply the same analyses for both urban wood tasks, because 'Puppet Tour' entailed significantly more data, less grounded activity and thicker outdoor vegetation than 'Make a Toy'. It was also not possible to apply either analyses to the other two tasks. Fixed workgroups and stable project locations precluded coarse-grained analysis of activity and collaboration for 'Build a Den', and the single-camera footage and distributed activity on 'Alien Adventure' produced insufficient data on interactions.

Nevertheless, the concept of measuring the exchange of ideas between framework categories which emerged from the development of these interactions analyses, proved instrumental for informing subsequent methods. It can be considered extant in the Stage 2 performance criteria and the Stage 3 focused interview guide.

### **3.9 Stage 2 Methods: Follow-up Questionnaire**

Stage 2 of data-gathering took place October to November 2013, 6-7 months after the experiments. This stage is primarily quantitative, entailing an 8-12 minute questionnaire which recorded recollections and preferences, of children and teachers (the latter administered at the same time as the Stage 3 interviews).

The goal for Stage 2 was to provide a stronger basis for analytical generalisation across the tasks. Specifically, it sought to answer three research questions:

- 1. Did the children better recall the outdoor task over the indoor?(RH1)*
- 2. Did they prefer the task and setting for performance-related criteria? (RH1)*
- 3. Is there any association between these data and natural richness? (RH2)*

This section will outline the questionnaire pilot, before moving on to describe the method, rationale, measurement criteria and approaches to the statistical analysis. Full details of the procedural details will be given in Chapter 5 with the findings.

### ***3.9.1 Stage 2: Questionnaire Pilot***

The questionnaire pilot was conducted in October 2013 with a village nursery. The choice of using pre-schoolers was based on the assumption that if the approach worked with them, then it would work with the older participants. Results are not presented on account of the tiny sample and a dynamic approach which aimed to validate and improve elements in real time.

The participants were 3 boys and 3 girls, aged 3-4 years, due to start school the following September. Each was interviewed in turn in a quiet back office, with a teacher present. The questionnaire referred to a day, a fortnight previously, which had entailed classroom and woodland activities. The procedure was identical to the main study, except that each child was also asked a qualifying question for one or two preference criteria to assess the statements had been understood (e.g. “*what was fun outdoors?*” or “*who was in your team?*”).

Following each interview, the child’s recollections and answers to qualifying question were validated with the teacher, and improvements to the method were discussed and then trialled with the next participant. Four changes we viewed to improve outcomes, and were carried forward to the main study. The “*slightly disagree*” face was removed from the 5 point Likert Scale (Mygind, 2009), as this mitigated a tendency to pick the extreme emoticons. The Likert Scale was explained to children as “*unhappy to happy*” as they seemed to grasp this more easily than “*disagree to agree*”, yet intuitively apply it in that context. While the setting order for task ratings (i.e. indoors before outdoors, or vice versa) was varied between participants, it was kept consistent within each interview because alternating the order seemed to confuse individuals. Finally, it was decided to ask questions in the first person (“*when I was outdoors...*” instead of “*when you were outdoors...*”), as this seemed easier for children to digest (McLeod, 2010).

### 3.9.2 Stage 2: Recollections

The pilot and main study questionnaire began with asking participants what they recalled about the task, without specifying setting. Recollections were recorded before preferences on the assumption that the former may enrich the context for the latter.

A *free recall* method was used (“*tell me one thing you remember..?*”), with simple open-ended prompts (“*anything else..?*”), until a participant remembered nothing further about either task. The *location of the first recollection* and *number of recollections* were analysed. Further specifics on procedure are given in Chapter 5.

#### *Rationale*

A ‘recollection’ is a declarative (explicit) episodic memory, defined here as *an autobiographical narrative that can be called to mind and articulated*. In the last chapter, it was put forward that episodic memory is founded upon rich stable experiential models recorded in non-declarative (implicit) memory (Mastin, 2015a; McGilchrist, 2012). It was also proposed that there was an association between the strength of memory traces and levels of environmental richness, compatibility and engagement ( Craik & Lockhart, 1972). This relationship between the richness of an environment and related experiential models is also an assumption of Piagetian Theory (Piaget & Cook, 1998) and the Santiago Theory (Maturana & Varela, 1992). It was also suggested that episodic memory is integral to learning (Mastin, 2015c) and the development of conceptual (semantic) memory (Mastin, 2015a; McGilchrist, 2012).

On these bases it is argued that recollections can be used to measure the cognitive and educational impact of a task setting. It is put forward that the sum *total of recollections* reflects the richness of the underlying experience (or the extent of ‘structural coupling’ in the terms of the theoretical framework). It is also proposed that the *location of the first recollection* or *readiness of recall* can be considered a rough measure of trace strength. Although the latter seems unsupported by the academic literature, in market research how “*top or front of mind*” a product or brand is in free recall is a generally accepted measure of comparative awareness or personal significance (Instantly, 2012). It is suggested that a similar underlying principle applies here.

### *Methodological Considerations*

The review also highlighted developmental implications for using recollections as a measure in young children. These included fragile metamemory (Kail, 1979), inconsistent performance, larger within group variation (Ceci & Bruck, 1993; Poole & Lindsay, 1995; Roebbers & Schneider, 2002), and greater susceptibility to interference, confusion and fantasy (Ceci & Bruck, 1993). Some researchers question the reliability of their long-term retention (Poole & Lindsay, 1995), while others argue that, with the right approaches, their event recollections can be more accurate and less susceptible to social influence than adults (Scott, 2008; Poole & Lindsay, 1995).

Free recall with simple open-ended prompts is generally regarded to yield the highest quality data for the age group, and to deliver consistently more accurate recollections than specific and direct questioning (Ceci & Bruck, 1993; Kail, 1979; Docherty & Sandelowski, 1999). It is also considered to reduce the possibility of confusion, or demand characteristics, that is, children altering or falsifying recollections to fit their interpretation of the experimental requirements (Poole & Lindsay, 1995).

### *Statistical Approaches*

The number of recollections for each participant were assessed using a ‘feature of the event’ approach similar to that employed in comparing verbal reports of child eyewitnesses. This approach is considered better suited for evaluating the structural completeness of an event memory, as opposed to using individual words or ‘units of information’ (Roebbers & Schneider, 2002) which tend to emphasise linguistic competency (Baker-Ward, Ornstein, Gordon, Follmer, & Clubb, 1995). A ‘feature’ was considered to be a discrete event (e.g. “*we were making tents*”) or related fact (e.g. “*my tent was green*”). To the extent possible, recollections were verified against video recordings and transcripts, which resulted in the exclusion of a negligible quantity of false or inaccurate data.

### 3.9.3 Stage 2: Measurement Criteria for Preferences and Ratings

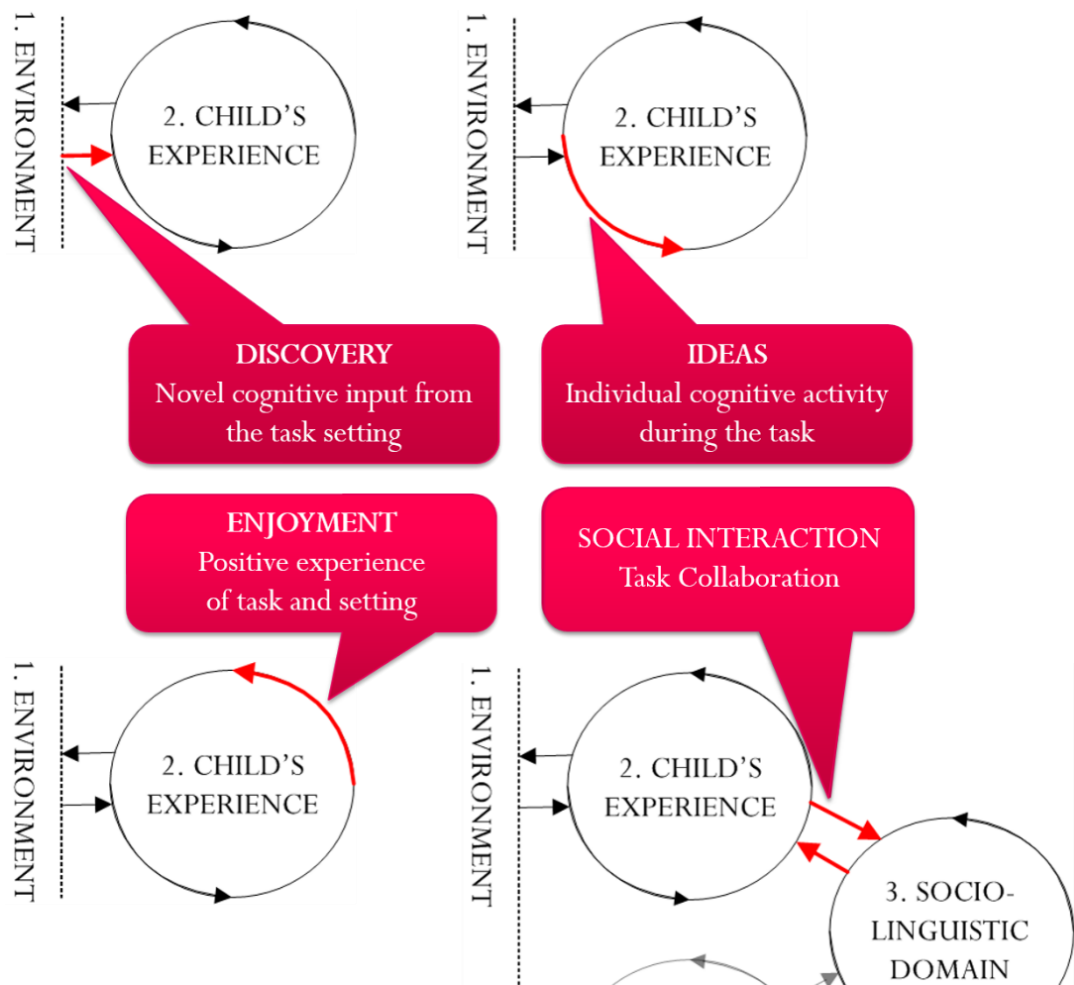
The second part of the questionnaire recorded task ratings and setting preferences in relation to nine measurement criteria. Four criteria are related to *performance* and were informed by the theoretical framework, four were adapted from the *perceived restorativeness scale (PRS)*, and there was one baseline measure.

#### *Performance Criteria*

The aim for the questionnaire's performance criteria was to develop some simple cognitive measures which were setting unbiased, and represented the systemic inputs, outputs and interactions of the theoretical framework (see Figure 3.8 overleaf). The scale is underpinned by a concept which emerged during the development of the interactions analyses, namely, that the exchange of task-related ideas between framework categories might be used as a measure of overall cognitive activity and flow.

The four performance criteria and what they purport to measure are as follows:

- **Discovery.** *"I could discover"* aims to assess novel cognitive input from the physical environment, that is, the level to which affordances promote new ideas for individuals. In the theoretical framework it is represented by the arrow from (1) Environment to (2) Child's Experience.
- **Ideas.** *"I had good ideas"* is intended to measure the degree to which task interactions enabled individual thinking and thus is proposed to be an evaluation of internal cognitive activity. It is represented in the theoretical framework by the arrows within (2) Child's Experience.
- **Enjoyment.** *"I had fun"* seeks to assess the positive affective dimension of individual task-related cognition, and is also represented by the arrows within (2) Child's Experience.
- **Social interaction.** *"We worked well as a team"* aims to measure the level of positive task collaboration between individual children and peers, as represented by the arrows between (2) Child's Experience and (3) Socio-Linguistic Domain.



**Figure 3.8 Performance Criteria**

*Perceived restorativeness scale (PRS) criteria and baseline measure*

The four PRS criteria are intended to assess setting factors relevant to Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989). While only indirectly related to the theoretical framework, the PRS is included for being a validated measure of environmental impacts on attention, albeit in a restorative context and entailing an inherent bias towards natural settings.

Typically, the PRS is used to evaluate the potential or likelihood that a setting will provide restoration, with interventions involving the presentation and rating of varying scenes (e.g. Hartig et al., 1991). Here, however, it is employed to assess the perceived restorativeness of specific task environments and experiences, retrospectively –an application which seems permissible from the theoretical perspective.

The youngest sample who appear to have been tested on a version of the PRS to-date were aged 8-11 years (Bagot, 2004; Bagot et al., 2007). The length of this test (the PRCS-C) and statements, together with some abstract content, rendered it unsuitable for children 3-4 years younger. In adapting the scale, my goal was to condense each ART component down to one simple statement, and employ concrete action-oriented terms suitable for the age group and task scenario. Resulting changes may have implications for the scale, and this will be explored in the main discussion.

The final four statements and the rationale for them are as follows:

- **Fascination** purports to measure pleasurable attention, under the control of the setting. While “*the setting had fascinating qualities*” seemed the most accurate measure of the quality, there were doubts that younger children would grasp the meaning. Thus “*I could explore*” was decided upon for entailing a concrete action proposed to be stimulated by fascination (Kaplan & Kaplan, 1989), and which has been used in previous PRS scales (Hartig et al., 1997).
- **Being Away** aims to assess freedom from demands on effortful attention. The *physical* aspect of ‘being away’ was not included because it might be confusing to a young child evaluating two settings to ask if one felt like a different location to the other, and vice versa.

The idea of escape from routine or obligation which underlies the *psychological* aspect of ‘being away’ also seemed abstract and inapplicable to a school task. Thus the statement chosen was “*I could do things where and how I wanted*” which was felt to express the idea of autonomy which underpins ‘being away’, in an active context.

- **Compatibility** is proposed to evaluate the degree to which a setting supports personal goals and disposition. The two ‘compatibility’ questions in the PRCS-C referred to wanting, or liking, all the things doable in a setting (Bagot, 2004). This seemed too abstract for young children, particularly in the context of a novel setting. Therefore, “*I liked being there*” was selected to articulate the feeling of environmental congruence and competence underlying the ART component.



- **Extent** seeks to evaluate the perceived scale, coherence and richness of a setting. “*There was lots of space where we played, and beyond*” was decided upon because it was felt to capture the immersive spatial quality of extent. This is a departure from the PRSC-C (Bagot, 2004) and PRS (Hartig et al., 1997), which seem to emphasise, respectively, enabling environmental richness (e.g. “*I can do many different things in one part of the school ground*”) or setting *incoherence* (i.e. the presumed opposite of extent –distracting, confusing or chaotic stimuli etc.).

The statement chosen for ‘extent’ was inspired by the comment by a P1 girl during ‘Alien Adventure’ that “*this wood is loads bigger than the school and the playground put together*”, when, in fact, it is a fraction of the size.

This recalled Kaplan and Kaplan’s description of ‘extent through intensity’ associated with Japanese miniature gardens, which entails imagined and seen aspects that can give the impression of “*a whole little world’ (... ) captured in a small space*”. They describe this spatial experience of ‘extent’ as:

*“A continuation of the world beyond what is immediately perceived (where) even relatively small natural environments can contain certain physical features that help make it vast conceptually – such as being big enough and complex enough to get lost in and offering numerous possibilities of what one might encounter on the way”* (Kaplan & Kaplan, 1989, p.191-192).

It is this immersive experience which the current measure seeks to capture. While, “*and beyond*” is relatively abstract, teachers felt its use in the catchphrase, “*to infinity and beyond*” (*Toy Story*, 1995), from a popular children’s movie would render it familiar and understandable to most.

The ninth and final questionnaire criterion is the proposed base line measure, **Naturalness**: “*there were real trees, bushes and grass all around me*”. The statement was felt to represent an unequivocal distinction between outdoors and indoors, and therefore, that an unequivocal outdoor preference might be considered to validate the method and participants’ awareness of their natural surroundings.

All measurement criteria are summarised in Table 3.6.

CRITERIA	DESCRIPTION (what the variable proposes to represent)	MEASURE (how the variable was measured)
<b>Performance</b>	<b>Perceived task performance</b>	
<i>Discovery</i>	Novel input from task setting	<i>I discovered things</i>
<i>Ideas</i>	Individual cognitive activity during the task	<i>I had good ideas</i>
<i>Enjoyment</i>	Positive experience of task and setting	<i>I had fun</i>
<i>Social Interaction</i>	Task collaboration	<i>We worked well as a team</i>
<b>PRS</b>	<b>Perceived restorative features</b>	
<i>Fascination</i>	Pleasurable attention, under the control of the setting	<i>I could explore</i>
<i>Being Away</i>	Freedom from demands on effortful attention	<i>I was free to do things where and how I wanted</i>
<i>Compatibility</i>	Extent to which the setting supports one's goals and disposition	<i>I liked being there</i>
<i>Extent</i>	Perceived scale, coherence and richness of the setting	<i>There was lots of space where we played and beyond</i>
<b>Baseline</b>		
<i>Naturalness</i>	Perceived naturalness of setting	<i>There were real trees, bushes and grass all around me</i>

**Table 3.6 Summary of Measurement Criteria**

### ***3.9.4 Stage 2: Measuring Setting Preferences and Task Ratings***

Participants gave responses to the measurement criteria by pointing at pictures. They rated outdoor and indoor tasks for a given criterion using a four emoticon Likert Scale, and then selected which setting they preferred most for that criterion using sketches which represented the classroom and the outdoors. This procedure is demonstrated in Figure 5.8, and copies of materials used are included in Appendix 1. A questionnaire intervention was complete when a task rating and a setting preference had been chosen for all nine criteria. Further procedural details are given in Chapter 5 along with the results.

The idea and rationale for using preferences came from the PRS (Bagot, 2004; Bagot et al., 2007; Hartig et al., 1991). Indeed, the questionnaire was developed from prototype PRS questionnaire which was prepared for the playground pilot. However, the prototype questionnaire wasn't used in the pilot due to time constraints, and therefore wasn't taken forward into the main study experiments.

The rest of this section will set out some methodological considerations regarding child questionnaire design.

### *Methodological Considerations*

The challenges of designing a questionnaire for young children are generally recognised. Jacqueline Scott regards standard questionnaires as “*clearly inappropriate*” for early years, but semi-structured approaches to be viable from age 7 years and upwards (Scott, 2008, p.90). A Danish review of child research methods found under 8s experienced difficulties selecting questionnaire answers, and were sensitive to question quality and the suitability of themes and concepts (Mygind, 2009).

Demands on memory, perception, verbal comprehension and social understanding have all been shown to confound the outcomes of early years' research (Donaldson, 1986). Children can struggle to remember even a limited set of response options. They also exhibit strong primary and acquiescence bias, that is, a tendency to select the first or most positive answers, respectively. Understanding what questions are asking or mean can represent a significant hurdle for a young mind, particularly when they are long, unclear, difficult or hypothetical (Scott, 2008).

Nevertheless, children over 6 years old are regarded as possessing the cognitive and language capabilities for effective interviewing and self-reporting (Docherty & Sandelowski, 1999). Scott writes:

*“(although) there is a reluctance to take what children say at face value...there is growing evidence to suggest that the best source of information about issues pertinent to children is the children themselves...while parents and teachers can provide useful insights into child behaviour, the direct interviewing of children provides a far more complete account of the child's life”* (Scott, 2008, p.95-96).

Recommendations for mitigating measurement error from child questionnaires include using a less structured approach with adult support, and response options which are easy to cope with (Scott, 2008), including the use of four-category Likert scales (Mygind, 2009).

Employing content and presentation meaningful to the child is also considered vital (Mygind, 2009; Scott, 2008). Scott proposes that *“for children under 11, visual stimuli can be especially useful in the questioning process, because pictures make the issue far more concrete than verbal representation alone”* (2008, p.91). However, she also warns that image repetition may bore those with limited attention and that pictures don't necessarily make decision-making any easier. She also emphasises the importance of setting, and deems school a cost effective choice, where the main drawback is the possible influence of classmates on each others' responses.

In summary, there are recognised challenges for early years' questionnaire research, which researchers suggest can be mitigated through attention to clarity and simplicity, use of child-relevant terminology and images, and by taking a supportive and less structured approach to interviewing.

### ***3.9.5 Stage 2: Statistical Analyses***

All data was analysed using SPSS (v. 21.0). Non-parametric tests were used to evaluate differences between groups and settings for recollections, task ratings and setting preferences, specifically, Chi-square, Wilcoxon signed rank, and Mann-Whitney U-tests. For task ratings, emoticons were scored from 1 to 4, and for overall analyses, or those involving performance or PRS totals, the sum of each participant's relevant criteria ratings and preferences were employed. While non-parametric tests are less powerful and more conservative than parametric tests (Horst, 2015), they are considered appropriate because the data are ordinal or nominal. It is also an exploratory study and, therefore, the normal data distribution required for parametric approaches cannot be assumed (Field, 2005). Similarly, only two-tailed statistics for Wilcoxon signed rank and Mann-Whitney U-tests are given, and therefore levels of significance are conservative in that they do not presume an outdoor preference.

To investigate the dataset for conceptual underpinnings, a principal components analysis of setting preferences is employed (PCA). PCA was chosen over a factor analysis because the thesis is neither testing, nor assuming, a pre-existing theory, but is rather openly exploring the data for possible patterns (Cross Validated, 2011). Likewise, a Varimax rotation is used because, compared with other loading procedures, it tends to group single variables with one or a small number of factors, thus rendering the conceptual structure of the data easier to interpret (Abdi, 2003). While this plays down data realities in the interests of clearer results, this is justified by the thesis's pragmatic position, which seeks not a nuanced account of observed phenomenon, but a practical general explanation.

To investigate associations between setting preferences and natural richness (RI) for RH2, logistic regression analyses are used (LR). LR predicts which of two categorical setting (e.g. playground vs wild setting), a setting preference or PCA component is most likely to belong to. The approach was appropriate because setting preferences did not demonstrate the normal distribution required for linear regression (Field, 2005). For both the PCA and the logistic regression analyses, setting preferences were used instead of task ratings, because they offered a decisive measurement of the strongest setting inclinations.

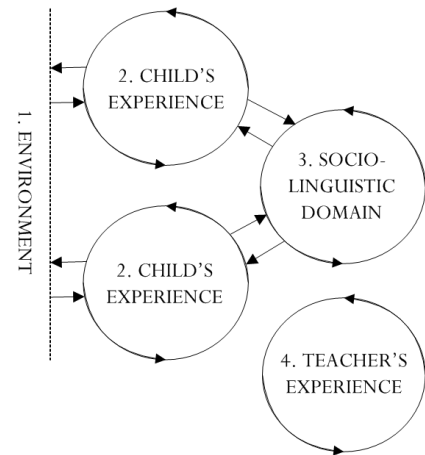
### **3.10 Stage 3 Methods: Focused Teacher Interviews**

The last stage of data-gathering took place in January 2014, around 7-10 months post-test. Stage 3 only involved the four participating teachers and hinged on a 45 minute focused interview, although the Stage 2 questionnaire was also administered to them at the same time.

The focused interviews sought to capture a whole task perspective for each teacher, where common themes might be used as a basis for a model of relevant variables and dynamics. The goal was to bolster any case for cross-task analytical generalisation, with the potential of providing an integrative context for other findings.

## FOCUSED INTERVIEW GUIDE

1. How did setting affect overall class mood or behaviour? (3.SLD)
2. How did setting affect the mood or behaviour of individuals? (2.C-Exp)
3. How did your perception of children differ between settings? (4.T-Exp)
4. How did you feel or behave differently between settings? (4.T-Exp)
5. In what ways did differences impact on their behaviour? (4.T-Exp)
6. How did teaching challenges differ between settings? (4.T-Exp)
7. How did processes and outcomes differ between settings? (1-4. All)
8. What were the key learning benefits of each setting? (1-4. All)
9. What setting features were responsible for differences? (1.E)
10. Which setting was the best overall for the task? Why? (1-4. All)
11. Did the task result in any longer-term impacts? (1-4. All)



**Figure 3.9 Focused Interview Guide with Theoretical Framework**

The interview consisted of 11 questions, which appear in Figure 3.9 above. These were designed to explore the teachers' views on important environmental and behavioural factors, and reflect on their own personal experiences, both in relation to the categories of the theoretical framework and the task(s) overall.

### **3.10.1 Stage 3: Methodological Considerations**

'Focused interviews' are defined as *asking interviewees questions about a specific situation or event that is relevant to them and of interest to the researcher* (Bryman, 2012, p.213). The approach was chosen because my objective was to understand the field experiments, not the teachers, and also for its capacity to provide rich experiences and perceptions of phenomena.

The guide was informed by Bryman's principles of good interview design (Bryman, 2012). It begins with perceptions of children's behaviour, moving from the general to the specific. Potentially embarrassing questions regarding personal experiences are left until later, when the interviewees were likely to be more comfortable with the

procedure. It is also sensitive to the implications of earlier answers, in that it closes with assessments which could be difficult without the context provided by prior questioning.

Kvale and colleagues argue that central to the interviewer's role is striking a successful balance between design objectives, and listening and adapting to what seems significant to the interviewee (Kvale & Brinkmann, 2008). Consequently, although the interview questions and order were consistent across interviewees (Bryman, 2012), time spent varied according to what seemed personally vivid or important to each participant.

Co-constructive processes between interviewer and interviewee have been criticised as a weakness of the approach (Phillips, 1974; Kvale & Brinkmann, 2008). However, in the present context, they are considered a strength. By this time, I knew the teachers well, and it felt as if I was consulting colleagues about a situation in their area of expertise, and about which there was a genuine shared interest in better understanding. There seemed a good symmetry in our relationship (Warren & Vincent, 2001), and the data appears open and candid. Nevertheless, for similar reasons, the possibility of social desirability bias should not be discounted (Bryman, 2012), as an unconscious desire for positive results may have caused the teachers to exaggerate differences.

### ***3.10.2 Stage 3: Thematic and Systems Analyses***

The interview data was subjected to a three-step analysis, shown in Figure 3.10 overleaf. The first step entailed importing video recordings into Nvivo, and then transcribing and coding content according to which framework category it seemed most relevant to. The objective was to simplify the dataset and, to the extent possible, isolate each category as a discrete entity. As the coding categories preceded the fieldwork and originated in a conceptual framework (Miles & Huberman, 1994), this approach can be considered a form of provisional coding (Saldana, 2012).



**Figure 3.10 Interview Analysis Approach**

### *Thematic Analysis*

The second step involved a thematic analysis, which was performed on each framework category in turn. A meta-review of thematic analysis studies proposes the following definition of a ‘theme’:

*“A theme is an abstract entity that brings meaning and identity to a recurrent [patterned] experience and its variant manifestations. As such, a theme captures and unifies the nature or basis of the experience into a meaningful whole”* (DeSantis & Ugarriza, 2000).

Thematic analysis is generally regarded as an ill-defined approach, and has been described as poorly demarcated (Braun & Clarke, 2006), and lacking any identifiable heritage or codification of core procedure (Bryman, 2012). However, Braun and Clarke propose questions which require consideration in any thematic analysis, and help to clarify a specific approach, and which will inform the remainder of this section (Braun & Clarke, 2006).

The current analysis should be considered predominantly *theoretical*, as its purpose was to develop theoretical constructs (Saldana, 2012). There was an inductive element in the sense that themes emerged through iterative reading and coding, and are not directly related to the questions (Bryman, 2012).

However, the analysis seeks to go further than just organising and describing the dataset, and to interpret “*various aspects of the research topic*” (Boyatzis, 1998, p.6). This combination of pattern-seeking and theoretical commitment complements the methodology’s grounded theory underpinnings (Charmaz, 2011).

The outcomes of this analysis should also be considered *latent themes* because they go beyond the explicit semantics of data, to propose implicit situational features and



dynamics. In the present analysis, a theme is termed ‘a qualitative variable (QV)’, or an axis of difference between indoors and outdoors, e.g. “(the degree of) dynamic novelty inherent in the environment”.

### *Causal Loop Analysis*

In the last step of the analysis, interrelationships and interdependencies between the qualitative variables are explored through the construction of a causal loop diagram (CLD) and a related closed loop analysis. The themes are expressed as variables as this is a CLD convention, which enables situational aspects to be represented within a whole system model (Morecroft, 2010). The approach entailed arranging the variables according to relations between them for which there was empirical support, and then identifying reinforcing or balancing dynamics, termed ‘closed loops’.

CLDs are the first step in the systems dynamics (SD) methodology, which was developed in the 1950s by Jay Forrester (Forrester, 1971) as a way of analysing business management problems using engineering modelling techniques. It has since been used for policy analysis and design across diverse fields (Radziki & Taylor, 2008), including the 1972 ‘Limits to Growth’ simulation of world systems, which was the first to highlight the unsustainability of the global economic system (Meadows, 2012).

Morecroft describes a CLD as “an approach for thinking about and simulating situations and organisations of all kinds and sizes by visualising how the elements fit together, interact and change over time” (Morecroft, 2010, p.25). In a CLD diagram, features of a situation are represented as noun variables, which are then linked by arrows which represent relationships between them, marked with a plus or minus signs to indicate positive and negative relations. The central purpose of a CLD is the identification of *reinforcing loops*, which represent virtuous or vicious cycles of circular chain reactions; or *balancing loops*, which is a dynamic which seeks equilibrium. Examples of loops and conventions will be given to aid understanding prior to the presentation of the CLD results in Chapter 6.

It is important to emphasise here that a CLD is a practical tool for *thinking* about a complex situation, and makes no claims to represent concrete reality. The word ‘causal’ in this way is perhaps misleading, particularly in the context of qualitative assessments such as is the application here. These constructions and related insights proposed should be regarded as abstract, speculative and relational, entailing neither constraints on systemic behaviour, nor proposed measurement criteria for the qualitative variables.

Nevertheless, a CLD is an effective technique for meeting what Saldana regards to be the main objective of a theoretical approach, namely, to elucidate “*each one of (the theoretical) constructs and how they integrate or relate with each other*” (Saldana, 2012, p.179-180). The objective here was to build a practical model of a ‘real-world’ system, not a nuanced account of specific aspects and it is freely acknowledged that this has entailed sacrificing detail and other ways of looking at the data (Braun & Clarke, 2006). Metaphorically-speaking, the present analysis might be viewed as an effort to discern the workings of a novel engine from the opinions of expert mechanics. To the extent of my knowledge, it is the first application of a CLD in a context such as this.

### ***3.10.3 Stage 3: Summary of Focused Interviews***

In summary, Stage 3 was comprised primarily on a focused interview with those teachers who supervised the field experiments. These aimed to capture their whole task perspective, while exploring cross-task common themes. A thematic analysis on the data was performed by framework category. The resulting constructs, or *qualitative variables*, were represented in a causal loop diagram, a methodology designed to explore the features and dynamics of complex situations.

## **3.11 Trustworthiness**

Lincoln and Guba propose four criteria by which the trustworthiness of naturalistic qualitative studies can be judged: confirmability, dependability, transferability, and credibility (Lincoln & Guba, 1985). I have endeavoured to ensure the *confirmability* of this research by being explicit regarding methodological position, development and

challenges, and limitations are dealt with in the concluding chapter. By this, I aim to give the reader everything they need to judge the quality and value of this study.

There are four ways in which I have tried to reinforce the study's *dependability* and *transferability*. First, are the conscious efforts taken to bolster internal, external and construct validity outlined throughout this chapter. Second, is the use of diverse experiments and contexts, which it is argued reinforces the generalisability of any common findings. Third, qualitative coding for the thematic analysis of focused interviews, which plays a central integrative role in this thesis, was cross-validated by a PhD candidate with a different research focus (macular degeneration), including a percentage of recollections and provisional interview codings (Elo et al., 2014; Lombard, Snyder-Duch, & Campanella Bracken, 2010). Lastly, I have sought continuous input and feedback regarding all aspects of the thesis's methodology and findings, from supervisors, teachers, children and a range of academics, educationalists and outdoor learning experts.

Finally, for *credibility*, a copy of the submission of the draft for pre-examination was distributed to participating teachers and key contributors for feedback, and to verify it presents an account of the situation or their experience which they consider believable.

### **3.12 Ethics**

For all tasks, a full risk assessment and ethical statement was reviewed and signed off by Heriot-Watt University. I also became a member of the Protecting Vulnerable Groups (PVG) Scheme, at the request of the participating schools.

The approach agreed with the schools and nurseries for seeking parental consent was the same for all. This entailed an information sheet being sent out to the parents of all participating children, explaining the research aims and methodology, with an opt-out option, two examples of which are given in Appendix 2. None objected, though one requested her daughter's face wasn't filmed, which was respected.

All data by which participants might be identified were stored on password protected hard-drives. It was agreed with the schools that data would only be shown to

supervisors and researchers with a direct thesis involvement, and that all would be erased upon completion of related analyses and reports. All schools and participants have been code-named, and faces blurred in photographs.

Finally, I have committed to a presentation of relevant findings to the participating schools, teachers and parents, and to make the completed thesis and related papers available to them, and all stakeholders who have helped in its realisation.

### **3.13 Conclusion**

This chapter set out details of the theoretical and research framework designed to inform, and confirm or disconfirm the thesis's two research hypotheses. A pragmatic methodology was described. This was exploratory, developing iteratively in response to a growing understanding of a complex research situation, and always seeking a basis for generalisation about real-world phenomena. The research entailed four diverse, and ecologically-valid, field experiments designed to compare indoor and outdoor impacts of a variety of primary school settings on performance. There were three consecutive stages of mixed methods data gathering and analyses, combining qualitative and statistical approaches. The rationale for each approach was detailed, as were the challenges of the research with early years' children, and in an ecologically-valid context, and how these were addressed. The results of these three stages will be set out over the next three chapters.

## CHAPTER 4. TASK OBSERVATIONS AND OUTCOMES

### 4.0 Introduction

This chapter and the two to follow address the fourth thesis objective, namely, *to analyse behavioural differences between outdoor and classroom groups and task settings, and their relationship to environmental factors*. Specifically, this chapter sets out the qualitative findings arising from Stage 1 of the study's data-gathering and analysis, which pertained to the observations and outcomes of the four experimental tasks.

As outlined in the methodology chapter, each of the four tasks entailed a unique character and set of challenges, which were difficult to foresee. Consequently, it proved impossible to establish general outcome measures as was originally intended, and each task features an analysis tailored to its particular dataset. Therefore, although common cross-task findings are identified, the stronger basis for analytical generalisation awaits for subsequent results chapters. Each task here should be viewed on its own terms, and for the unique and valuable viewpoint it contributes, and the findings overall as providing a rich and grounded context for the more theoretical perspectives to come.

The chapter will first give an overview of notable differences and similarities between the four tasks, before outlining each and its findings in turn. It ends on a summary of three findings which are common to all.

### 4.1 Differences and Similarities between the Tasks

This section will outline some differences and similarities between the four tasks other than setting, and which therefore are relevant to the reader's consideration of the findings (McLeod, 2012; Shuttleworth, 2006; Tripp, 1985; Yin, 2013). These are set out in Table 4.1 below.

Due to the specific circumstances of each school, the experiments entail different variations of a repeated measures design. The playground task, ‘Build a Den’, employed a cross-over design with two matched groups, each a mix of primary one classes (allocated by the teacher), and assigned to a different setting order. The school had agreed to one experimental task only. As this was to be the only one with a playground setting, controlling for order effects was considered more important than having a true statistical control.

The urban wood tasks, ‘Make a Toy’ and ‘Puppet Tour’, each involve a different order of setting, and feature both an experimental group and an observational control, which were two pre-existing sub-groups of a single primary one class. Originally, there was to be a full statistical control. However, for ethical reasons, it was later decided the two groups should swap for the second task so both had an opportunity for a woodland lesson.

For the rural wood task, ‘Alien Adventure’, limited numbers and resources meant a second exposure group was not viable, and thus only one setting order was tested: classroom then woodland.

<b>Case Study <i>Experiment</i></b>	<b>Playground <i>Build a Den</i></b>	<b>Urban Wood</b>		<b>Rural Wood <i>Alien Adventure</i></b>
		<b><i>Puppet Tour</i></b>	<b><i>Make a Toy</i></b>	
Outcome	Den		Toy	Story/Pic
<b>Materials:</b>				
Indoor	Building		Junk	Drawing
Outdoor	Building			
Context	Story	Project/Story	Project	Project
Presentation	De Bono Qs			Story
Workgroups	Workgroups of 3-4			Buddy groups of 2-3
<b>Active Time:</b>				
Indoor	50 mins	45 mins	70 mins	75 mins
Outdoor	50 mins	45 mins	45 mins	55 mins
Adult Observers	Ed Officer: Setting 1	Ed Officer: Outdoors		

**Table 4.1 Non-Setting Similarities and Differences between the Tasks**

The tasks are also differentiated by six extraneous variables. The first is *the degree of task open-endedness*. While subsequent, and relative to, ‘Autumn Leaves’, all tasks chosen by teachers were markedly more open-ended, there were still variations. All but one indoor task – ‘Puppet Tour’ (urban wood)– prescribed task affordances and outcomes. Although all wild setting tasks relied entirely on natural affordances, the playground task – ‘Build a Den’– employed the same den-making materials outside as the classroom. Finally, only ‘Build a Den’ and ‘Alien Adventure’ (rural wood) involved children presenting their task experiences at the end.

The second variable is *the degree to which social interaction was prescribed*. For ‘Build a Den’ (playground) and ‘Alien Adventure’ (rural wood) teachers predetermined who children worked with: workgroups of 3-4 and buddy groups, respectively. Conversely, both urban wood tasks – ‘Make a Toy’ and ‘Puppet Tour’– permitted open-ended collaboration.

Thus, the playground task, ‘Build a Den’, was the least open-ended of the outdoor tasks overall, featuring prescribed outcomes, affordances and collaborators. The most open-ended was ‘Puppet Tour’ (urban wood), where none were prescribed in either the wild setting or the classroom. With the exception of ‘Puppet Tour’, the three remaining indoor tasks scored similarly for open-endedness, and all were more prescriptive than their outdoor counterparts.

The third variable is *the thematic context* for the tasks. Both ‘Build a Den’ (playground) and ‘Puppet Tour’ (urban wood) began with stories familiar to the participants, and all tasks except ‘Build a Den’ related to term projects. These factors may have enabled and informed related task activities.

The fourth variable is *the time allocated to each task component*. All components occupied a full school afternoon. The activity times for all outdoor tasks were roughly approximate. However, for the indoor tasks, children had an extra half-an-hour for ‘Make a Toy’ (urban wood) and ‘Alien Adventure’ (rural wood), compared with ‘Build a Den’ (playground) and ‘Puppet Tour’ (urban wood). Due to transit time, two wild setting tasks – ‘Make a Toy’ and ‘Alien Adventure’– also entailed 20 minutes less activity time outdoors than indoors. For ‘Build a Den’ (playground) and ‘Puppet Tour’ (urban wood) the time spent on both components was almost identical.

The fifth variable is *the period between exposures to the experimental conditions*, and which could reinforce any order effects. Here there are marked differences between the four tasks, varying from 2-4 days for ‘Puppet Tour’ (urban wood) to 3 months for ‘Build a Den’ (playground), with both ‘Make a Toy’ (urban wood) and ‘Alien Adventure’ (rural wood) at around 1 month each.

The final variable is *the presence of an adult observer at one task component, but not the other*. There were two instances of this. For the first two interventions of ‘Build a Den’, one in the classroom and one in the playground, the teacher was supported by an Education Officer. For the wild setting component of ‘Puppet Tour’ (urban wood) a Woodland Officer attended as a passive observer.

In summary, it is proposed that differences and similarities between the four tasks may be relevant to an interpretation of the findings, over and above impacts attributable to the change of setting. These are variations in experimental design, the open-endedness of the task design and the social interaction it prescribed, the thematic context for the activities, the time allocated to components within and between tasks, the period between setting exposures; and the presence of adult observers for one task component but not the other.

#### **4.2 Playground: ‘Build a Den’**

‘Build a Den’ was the only study task which featured a playground for its outdoor setting. It employed a cross-over repeated measures design (see Table 3.3 below), and entailed matched groups building a den for ‘teddy’ to hide from a story character, first in the classroom and then the playground, or vice versa.

Nineteen primary one schoolchildren, average age 5 years, completed both conditions and the questionnaire, including 6 underachievers. Two boys, one from each group, were absent from one condition. Pupils and the supervising teacher were new to outdoor learning.



	Children (Av Age 5yrs)				Task: Build a Den	
	Total	m	f	UA*	Setting 1	Setting 2
Group 1	10	4	5	3	Indoors	Playground
Group 2	9	5	5	3	Playground	Indoors
Totals:	19	9	10	6		

*\*Underachievers: 1 boy & 2 girls in each group*

*Each group was subdivided by the teacher into 3 workgroups of 3 or 4 children*

**Table 4.2 Design for Urban Playground Task: ‘Build a Den’**

The settings were a primary one classroom and the school playground, the latter comprising a large area of tarmac and a playing field with some features (e.g. benches, bollards, raised flower beds, and a small climbing area), shown in Figure 4.2. The weather was fine for both outdoor components, though for the Setting 2 intervention high winds and parched ground presented challenges to fulfilling task requirements.



**Figure 4.2 Urban Playground Task Settings**

All components employed the same generic building materials – bamboo canes, tarpaulins, foam and wicker mats, string and clothes pegs – and children were free to use other available setting affordances (tables, chairs, toys, bollards, benches etc.)

The procedure entailed children being read a short familiar story in the classroom by the teacher – “The Gruffalo” (Donaldson, 1999) for Setting 1, and “Katie Morag and Tiresome Ted” for Setting 2 (Hedderwick, 2010). Workgroups then chose a teddy bear from a pile and were instructed to build a den for it to hide from a character in the story. In the last 10 minutes of each component, each workgroup presented their den to classmates in response to three Thinking Hat questions designed to evaluate personal models of the task, valued experiences and metacognition (De Bono, 2009).

Data for analysis were field observations, video recordings and transcriptions, and the Thinking Hat outcomes, the latter which were subjected to an inductive thematic analysis.

#### ***4.2.1 ‘Build a Den’ Findings***

##### *‘Build a Den’: General Observations*

Compared with the classroom, there was a greater diversity of dens in the playground, more time was spent on construction, and higher levels of physical activity were observed.

Indoors, most dens consisted of a tarpaulin slung over chairs and tables. Many children spent a good deal of the lesson playing with toys underneath, and at times required behaviour management by the teacher. Outdoors, den design was comparatively diverse, attributable in part to which affordance was chosen as a starting point (e.g. bollards, climbing frame, bench). Outdoors, workgroups spent their entire time constructing and improving dens, rather than playing inside them. In the case of Group 1, Setting 2, where high winds and parched ground rendered the outdoor task technically impossible, workgroups persevered cheerfully throughout, reconstructing and redesigning their dens as time and again they were blown down.

Figure 4.2 shows a comparison between the outdoor and indoor dens by two of the Group 2 workgroups. The outdoor ‘pavilion’ of the first workgroup gives some impression of the sophistication of some playground productions, and was constructed with minimal adult support. Their indoor design is representative of the majority of the

classroom dens, as described. The second workgroup, which included two underachievers, produced the only free-standing classroom den. This featured a very similar design to the one they had built outdoors 3 months previously with basic construction tips from the Education Officer.



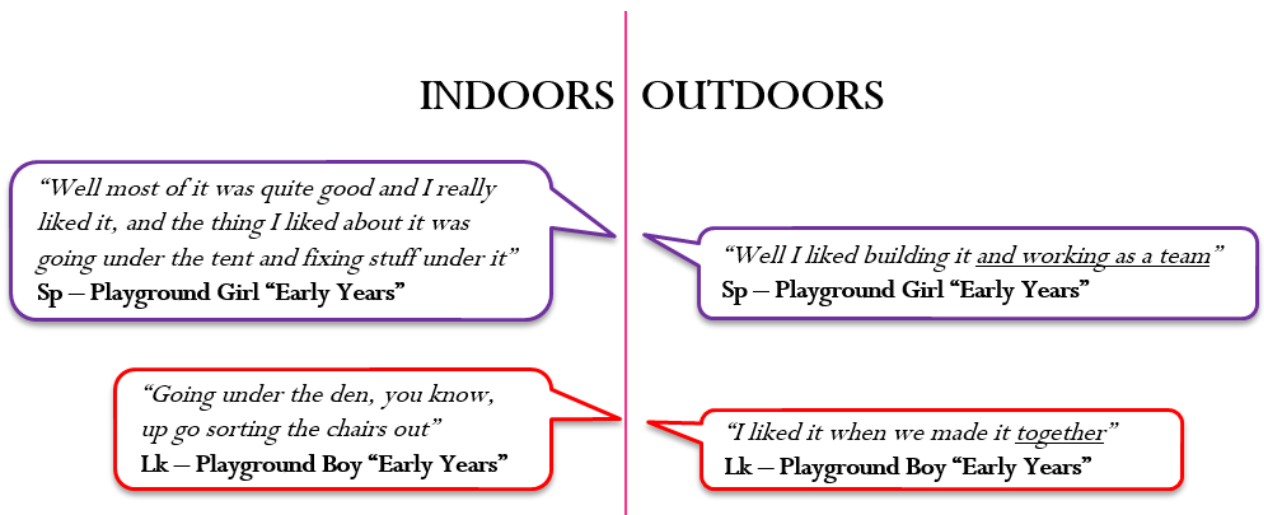
**Figure 4.2 Comparison between Classroom and Playground Dens**

Outdoors there were notably higher levels of physical activity outdoors, as children moved back and forth to fetch equipment or check out each others' dens. Of the four Richness Index (RI) affordance items scored for the playground setting, the only related action not observed was 'climbing' (the rudimentary climbing frame responsible for the item scoring was only ever employed for den construction). Indoors, space constraints meant children rarely moved from their den location.

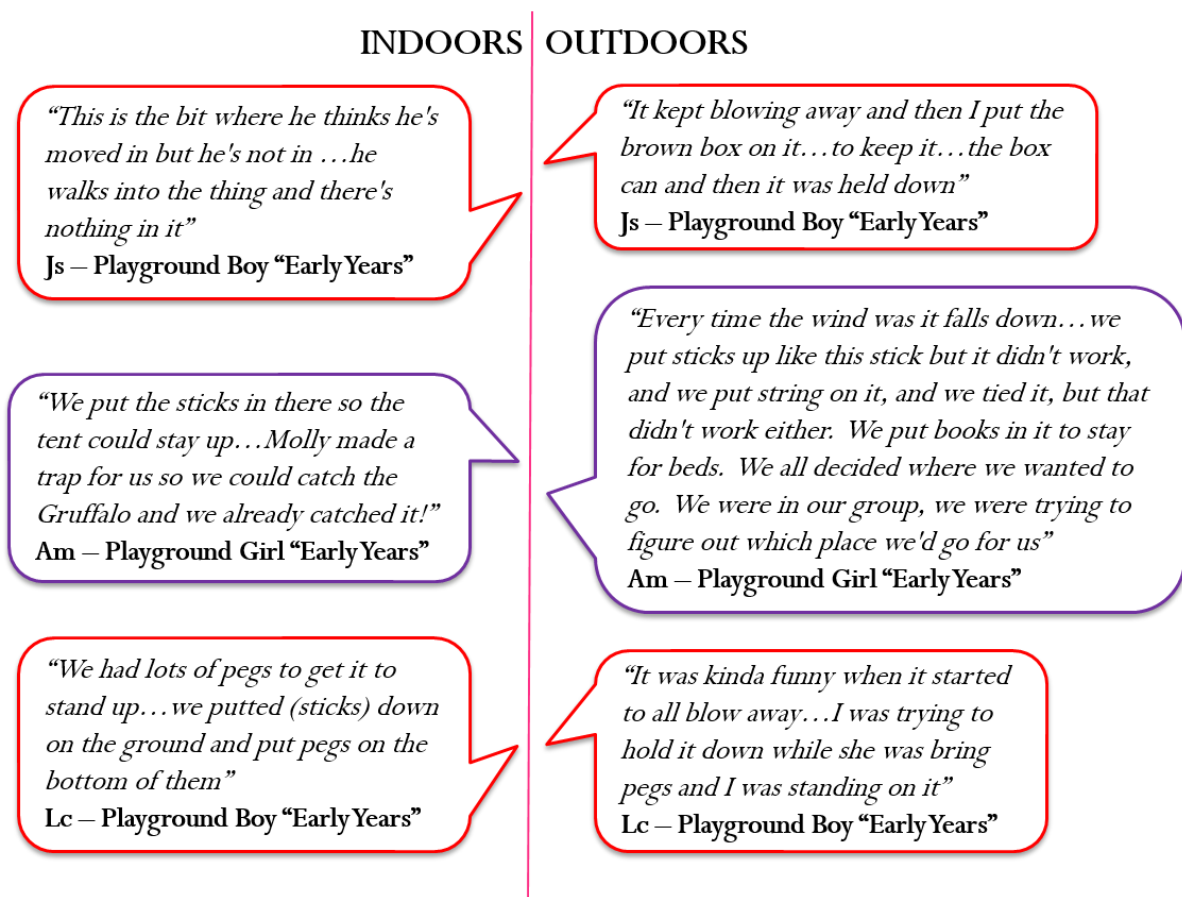
*'Build a Den': Thinking Hat Responses*

A thematic analysis of Three Thinking Hat responses revealed some differences between indoor and outdoor utterances, which may indicate comparatively greater positive interdependence, problem-solving and metacognition in the playground setting.

Of the children who answered the Yellow Hat (positives) in both settings, 23% referred in some way to teamwork outdoors (5 out of 22 responses), while none did indoors, where positives seemed largely egocentric. Two examples, featuring full responses to the Yellow Hat questions, are given in Figure 4.3 below. In the first, a girl states that outdoors, she enjoyed, “*building (the tent) and working as a team*”, whereas indoors she liked “*going under the tent and fixing stuff under it*”. In the second, a boy returns similar responses to the girl for both settings.



**Figure 4.3 Examples of Positive References to Teamwork in the Playground**

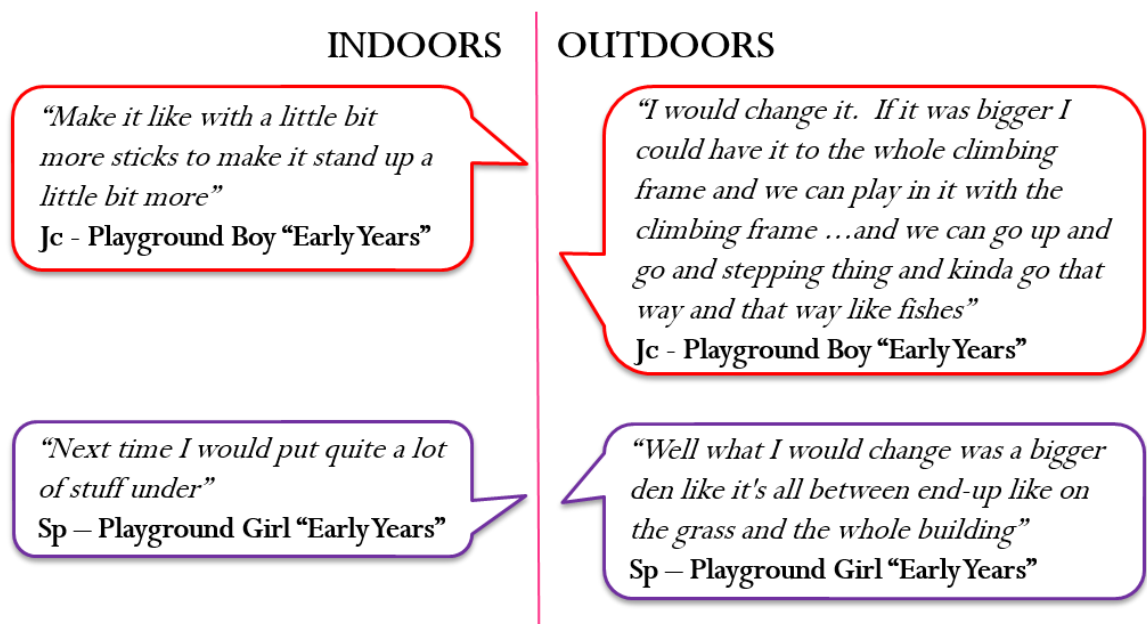


**Figure 4.4 Examples of Explicit Problem Solving on the 'Windy' Task**

Those utterances implying problem-solving and metacognition are most strongly associated with Group 1's 'windy' outdoor task. 67% of participants' (8 out of 12) White Hat (facts) playground responses include one or more problems they faced and how these were addressed. Indoors, none feature problems and solutions, but rather offer straightforward descriptions of den or trap construction.

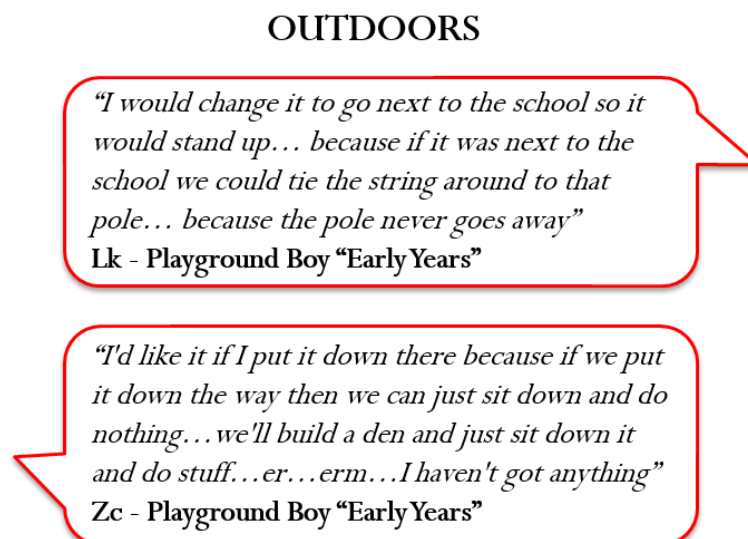
Figure 4.4 give examples of full White Hat responses from three Group 1 children. These include a girl (Am), who states that in the playground *"we put sticks up...but it didn't work...we put string on it and we tied it, but that didn't work either"*, whereas in the classroom *"we put sticks in there so the tent could stay up"*.

Additionally, 7 out of 8 of Group 1's Green Hat (metacognition) playground responses suggest reflective observation on den construction (88%), compared to only one in the classroom (12%). In the examples in Figure 4.5 above, a boy and girl state that, given an opportunity to repeat the task, they would use *"the whole climbing frame"* or put their den up *"between end-up like on the grass and the whole building"*.



**Figure 4.5 Possible Examples of Metacognition on Group 1's 'Windy' Task**

Both constitute radical reimaginings of their current design, and might be viewed as plausible remedies to the environmental challenges they had faced. In the classroom, however, they seem rather to refer to what they might do next with the den they had just made, such as *"make it stand up a little bit more"* or *"put quite a lot of stuff under"*.



**Figure 4.6 Possible Examples of Playground Metacognition from Group 2**

While not as strong as Group 1, Group 2's Green Hat responses also suggest greater empirical support for metacognition in the playground than the classroom, 36% (5 out

of 14) versus 14% (2 out of 14), respectively. In Figure 4.6 above, two quotes from Group 2 boys are among the stronger examples of higher-order playground reasoning. One (Lk) foresees using a school drainpipe next time round “*because the pole never goes away*”. His colleague Zc appears to plan a less energy-intensive construction, as “*then we can sit down and do nothing*” (before quickly realising it was perhaps not what the teacher wanted to hear!).

#### **4.2.2 ‘Build a Den’: Summary of Findings**

A cross-over experiment compared children’s behavior and outcomes on a den-building task performed in a classroom and a playground. General observations were that, compared with the classroom, playground dens were more diverse in design, more time was spent on their construction, and the task entailed more physical activity. Additionally, participants’ responses to three Thinking Hat questions (De Bono, 2009) implied stronger empirical support for perceived positive interdependence in the playground, as well as for explicit problem-solving and reflective observation, the latter more strongly associated with the most challenging outdoor component.

#### **4.3. Urban Wood: ‘Make a Toy’ and ‘Puppet Tour’**

Urban wood conducted two experimental tasks, ‘Make a Toy’ and ‘Puppet Tour’. Each entailed a repeated measures design with an observational control group, and a different setting order (see Table 4.3 overleaf). Two pre-existing sub-groups of the school’s primary one class –equally matched for numbers, gender and ability– took it in turns to be the experimental or control condition.

The pupils and their supervising teacher had never taken an outdoor lesson prior to these interventions. However, the teacher had recently taken a short forest learning CPD course (continuing professional development), which had sparked her interest.

Overall, 29 primary one children, average age 5 years, participated in both conditions of one of the tasks and the questionnaire. These included 7 underachievers, all but one of them boys. Fourteen additional participants –9 from Group 1, and 5 from Group 2–

were absent from one condition or the questionnaire and, therefore, do not appear in the data table or statistical analysis, but are referred to in this chapter’s findings.

	Children (Av Age 5yrs)				Task 1: Make a Toy		Task 2: Puppet Tour	
	Total	m	f	UnderA	Setting 1	Setting 2	Setting 1	Setting 2
Group 1	13	7	6	3	Indoors	Wild	Indoors	Indoors
Group 2	16	8	8	4	Indoors	Indoors	Wild	Indoors
Totals:	29	15	14	*7				

*\*Underachievers: All male, except one girl in Group 1*

KEY:

Experimental
Control

**Table 4.3 Design for Urban Wood Tasks: ‘Make a Toy’ and ‘Puppet Tour’**

The task settings are shown in Figure 4.8. These were the primary one classrooms and a mixed woodland adjacent to the school grounds, categorised as a ‘wild setting’ using Richness Index. The two outdoor tasks took place either side of Spring growth, so whilst the area used for both was identical, its character varied between them.

For the first task, ‘Make a Toy’, children made a toy in the classroom, and then in a local wood. The toy they made, how they made it using available affordances, and with whom, was up to them.

Indoor materials were a table of ‘junk’ –cardboard tubes, plastic bottles and cups, cereal boxes, yoghurt pots and other household containers– and some scissors, glue and sticky tape (see Figure 4.9).

Predominantly, outdoor materials were the affordances of the setting –trees, branches, twigs, leaves, mud and stones– although scissors and string were available to facilitate construction.



Settings for Urban Wood Task 1 – ‘Make a Toy’



Settings for Urban Wood Task 2 – ‘Puppet Tour’



**Figure 4.8 Urban Wood Task Settings**

The second task, ‘Puppet Tour’, required children to take a stick puppet of their favourite character from “Farmer Duck” (Waddell, 1995) on a tour of the wild setting, and then the classroom, after being read the story in situ.

In both settings children were free to use available affordances however, and with whomever, they wished. The only materials were the book and the stick puppets, which the children had made in a previous lesson, and appear in Figure 4.10 overleaf.



**Figure 4.9 ‘Make a Toy’: Classroom ‘Junk’ Materials**



**Figure 4.10 ‘Puppet Tour’: Stick Puppets**

The data for analysis were field observations, video recordings and related transcriptions. For all experimental conditions a video analysis was conducted which assessed the productions or activities of each observable child, and their collaborators. The outcomes are models of whole class interactions for the two settings. For ‘Make a Toy’, these represents total behaviour over the full course of the two components. For ‘Puppet Tour’, it shows how individual and group activity progressed over the first 10 minutes of each.

### 4.3.1 'Make a Toy' Findings

General observations were that there were comparatively higher levels of collaboration and movement outdoors. Productions were also larger scale, and more often entailed an imaginative context than those in the classroom.




Figure 4.11 is a birds-eye snapshot of the experimental group's total classroom interactions. The ovals represent participants: purple for girls, red for boys (*italics* indicate those absent for the second component). All children chose to sit around one large table, labelled at centre. Each child is linked by an arrow to the toy concept they made, represented by the grey rectangles.

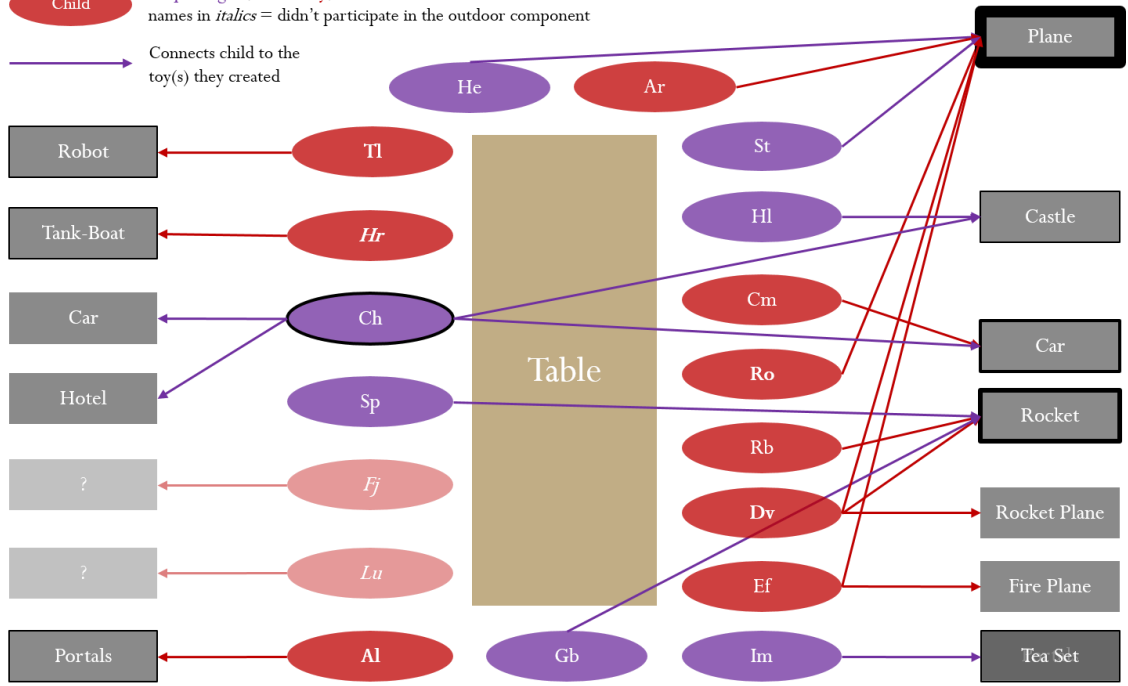
The thickness of the pointlines around each rectangle are an indication of the number of children who made the particular concept. As can be seen, while each child worked exclusively on their own toy, many employed the same concept as their neighbours, termed here 'conceptual overbleed'. The outright favourite was the plane (n=6). A notable exception is the underachievers (He, Al, Dv, Tl and Rb), almost all of whom produced a standalone concept or an incongruous conflation of two.

Toys often seemed 'inspired' by the shape of the prominent junk, such as 'bottle' rockets and 'cereal packet' buildings, robots and vehicles. Although there was chatter throughout, each child worked individually and remained seated at the same location. Gross motor movement was limited to occasional visits to collect materials from the 'junk' table.

The same general pattern of social and conceptual interaction was also observed on both control conditions. While the most popular concepts varied in each – a ship and castle in the first (both n=3), and a rocket and a robot in the second (both n=3) – five of the control group also used the same concept in the second as they had in the first. Engagement also seemed to tail off towards the end of the second control task, and many spent the last 15 minutes being read a story because they had "finished".




**KEY:**

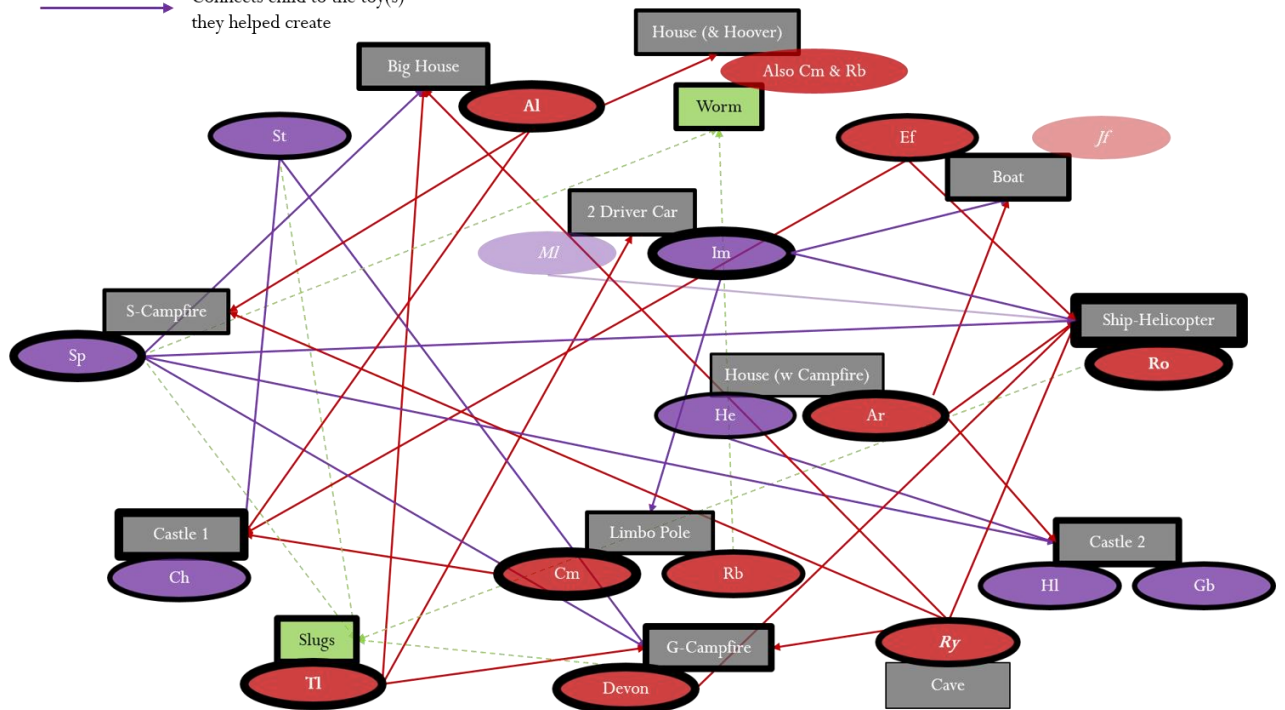
-  Toy Outline point-size = number of children who **made** that toy
-  Child Purple = girl ; red = boy; names in **bold** = underachievers names in *italics* = didn't participate in the outdoor component
-  Connects child to the toy(s) they created



**Figure 4.11 'Make a Toy' Indoor Interactions Analysis – Experimental Group**

**KEY:**

-  Toy Outline point-size = number of children who **worked on** that toy
-  Child Purple = girl ; red = boy; names in **bold** = underachievers; names in *italics* = didn't participate in the outdoor component Outline point-size = number of other children **collaborated** with during the task
-  Connects child to the toy(s) they helped create



**Figure 4.12 'Make a Toy' Outdoor Interactions Analysis – Experimental Group**

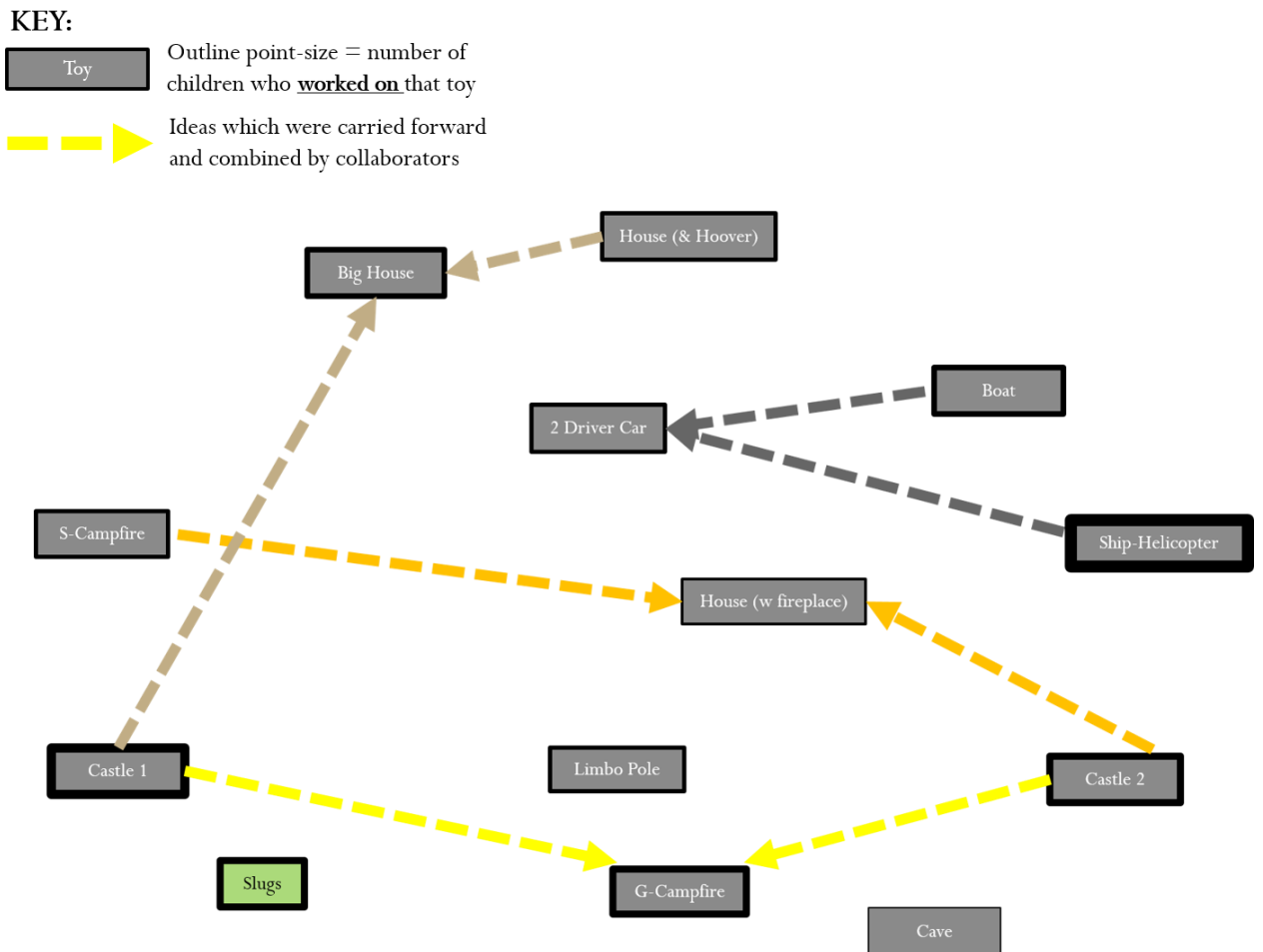
Figure 4.12 offers a similar plan view of the interactions for the outdoor experimental task, which covered a small area of woodland. Children and toys are still represented by ovals and rectangles, respectively. However, there are two differences from Figure 4.11. The first is the introduction of pointlines around the ovals to indicate the number of peers each child was recorded working with over the course of the component.

Table 4.4 below compares social interaction statistics between indoors and outdoors, showing individual children (rows), their collaborators and the productions they collaborated on (columns).

Children	# Collaborators		# "Toys"		Description of "Toys"	
	Indoors	Outdoors	Indoors	Outdoors	Indoors	Outdoors
Tl	0	6	1	3	<i>Robot</i>	<b>G-Campfire, 2 Driver Car, Big House</b>
Ch	0	4	2	1	Car/Hotel	<i>Castle 1</i>
Sp	0	6	1	5	Rocket	<i>S-Campfire, G-Campfire, Castle 2, Ship-Helicopter, Big House</i>
Al	0	6	1	4	<i>Portals</i>	<b>G-Campfire, Castle 1, House (&amp; Hoover), Big House</b>
Gb	0	4	1	1	Rocket	<i>Castle 2</i>
Im	0	7	1	4	<i>Tea Set</i>	<i>Limbo Pole, Ship-Helicopter, Boat, 2 Driver Car</i>
Ef	0	4	1	3	Fire Plane	<i>Castle 1, Ship-Helicopter, Boat</i>
Dv	0	6	1	2	<b>Rocket Plane</b>	<b>Ship-Helicopter, G-Campfire</b>
Rb	0	4	1	2	<i>Rocket</i>	<i>Limbo Pole, House (&amp; Hoover)</i>
Ro	0	7	1	1	Plane	<i>Ship-Helicopter</i>
Cm	0	7	1	3	Car	<i>Castle 1, Limbo Pole, House (&amp; Hoover)</i>
Hl	0	4	1	1	<i>Castle</i>	<i>Castle 2</i>
St	0	4	1	2	Plane	<i>Castle 1, G-Campfire</i>
Ar	0	6	1	4	<i>Plane</i>	<i>Ship-Helicopter, Boat, Castle 2, House (with Campfire)</i>
He	0	3	1	2	Plane	<i>Castle 2, House (with Campfire)</i>
Ry				5		<b>Ship-Helicopter, S-Campfire, Cave, G-Campfire, Big House</b>
Hr	0		1		<i>Boat/Tank</i>	
Mean	0	5.2	1.1	2.7	Key: red = boy; purple = girl; bold = underachiever; italics = leader(s)	

**Table 4.4 ‘Make a Toy’ Interactions Analysis: Social Interaction**

As mentioned, there was no direct collaboration indoors, and with one exception, there was only one production per child. Outdoors, each child engaged with an average of five collaborators and three ‘projects’, with slightly higher means for underachievers.



**Figure 4.13 ‘Make a Toy’ Outdoor Interactions Analysis 2: Inherited Ideas**

Conceptual overbleed was also observed outdoors, as were three instances where projects incorporated ideas which contributors appeared to have inherited from previous separate collaborations. These are shown in Figure 4.13, which is a feature of the outdoor interactions analysis shown separately for readability. One example is represented by the yellow arrows. These show a three-member project led by Al, probably the most severely disadvantaged child in the study. Having collaborated previously on ‘castles’ and ‘houses’, Al began to work on a ‘big house’ in a tree, which combined features from both, and which attracted two collaborators. Indoors, Al’s toy was unique and rudimentary, consisting of two sheets of paper, each with a scrunched up tissue ball stuck to it to represent ‘Portals,’ a feature of a favourite video game.

Another example is shown by the orange arrows. These point to a ‘2 Driver Car’, a sophisticated life-size conception with moving parts, which integrated features of prior projects the female contributors had worked on different collaborators. One of them, Im

was typically a very shy girl according to her teacher, which was attributed partly to English being her second language. She was also the only non-underachiever to create a standalone classroom toy.

The second difference between Figures 4.11 and 4.12 is that the grey rectangles in the outdoor analysis represent the approximate physical location of productions in the activity area. Additionally, their pointlines indicate the number of children observed to collaborate on each, as opposed to the number who employed the particular concept. Thus, the arrows connecting children to productions can also be considered representative of the high levels of movement observed during the component. This featured every action enabled by the RI affordance items scored for the wild setting, except ‘splashing’.

In the main, the location of projects seemed determined and anchored by interesting affordances – e.g. an odd shaped branch, or tree, or pile of sticks. These would inspire creative activity for a particular child, which then attracted others. While a few children were engaged on the same project throughout (each is overlapped by its apparent leader(s)), most were observed browsing, contributing to several projects before settling on one. Around halfway through the component, overall activity stabilised into the pattern of projects suggested by the diagram.

Table 4.5 overleaf compares the productions or projects between the indoor and outdoor experimental components. The rows feature concepts, and the columns are their contributors –creators indoors, and collaborators outdoors, where leaders are emboldened.

While both entail about eight concepts overall, indoors these were created individually, whereas outdoors, an average of four children contributed to each project. The most popular involved eight collaborators: a ship-helicopter led by Ro, a boy classified as an underachiever on account of poor attention and language skills.

Unlike the second control condition, only one child produced the same concept in the outdoor experimental condition as they had in the classroom (7% of the group vs 36%, respectively), and there was sustained vigorous engagement throughout.

"Toy"	INDOORS		"Toy"	OUTDOORS		
	# Creators	"Creators"		# Creators	Lead	"Co-creators"
Plane (Fire Plane / Rocket Plane)	1	Ar, Ef, Dv, Ro, St, Ar, He	Ship-Helicopter	8	Ro	Dv, Ar, Ry, Ms, Im, Ef, Sp
Rocket (Rocket Plane)	1	Rb, Dv, Sp	Castle 1	6	Ch	St, Ry, Al, Cm, Ef
Castle (Hotel)	1	Hl, Ch	"Gourmet" Campfire	5	Dv	Ry, Sp, St, Tl
Car	1	Cm, Ch	Castle 2	5	Hl, Gb	Ar, Hl, Sp
Robot	1	Tl	Big House	4	Al	Tl, Ry, Sp
Portals	1	Al	Boat	4	Ef, Jf	Im, Ar
Tea Set	1	Im	House (and Hoover)	3	Cm, Rb	Al
Tank-Boat	1	Hr	2 Driver Car	3	Im, Ms	Tl
			Bug / Limbo Pole	3	Cm, Rb	Im
			"Sausage" Campfire	3	Sp	Ry, Al
			House (with Campfire)	2	He, Ar	
			A Cave	1	Ry	
Approx Total: 8			Approx Total: 8			
	1	Key: red=boy; purple=girl; bold = UA		3.9	Key: red=boy; purple=girl; bold = underachiever	

**Table 4.5 'Make a Toy' Interactions Analysis: Productions and Projects**

Figure 4.14 overleaf, compares some indoor and outdoor productions, which serve to illustrate differences in scale, if not in detail and sophistication. Outdoor productions were usually large, with life-size parts, and sometimes morphed from one concept into another during development and collaboration (e.g. the ship-helicopter).

Outdoors, children seemed to interpret 'toy' as a basis for exploratory play, and their descriptions often featured their creation doing something, and a broader imaginary context which often exhibited domestic themes (e.g. homes, fires and cooking). On the other hand, indoor productions were more typical conceptions of a 'toy' –i.e. a scaled-down 'model' of something– and were usually described in terms of what it was, rather than what it did.





**Figure 4.14 ‘Make a Toy’: Comparison of Indoor and Outdoor Toys**

Figure 4.15 overleaf compares the toy descriptions of two children between indoor and outdoors. These are chosen for illustration because the participants had similar productions across settings, which may serve to highlight differences. Although, indoor productions are conveyed largely as feature lists, outdoors descriptions confer a sense of being inside the productions, where imaginary situations involve characters and backstories (“sisters”, “babies”, “giants”).

A final outdoor observation was the interest attracted by incidental discoveries of a worm and a slug during the task (represented as green rectangles in Figure 4.12). In both cases children exhibited remarkable empathy and fascination for the animals during these encounters. An illustrative example is given in Fig 4.16 below, where Cm becomes protective of a worm on the basis that he “doesn’t like people’s hands” and needs to be “cold, wet and down” (I am “R”, the Researcher).

**Ch Indoors:**

**HOTEL**

R: "So tell me about your toy"

Ch: "It's a hotel, where they stay, people when they come into the airport"

R: "Well that's good because we've got so many aeroplanes now"

Ch: "And I made a car and it gets cleaned somewhere"

R: "Have you anything else you want to tell me about it?"

Ch: "No that's all"

**Ch Outdoors: CASTLE**

R: "Where's the castle?"

Ch: "That's the castle"

R: "It's very well hidden. Is there anyone at home?"

Ch: "Yes" \*jumps up and down smiling\*

R: "Who's at home?"

Ch: "Me"

R: "Can you show me around?"

Ch: "Yeah. Come in. That's where they go inside and that's where they stay"

R: "So that's the bedroom?"

Ch: "Yes and you plug that into there (electricity) and that's how it works"

R: "It's much bigger on the inside isn't it?"

Ch: "Yeah. That's where they go into bed and they go up there when they want to play"

R: "Ah so the playroom is all the way up there is it?"

Ch: "Yeah. And that's where the other one is, that's where that one is"

R: "So there's more than one playroom?"

Ch: "Uh-huh"

R: "Are those towers then (the tree trunk splits)?"

Ch: "Yeah"

R: "So who lives up that one?"

Ch: "The giant. Way up there. Goes way up to the clouds"

**Hl Indoors: CASTLE**

R: "What's this then?"

Hl: "A castle. It's a castle"

R: "A castle, well that's different from everybody else's. So what are these bits?"

Hl: "This is where the people stays in there, that's the kids room and that's the family room, and that's another family room. These are windows"

R: "What's this bit then?"

Hl: "The bathroom"

R: "Is that the bath. It's huge. More like a swimming pool"

Hl: "It's a family sized bath"

R: "Wow and what's this bit"

Hl: "This is the bit where the flag goes"

R: "Ah so you've got a little flag as well. Is that the flag?"

Hl: "Yes"

R: "What's this bit?"

Hl: "The door"

R: "The front door?"

Hl: "Yes and this is the back door, where nobody else can get in except the mummy, daddy and the family"

**Hl (and Gb) Outdoors: CASTLE**

R: "I hear there's a castle round here somewhere"

Hl: "Two castles"

R: "It's almost disguised. I can't see it"

Hl: "It's here. The baby's sleeping. Waaah (baby crying)!" \*Hl shows me a leaf\*

R: "And what's this?"

Hl: "A wee person"

R: "A little person? So tell me about your castle. What are the little bits?"

Hl: "These are beds and these are stairs. And here's more beds" \*walking the leaf\* "they can go up here, then down here straight to the bedroom, or and back up the wee stairs to see the baby. And here's the baby there"

R: "So is that Mummy then? (referring to the leaf)"

Hl: "No it's sister"

R: \*using fingers as a person\* "so I'm walking up the stairs. I've come to see the baby"

Gb: "Come down here then, then stop there. That's the covers and that's the baby"

Hl: "And I made the wee covers"

**Figure 4.15 'Make a Toy': Comparison of Indoor and Outdoor Toy Descriptions**

*Cm: \*holding the worm\* "Look you can see his face"*

*Al: "Aw he's so cute"*

*Cm: \*suddenly putting the worm down\* "He's not allowed he doesn't like in people's hands. Let her go. Look at him. Somewhere safe"*

*R(earcher): "He'll find his way down. Where did you find him? When you uncovered the soil?"*

*\*Rb goes to pick him up\**

*Cm: "Nah. Leave him. Leave him"*

*R: "You can pick him up if you're gentle with him"*

*Cm: "Nah. It's hot. He dinnae like hot hands."*

*Sp: "There he is"*

*Rb: \*pretending\* "ach he just bit me"*

*R: "Do you want to hold him?"*

*Rb: "I want to hold him"*

*Cm: "I think you should leave him"*

*R: "Be very gentle with him though"*

*Cm: "He doesn't like in people's hands. He could die with the hotness. He needs to be cold, wet and down"*

**Figure 4.16 ‘Make a Toy’: Conversation about a Worm**

### 4.3.2 ‘Make a Toy’: Summary of Findings

An experiment compared the behaviour of an early years’ group making a toy in a classroom and then a woodland setting, while an observational control group performed the task twice indoors. General observations and an interactions analysis highlighted significantly higher levels of social interaction and physical activity outdoors. While indoors each child worked on their own toy, outdoors they typically collaborated on several. On average, underachievers collaborated with more children and on more projects outdoors than peers, while in the classroom their productions seemed uninfluenced by others and more conceptually confused. Outdoor productions were often life-size and descriptions hinted at their broader imaginative context, whereas indoors they tended to typical small-scale toys described in terms of feature sets. A characteristic of both indoor and outdoor components was ‘conceptual overbleed’,

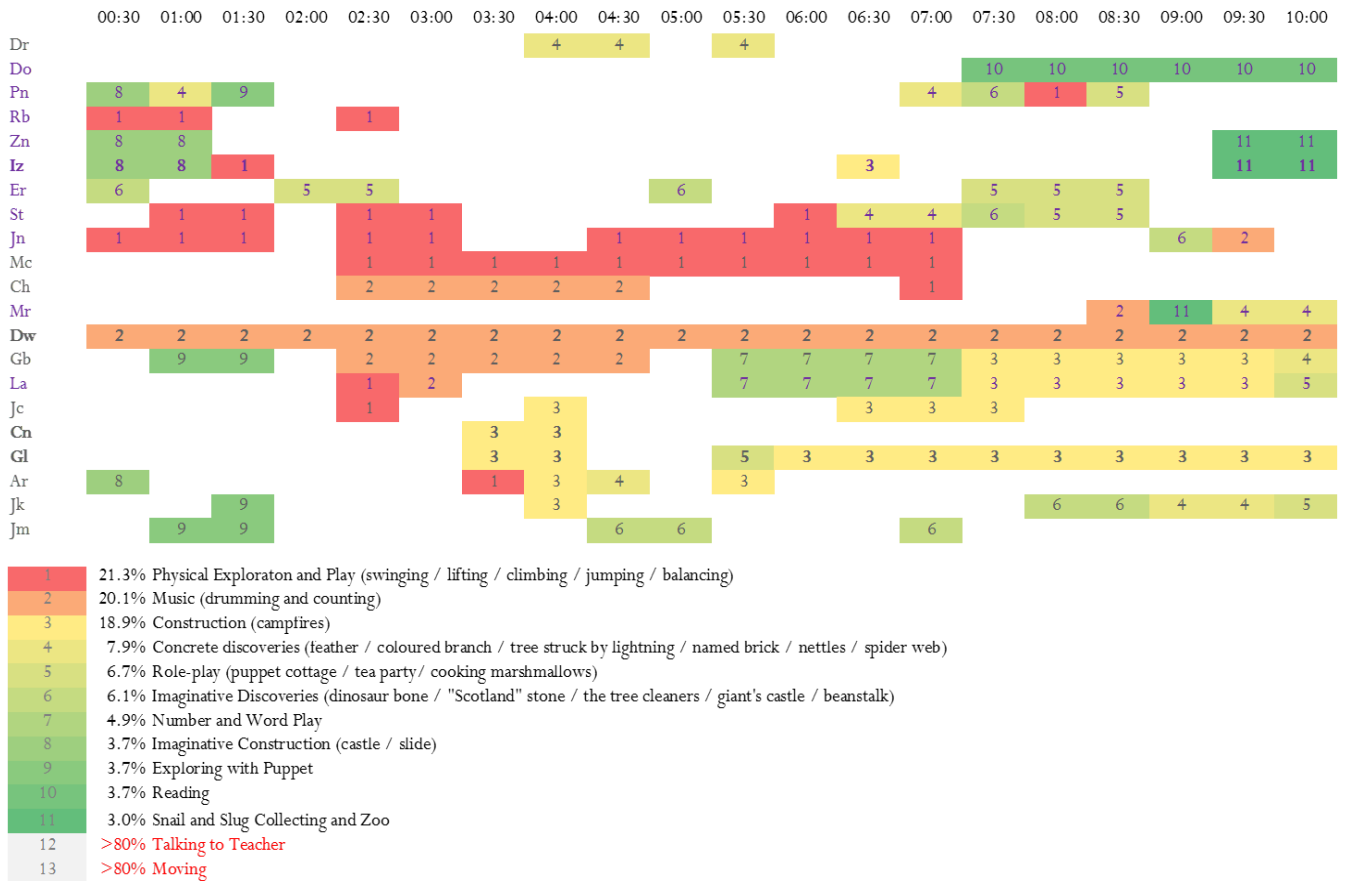
where children borrowed the ideas of others and developed them further, though this occurred in the classroom without any direct collaboration. Similar behaviours were observed on the two indoor control conditions as the classroom experiment. On the second control many children employed the same concept as they had in the first and task engagement tailed off well before the end, whereas neither was the case for the woodland task compared to its previous classroom counterpart.

### ***4.3.3 'Puppet Tour' Findings***

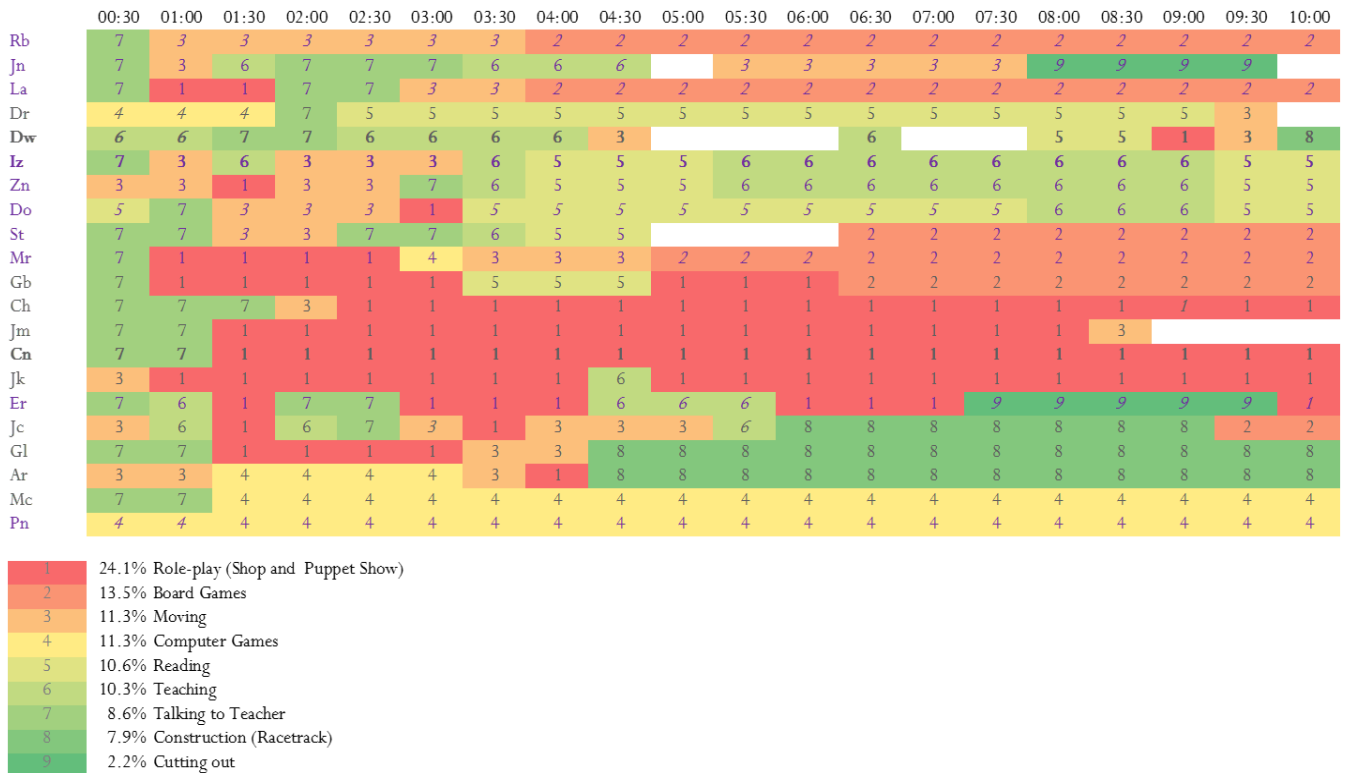
Compared with the classroom, 'Puppet Tour' outdoors exhibited a greater diversity of task interpretation, particularly in the initial stages. This included greater, richer environmental exploration and discovery, actual and imaginative, but featured less behaviour related to the story theme than the classroom task. Another general observation were higher levels, and different patterns, of social interaction and physical activity.

Figures 4.17 and 4.18 overleaf are the interactions analyses for the first 10 minutes of the outdoor and indoor experimental components, respectively. The rows are participants: girls are purple, boys are red, underachievers are emboldened, and solitary workers are italicised. Each columns represents a 30 second periods. Each cell is coloured and numbered according to the activity each child was observed doing for the majority of the particular period, for which the key is given below. To the extent possible, rows are arranged so children involved in the same 'projects' are adjacent to each other, to give a sense of patterns of collaboration.

The principal difference between the two analyses is the greater diversity of task interpretation outdoors, compared with the classroom. While it was only possible to categorise 60% of the total outdoor behaviour with certainty, 11 activity categories were observed in the first 10 minutes. Indoors, there were only 9 categories, although 97% of behaviour was recorded and could be categorised with confidence. Two discrete indoor categories – 'movement' and 'talking to teacher' – are inherent in outdoor activities. Otherwise there is negligible overlap in categories between the settings.



**Figure 4.17 ‘Puppet Tour’ Outdoor Interactions Analysis (first 10 minutes)**



**Figure 4.18 ‘Puppet Tour’ Indoor Interactions Analysis (first 10 minutes)**

Furthermore, each of outdoor categories 4-9 in itself encompasses a rich diversity of behaviours. Comprising around 33% of total activity, these share a broad theme of discovery and exploration, and have no real equivalents in the classroom. They include a variety of discoveries: concrete (*a feather or spiderweb*), imaginary (*a dinosaur bone or a beanstalk*), and living (*snails and slugs*); and the exploration of setting through construction (*a campfire, playground or castle*), and as a imaginative context for role-play (*a tea party at the woodland cottage*) and adventure (*exploring with puppet*).

The incompleteness of the outdoor analysis is attributable in part to the difficulty of interpreting children's activities confidently from pure observation. Their content was often revealed only through participation by the teacher or myself (hence why *"talking to teacher"* is an 'inherent' category), and frequently suggested experiential richness and complexity.

**Urban Wood Teacher:** *"Tell me about these slugs. Where did you find them?"*

**Iz:** *"I found them all alone and I'm putting them together so they can be a family...so they can be a famileeeee!"*

**Urban Wood Teacher:** *"What do they feel like Iz?"*

**Iz:** *"They all feels like it's slimy...cause I found two slugs and two snails at my home. It's why I'm going 'Mum you really cannae die it never' so I did take them. My Mum said to put it outside and now I'm always going to see it"*

**Figure 4.19 'Puppet Tour': Exchange between Teacher and Pupil about Slugs**

For example, Figure 4.19 above is an exchange between the teacher and a girl underachiever, Iz, the project leader for the slug and snail zoo. Iz's comments suggest the zoo is a continuation of her efforts to protect these animals from her mother at home, and also a family reunion for them. The zoo went on to become one of the most stable and popular outdoor projects, engaging a quarter of the group, all girls, in constructing enclosures, caretaking or hunting (several of whom initially expressed disgust or caution at Iz's activities).



**Figure 4.20 ‘Puppet Tour’: Indoor Affordances supporting Role-play**

Indoors, no environmental discoveries were apparent. Arguably, only one category involved affordance-motivated imaginative exploration: the shop / puppet show role-play. This centred around a unit comprising a toy till and phone, and a counter which also doubled as a puppet stage (see Figure 4.20 above). This was far and away the most popular activity in the first 10 minutes, involving over half the group and 24% of total activity time. Remaining categories entail activities typically associated with an early years’ classroom: teacher role-play, reading, board and computer games, and race-track construction. Compared to the outdoors, these activities seemed unambiguous and easier to categorise from observation alone.

Nevertheless, more indoor behaviour seemed to relate to the specific task requirements and the story theme (around 50%). In all indoor components, some teacher role-play entailed children taking the puppet around the classroom and explaining features to them. This usually tailed off, such as in the first indoor control, where the dominant activity quickly became colouring in or recopying puppets. The shop / puppet show featured characters, scenes, and verbatim quotes from the book, as did the most popular and enduring activity on the second control condition, some rich farm-based role-play.

By comparison, less than 10% of outdoor activities in the analysis appeared explicitly related to either the book or the task requirements, although children may have interpreted ‘tour’ in the context of exploration. This declined over the course of the component and many puppets were mislaid or lost by the end.

Another notable difference between the settings were levels and patterns of social interaction. The chaos of individual interpretations in the first 10 minutes of the outdoor task, settled over its course into four stable projects which engaged almost all participants (a tea party, a campfire, a slug and snail zoo, and activities centring on an interesting tree). Even independent explorers brought back discoveries to share with peers. While social interaction was intense and not without controversy, it seemed predominantly good-natured and only once required mediation from the teacher.

In the classroom, interaction generally exhibited the opposite trend. This was characterised by an initial burst of collaboration, particularly around the role-play activities. It then stabilised into a pattern of a few workgroups of 2 or 3, with over a quarter engaged in solitary or parallel play (e.g. cutting out, drawing, reading, doing puzzles), some of whom did so from the outset (e.g. Rb, La and Do in Figure 4.18).

A final distinction between the settings was levels of physical activity. The top three categories of outdoor analysis are characterised by physical activity, accounting for 60% of the total behaviour classified. Furthermore, gross motor movement was so integrated into all activities recorded, it was not a viable standalone category as it was in the classroom. With the exception of 'splashing', all actions associated with RI affordance items scored for the setting were observed, and high levels of activity were sustained throughout. In the classroom, the movement of children between domains of activity constituted 11.3% of all behaviour in the first 10 minutes. This was the only significant gross motor behaviour observed, and levels quickly decreased over the course of every indoor components, with a significant majority of children seated by the end.

#### ***4.3.4 'Puppet Tour': Summary of Findings***

A group of early years' schoolchildren performed a task in a wood, and then a classroom, which involved being read a storybook and then taking a stick-puppet of their favourite character on a tour of the setting. Behaviour was compared between the settings and in comparison with a control group who did the task twice indoors. A greater diversity of task interpretation was observed outdoors, particularly in the early



stages. This seemed only loosely related to the specific requirements or story theme, but included rich environmental discovery and exploration, actual and imaginative. Indoor activities were ones typically associated with a classroom, but did feature rich role-play based on the story theme. Levels of social interaction were higher outdoors, and exhibited a pattern which evolved from diverse individual expression into stable team projects. With the exception of the enduring story-based role-play, the indoors pattern tended from collaboration towards small workgroups, and parallel or solitary activity. Finally, higher levels of physical activity was observed outdoors, where it was also more integrated into creative pursuits.

#### 4.4 Rural Wood: ‘Alien Adventure’

The fourth experimental task, ‘Alien Adventure’ entailed a repeated measures design but with only a single group and setting order (see Table 4.6 below). The task required buddy groups –pre-existing pairings of an ‘early years’ and an ‘experienced’ child– to invent a story about an adventure on an alien planet, in a classroom and then in a wood.

Twenty three participants completed both conditions and the questionnaire, including 9 early years’ and 14 experienced pupils, average age 5½ and 9½ years’, respectively. Two boys, one from each group, were absent from one condition. Five early years children were not present for the questionnaire, and don’t feature in data tables and statistical analysis, but are referred to in this chapter.

	Children				Task: Alien Adventure	
	Total	m	f	UA***	Setting 1	Setting 2
Early Yrs**	9	4	5	0	Indoors	Wild
Experienced*	14	6	8	1		
<b>Totals:</b>	23	10	13	1		

\*Av age 9½; \*\*Av age 5½

\*\*\*Underachiever

**Table 4.6 Design for Urban Rural Task: ‘Alien Adventure’**

The two supervising teachers and the experienced group had 4-5 years’ regular exposure to woodland learning, and the early years’ between 6-18 months’. While the

manipulation of setting means this is not a cross-sectional study (Cherry, 2015b; Trochim, 2006b), it does have the character of one, as some differences between the groups are assumed to be attributable to the extent of exposure to the wild setting.

The two experimental settings are shown in Figure 4.21 below: two connected classrooms, and a small spruce plantation adjacent to the school grounds. The latter was the children's usual outdoor classroom, and was categorised as a 'wild setting' by the Richness Index.



**Figure 4.21 Rural Wood Task Settings**

The task began with the teacher outlining a premise regarding an alien called Nanu who, while flying home to his family on Planet Love Heart, encounters a distress signal from two alien planets (one for each component). Buddy groups were then required to invent an adventure which included an account of the alien planet, who sent the distress signal and why, and how they and Nanu remedied the crisis.

Indoors, the experienced child was required to write the story, while their early years' buddy drew it, using writing and drawing materials. During the task, they were free to move and use the classrooms as they wished. Outdoors, buddy groups roamed freely, using the affordances of the setting as a basis for inventing their story.

The tasks ended with everyone reconvening in the early years' classroom. There the teacher picked some buddy groups to present their stories. For the indoor component the experienced child read out their story and then their early years' buddy described

their picture, while for the outdoor, this was an unstructured verbal presentation involving both children.

Data were observations, video recordings and transcriptions, and the children's stories, which were subjected to an inductive thematic analysis.

#### ***4.4.1 'Alien Adventure' Findings***

As outdoor observational data are limited due to dense woodland and the single camcorder recording, results focus predominantly on a comparison of indoor and outdoor stories.

Three buddy groups had an opportunity to present their stories for both settings, and a further four groups presented their story in one setting but not the other. These are set out in full in Tables 4.7 and 4.8, respectively. A thematic analysis implies four between-setting differences.

The first is that *reimagined affordances seem integral to the woodland stories, but barely feature in the indoor stories*. For example, the “*broken house*” (Group 1), “*trees*” and “*leaves*” (Group 2), and “*slime*” and “*wind*” (Group 3), all correspond to concrete features the buddy groups were observed encountering outdoors: a pile of wood, some saplings, and mud and the breeze, respectively. Similarly for the two other outdoor stories, which feature “*trees*” and “*mud*” (Group 6), and “*flowers and sticks*” (Group 7). There is no evidence of reimagined classroom affordances in any indoor stories, although wall-mounted materials related to the space project may well have served as prompts.

GROUP	INDOOR STORY	OUTDOOR STORY
1	<p><b>An (“experienced”):</b> <i>*reading story*</i> One day there was an alien called Nanu. He got a new spaceship from his mum and dad because it was his birthday. Nanu's cousin came inside. “Where's Nanu?”. Nanu's mum said “he's flying in his new spaceship”. When Nanu landed Nanu's cousin said let's go inside and have your birthday cake. When Nanu was full they went outside and played Indian ball with his new ball and when they had finished playing, Nanu's cousin said can I have a fly in your spaceship? Nanu said yes..... <i>*describing what happens next*</i> Nanu's going to fly and his cousin lost control and he crashed. He's gonna get his radio. It was still working so he called us. We didnae understand it so we got a translator and translated it.</p>	<p><b>An (“experienced”):</b> <i>*relating story*</i> When we landed on the planet we were walking around investigating. There was some scary stuff but then we found out Nanu's house was broken because it was wobbly on every side and when Nanu recognised it was fine - like wobbly - he'd just two bags - one with clothes and one with his food - and he went out, and when he was walking he never realised that his clothes bag was blue, ripped, and all his best clothes was missing and then he'd only a good bag but when he was walking this tree, by the tree, and the other bag - which was yellow yeah? - he got all his food and then he saw his friend who was in a fallen tree. They sat down and ate food and shared all the food with each other and a bottle of water...we couldnae find Nanu but we found all his stuff, like all his clothes.</p>
2	<p><b>Re (“experienced”):</b> <i>*reading story*</i> So we were playing a game of tag which was so much better because there's no gravity. Then we got a distress signal from the Planet Blue so we rushed to the rescue. When we landed, the shuttle door slowly opened - it was all blue and lots of dice were floating in the atmosphere... <i>*describing what happens next*</i> The mole actually got stuck in his hole so we had to like build a crane to lift him out...He ate too much worms...he tried to get through his hole and got halfway through and then he got stuck</p> <p><b>Ka (“early years”):</b> <i>*describing picture*</i> The mole's flying up to the top of there. That's the wee hole he needs to get through it. That's a lamp post. Everything's under it: a blue cow, and this stuff, and a stick, and some leaf petals.</p>	<p><b>Ka (“early years”):</b> <i>*relating story*</i> Though we landed on the planet and there was leaves on the ground but if all the leaves died then the planet wouldn't exist any more. So we needed to plant more trees</p> <p><b>Re (“experienced”):</b> So we got like saplings or whatever they're called and...</p> <p><b>Ka (“early years”):</b> And a tree...</p> <p><b>Re (“experienced”):</b> Saplings...out of our ship and planted them on the planet and we used a special...</p> <p><b>Ka (“early years”):</b> Shape...</p> <p><b>Re (“experienced”):</b> Shape to grow them...we just had (the saplings) on the ship</p> <p><b>Ka (“early years”):</b> Because we thought that's what the purpose was...and the leaves were different colours to make. They had to be different colours</p> <p><b>Rural Wood Teacher 2:</b> And did that save the planet - planting the trees?</p> <p><b>Both:</b> Yeah</p>
3	<p><b>Ai (“experienced”):</b> <i>*reading story*</i> One day I got a call from space. We didn't know who it was. The message was saying help help help me. I think we should help them. Let's go and get a space rocket. I got a space rocket, yes. Then we can go out into space. I wonder what the planet looks like? Let's get a space suit from the shop but I'm not sure the shop will have a space suit. I will have to make one. Once I have a spacesuit I will fly out into outer space. We were going to get our spacesuits on. We were getting out the space rocket at NASA. Once we were up in space, I seen a planet. I think it was the right planet. That's it... <i>*describing what happens next*</i> We were going to go off into space and then walk on the planet and then they'll see a house and that's where Nanu's mum lives and she's like trapped or something.</p> <p><b>Mi (“early years”):</b> <i>*describing picture*</i> That's the shop. And that's a house that's underground. And this – aliens – this is what this is.</p>	<p><b>Ai (“experienced”):</b> <i>*relating story*</i> When we landed like half of the planet was orange and green. It was all slimy so it was hard to walk around. But a wizard came and it helped us to get out of the slime. And then after that we were walking around in the night, but the weather it got bad, and the wizard casted a spell. The wind was blowing strong so we couldn't control ourselves, but we found Nanu's house. It was really messy, but we think the wizard made it messy. We never really thought that Nanu would be untidy. But we never really found out who the distress call was from and we're not too sure if the wizard was trying to trick us.</p>

**Table 4.7 ‘Alien Adventure’: Comparison of Three Indoor and Outdoor Stories**

GROUP	INDOOR STORIES	GROUP	OUTDOOR STORIES
4	<p><b>Ke (“experienced”):</b> <i>*reading story*</i> Once upon a time there was a planet called Planet Easter Egg. It was brown with beige stripes on it. Planet Easter Egg had strawberry pom poms on it. Then I got a call from Planet Easter Egg and the call said help help there is help needed on Planet Easter Egg. So I said what is wrong? And they said there is someone drowning in underpants swimming pool. So I said I will come as soon as I can. So I got a space rocket and I saw Planet Easter Egg and I saw aliens waving to say help help this is Planet Easter Egg. So I shouted where should I land? And the alien said anywhere. So I landed and ran over to underpants swimming pool... <i>*describing what happens next*</i> I was going to get an oxygen tank cause there was an oxygen pipe in the rocket and then I was going to dive down and then pick the person up and bring her out and then give her oxygen.</p> <p><b>Lo (“early years”):</b> <i>*describing picture*</i> Well this is the chocolate factory And this is underpants. swimming pool.</p>	6	<p><b>Pa (“experienced”):</b> <i>*relating story*</i> Well once we landed there was pink and purple snow. When it was in the sky it was pink and when it fell on the ground it was purple <i>*echoed in Co’s movements*</i> and we found Nanu’s house. It was green, the sky was green. Nanu’s house was green and blue, and the trees were all blue ...” <i>*Co whispers in her ear. Pa prompts her*</i></p> <p><b>Co (“early years”):</b> The trees are green.</p> <p><b>Pa (“experienced”):</b> Some of the trees were green.</p> <p><b>Co (“early years”):</b> And they had apples on them...orange apples...</p> <p><b>Rural Wood Teacher 2:</b> Did you find Nanu’s house?...What colour was his house? What was it like?</p> <p><b>Co (“early years”):</b> Green.</p> <p><b>Pa (“experienced”):</b> Well it was all messy and it wasn’t tidy or anything. It was underneath mud.</p> <p><b>Co (“early years”):</b> Green and blue.</p> <p><b>Rural Wood Teacher 2:</b> Green and blue? Who made it messy?</p> <p><b>Br (“early years”):</b> Nanu...and sometimes his uncle.</p> <p><b>Co (“early years”):</b> Nanu was nibbling a stick. He was nibbling a stick.</p> <p><b>Rural Wood Teacher 2:</b> Who was?</p> <p><b>Br (“early years”):</b> Me <i>*smiles*</i>.</p> <p><b>Co (“early years”):</b> It was not you. You don’t eat sticks!</p> <p><b>Br (“early years”):</b> Yes I do...I like them!</p> <p><b>Pa (“experienced”):</b> In Nanu’s house we put the stick in and somebody was eating the stick.</p> <p><b>Co (“early years”):</b> I think it was Nanu’s mum <i>*Br laughs*</i>.</p> <p><b>Re (P5/6):</b> Maybe it was an alien beaver?</p> <p><b>Co (“early years”):</b> He might be nibbling it!</p> <p><b>Br (“early years”):</b> And a boy eat them <i>*Co laughs*...I eat them!</i></p>
5	<p><b>Fi (“experienced”):</b> <i>*reading story*</i> One day in space we got a call from an alien. The alien call came from Planet Easter Egg. The call said help help there is a girl drowning in the swimming pool so we rushed to go to the planet but we did not know what it looked like so we looked in the planet book and we headed off to Planet Easter Egg. When we got there it was easy to spot the swimming pool because it was the shape of underpants. When we got there we put our snow clothes on... <i>*describing what happens next*</i> We had snow clothes but cause so the hole was so deep you could fit a whale in it so we had to have really long snorkels.</p> <p><b>Kt (“early years”):</b> <i>*describing picture*</i> This is the rocket. That’s flying up to Planet Easter Egg. And that’s the stripes (of chocolate) there and there and that’s the curve of underpants.</p>	7	<p><b>Er (“early years”):</b> We found a hole and it was the place where the bird escapes, and we went, and we found alien sticks and alien flowers and stuff.</p> <p><b>Rural Wood Teacher 2:</b> So who was in distress on your planet?</p> <p><b>Er (“early years”):</b> It was the baby prince.</p> <p><b>Rural Wood Teacher 2:</b> What happened to him?</p> <p><b>Mi (“experienced”):</b> He had a sick bird, didn’t he (<i>to Er</i>)?</p> <p><b>Er (“early years”):</b> Yes. Cause the baddies came and I rescued him.</p>

**Table 4.8 ‘Alien Adventure’: Remaining Indoor and Outdoor Stories**

The second is that *the outdoor stories exhibit greater coherence, depth and mood, than the indoor*. Each outdoor story seems to build around a single narrative theme: the hunt for Nanu (Group 1), saving a planet from environmental catastrophe (Group 2), a mysterious wizard (Group 3), Nanu's house (Group 6), and the baby prince's bird (Group 7). The quality of story-telling seems particularly mature for Groups 1-3. For example, Group 3's outdoor story has a genuine sense of the uncanny about it:

*"It was all slimy so it was hard to walk around. But a wizard came and it helped us to get out of the slime. And then after that we were walking around in the night, but the weather it got bad, and the wizard casted a spell. The wind was blowing strong so we couldn't control ourselves, but we found Nanu's house. It was really messy, but we think the wizard made it messy. We never really thought that Nanu would be untidy. But we never really found out who the distress call was from and we're not too sure if the wizard was trying to trick us."*

On the surface, the indoor stories may appear more imaginative and complete. However, they also have a fragmented 'and then' character about them, where events and sentences seem determined more by those immediately preceding them, than any overarching story concept. Group 3's indoor story offers an illustration:

*"I wonder what the planet looks like. Let's get a space suit from the shop but I'm not sure the shop will have a space suit. I will have to make one. Once I have a spacesuit I will fly out into outer space. We were going to get our space suits on. We were getting out the space rocket at NASA".*

A third weaker difference is *that there seems to be more agreement between "experienced" and "early years" on the outdoor story, than the indoor*. The closer integration of the two contributions is notable in the outdoor stories of Groups 2, 6 and 7. For example, Group 2's seamless co-presentation of their outdoor story gives the sense that it was a genuinely shared experience. However, while indoors their accounts are still largely complementary, the early years' includes content not apparent in the experienced boy's –the *"flying mole"*, *"lamppost"*, *"blue cow"*, *"leaf petals"* – implying slightly different conceptions of the story. While the indoor stories of Groups 4 and 5, who both shared the same table, exhibit closer agreement between buddies, the

early years' contributions still feature unique content (e.g. “*stripes*”; “*chocolate factory*”).

The last difference is that the *indoor stories feature more details of the space project*, for example, “*flying spaceships*” (Group 1), “*gravity*” and “*shuttle doors*” (Group 2)”, and “*NASA*”, “*rockets*” and “*space suits*” (Group 3). Groups 4 and 5 exhibit less project-related references, but a similar trend. By comparison, the outdoor stories entail minimal direct references to the space project beyond “*landing on the planet*”.

A final general observation was the differing levels of physical activity between the settings. Indoors, buddy groups rarely moved once they had established a workstation. Outdoors, they were observed moving throughout the designated area, and of the RI affordance items scored for the setting, all corresponding actions were observed.

#### **4.4.2 ‘Alien Adventure’: Summary of Findings**

Seven ‘buddy group’ pairings of early years and experienced children were required to co-create and present an ‘Alien Adventure’ story, first in a classroom using writing and drawing materials, and then a woodland using the affordances of the setting. Based on a comparative thematic analysis, it is proposed that the outdoor stories feature more reimagined affordances, appear more thematically coherent, exhibit closer agreement between buddy versions, but include fewer references to the space project. As already noted, variations in story format and presentation may have influenced these findings. Lastly, high levels of physical activity were observed in the outdoor settings, whereas the indoor condition was primarily sedentary.

#### **4.5 Summary of Task Observations and Outcomes**

Primary schoolchildren performed four diverse tasks once in a classroom, and then outdoors (a playground or a wood), or vice versa, and observations and outcomes were compared between the settings. All were repeated measures experiments, but each featured a particular design and analytical approach due to its unique character and

situational requirements. Despite these variations, findings suggest three common differences between indoor and outdoor settings.

The first is the greater diversity of task outcomes and interpretations outdoors, where actual and imaginary productions seemed strongly influenced by environmental features and discoveries, particularly in the wild settings. The classroom tasks entailed negligible environmental discovery, and affordances featured less prominently and were used in more conventional ways.

The second is that creative collaboration was more sustained in the outdoor settings. On the urban wood tasks both outdoor components exhibited a pattern which evolved from individual expression into stable projects. These engaged almost all children, notably underachievers. On the corresponding classroom tasks, there was significantly more parallel or solitary play, and implications of social withdrawal for underachievers, particularly on 'Make a Toy'. On 'Alien Adventure' more effective collaboration is also implied by the closer agreement between buddies' outdoor stories, compared with the indoor. While between-setting differences seemed less notable for the playground task, some children cited teamwork as a positive outdoors, while none did indoors.

The last common difference is the higher levels and diversity of physical activity observed outdoors, and which were negligible indoors. In the wild setting, gross motor movement also seemed more intense and integrated into creative pursuits than in the playground, and more integrated into creative pursuits.



## CHAPTER 5: TASK RECOLLECTIONS AND PREFERENCES

### 5.0 Introduction

This chapter sets out the quantitative findings arising from Stage 2 of data-gathering and analysis. This entailed a follow-up questionnaire with children carried out 6-7 months after the field experiments. Teachers took the same questionnaire concurrent with their Stage 3 interviews, and their findings will be described here also.

The goal of Stage 2 was to establish a stronger basis for cross-task analytical generalisation, towards resolving the thesis's third objective and research hypotheses. Specifically, it aimed to answer three research questions:

1. *Did the children and teachers better recall the outdoor task over the indoor?(RH1)*
2. *Did they prefer the task and setting for criteria related to performance? (RH1)*
3. *Is there any association between these data and natural richness? (RH2)*

The chapter begins with an overview of the questionnaire and analysis. It will then move onto the specific procedure and findings for its two parts, first task recollections and then task ratings and setting preferences. The section on children's setting preferences also includes the outcomes of the analyses which investigated associations with natural richness. The chapter ends with a general summary of findings.

### 5.1 Questionnaire Design, Participants and Procedure

#### *Overview of Design and Participants*

Each questionnaire took 10-12 minutes. The first part recorded participants' recollections for both experimental conditions, and the second, their task rating and setting preferences, using 9 criteria relevant to performance.

There was a total sample of 71 primary schoolchildren and 4 female teachers, all of whom participated in both conditions of one of the experiments. Children include a roughly equal split of female (n=37) and male (n=34) and a sub-group of ‘underachievers’ (n=14). Impacts of exposure to outdoor learning compare an ‘experienced’ group of rural wood children (n=14; mean age 9½ yrs) who had taken regular woodland lessons for 4-5 years, and an ‘early years’ group (n=57; mean age 5½ yrs). Most early years’ had never experienced of outdoor learning (n=48), although those from rural wood had for between 6-18 months (n=9). The two rural wood teachers had extensive experience teaching outdoors, while the urban wood and playground teachers had none.

The natural richness of all experimental settings were categorised using a checklist of affordances and biodiversity, called the Richness Index (RI). The study settings in order of richness, together with their sample allocation, were three ‘indoor’ (n=71), one ‘playground’ (n=19), and two ‘wild settings’ (n=52). Both indoor and wild settings include experienced and early years groups. Table 5.1 below shows an overview of child participants by group.

The open-endedness of the tasks was assessed using a measure which scored each component on a scale of one to eight according to the implicit constraints the task requirements and materials imposed on environmental interaction.

	All Children				"Playground"				"Wild"				
	Total	m	f	***UA	Total	m	f	U-A	Total	m	f	U-A	
<b>*EY</b>	57	28	29	13	19	9	10	6	38	19	19	7	
<b>**EXP</b>	14	6	8	1	0	0	0	0	14	6	8	1	
<b>Totals:</b>	71	34	37	14	19	9	10	6	52	25	27	8	
<i>*Early Years: Av Age 5.5yrs</i>				<i>Underachievers</i>									
<i>*Experienced: Av Age 9.5yrs</i>				<i>9 males, 5 females</i>				<i>2 males, 4 females</i>			<i>7 males, 1 female</i>		

**Table 5.1 Questionnaire: Overview of Child Participants**

### *Procedural Overview*

All questionnaires were administered one-to-one at a desk in a quiet area of the school, either an unused classroom or hall. They took place during lesson time for children, and over lunchbreaks with teachers.

Children were fetched from their classroom, one at a time. The walk to the interviewing area was used to re-establish rapport built during the tasks. The interview began by asking the participant if they remembered *“when I was here last (school) year, we...”* citing the experiment, but never a setting. The participant was then informed:

*“I am going to ask you some questions about (the task) because I’m really interested in what you think about them. Don’t worry, there aren’t any right or wrong answers, and if you don’t understand anything I’ve said, or you want me to say something again, then you will tell me won’t you?”*

The interview proceeded with the two parts of the questionnaire, the specific procedures for which will be detailed in due course. To avoid any test-associated stresses, responses were recorded by a discreetly placed Flip™ Camera (e.g. concealed in a box of toys), pointing away from the participants, and down at the desk and materials.

Two-tailed non-parametric tests are used to assess statistical differences between data for groups and settings. The conceptual underpinnings of setting preferences are explored using a Principal Components Analysis (PCA) with Varimax rotation, and their possible association with natural richness employs a Logistic Regression Analysis. Further details of these statistical approaches and their rationale can be found in 3.9.5

## **5.2 Recollections**

The first part of the questionnaire addressed the research questions: *“did the children and teachers better recall the outdoor task over the indoor (RH1)?”* and *“is there any association between these data and natural richness?” (RH2)*

Participants were asked the question *“tell me one thing you remember about the task?”*, and then further recollections were solicited using the prompt, *“anything more or*

else?” On the rare occasion they recalled nothing or only one setting, they were prompted with one relevant contribution they had made. When they could remember nothing further, the interview proceeded to part two.

	All Children				Indoor vs Playground				Indoor vs Wild			
	Total	m	f	U-A	Total	m	f	U-A	Total	m	f	U-A
<b>*EY</b>	24	12	12	6	5	4	1	2	19	8	11	4
<b>**EXP</b>	8	4	4	1	0	0	0	0	8	4	4	1
<b>Totals:</b>	32	16	16	*7	5	4	1	2	27	12	15	5
<i>*Early Years: Av Age 5.5yrs</i>				<i>5 males, 1 female</i>				<i>1 male, 1 female</i>				<i>4 males, 1 female</i>
<i>**Experienced: Av Age 9.5yrs</i>												

**Table 5.2 Recollections: Overview of Child Participants**

The two outcomes measured are the setting for their first recollection, proposed to imply the strongest task memory trace; and the sum total of their recollections (‘features of the event’) for each setting, proposed to be a measure of cognitive impact. The total sample (n=32) is smaller than for preferences and ratings due to a hard drive failure which occurred before all recollections were transcribed. An overview of the number of recollections for the children by group appears in Table 5.2 above.

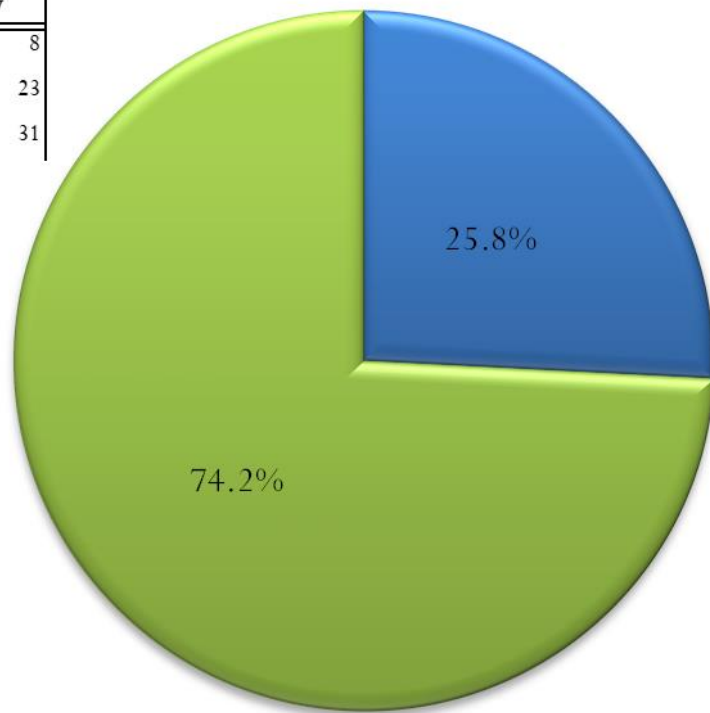
### 5.2.1 Recollections: Results

*Did children more readily recall the outdoor task? Was natural richness a factor?*

A Chi-square test showed that the children’s first recollection was more often of the outdoor task,  $\chi^2(1, n = 31) = 7.258, p = .007$  (see Figure 5.1 below). A Mann-Whitney Test also revealed they remembered the wild settings first more frequently than they did the playground,  $U = 21.5, p < .001$ . No significant difference was found for readiness of recall between the two wild studies.

Setting	%	Frequency
Indoors	25.8%	8
Outdoors	74.2%	23
Total	100%	31

■ indoors  
■ outdoors



**Figure 5.1 Recollections: Location of Children’s First Recollection**

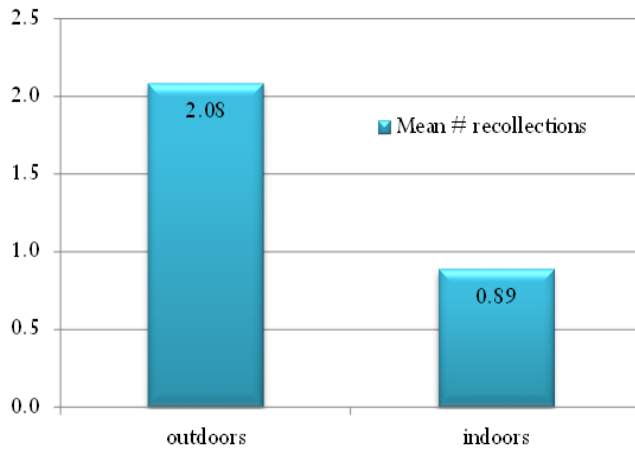
*Did the children recall more about the outdoor task? Was natural richness a factor?*

Wilcoxon tests revealed children recalled significantly more about the outdoor component, than the indoor, (n = 32),  $Z = -2.729$ ,  $p = .006$ . The trend was observed for the teachers, though the difference was not significant (n = 4),  $Z = -1.857$ ,  $p = .063$ . Indoor and outdoor means for both groups are set out in Table 5.3 below and in the bar graphs in Figure 5.2 overleaf.

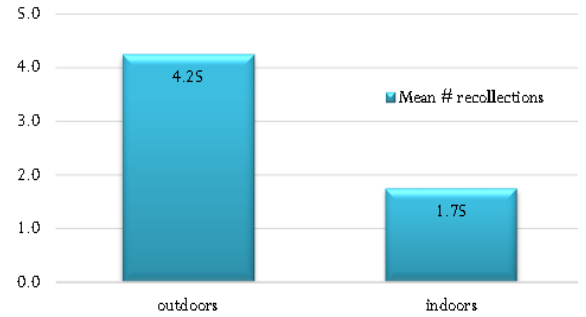
	# Recollections		Wilcoxon Signed Ranks
	Indoor Mean (SD)	Outdoor Mean (SD)	
Children (n = 32)	0.89 (1.72)	2.06 (2.67)	$Z = -2.729$ , $p = .006$
Teachers (n = 4)	1.75 (0.96)	4.25 (1.50)	$Z = -1.857$ , $p = .063$

**Table 5.3 Recollections: Indoors vs Outdoors, Children and Teachers**

# Recollections:  
Children (n = 36)

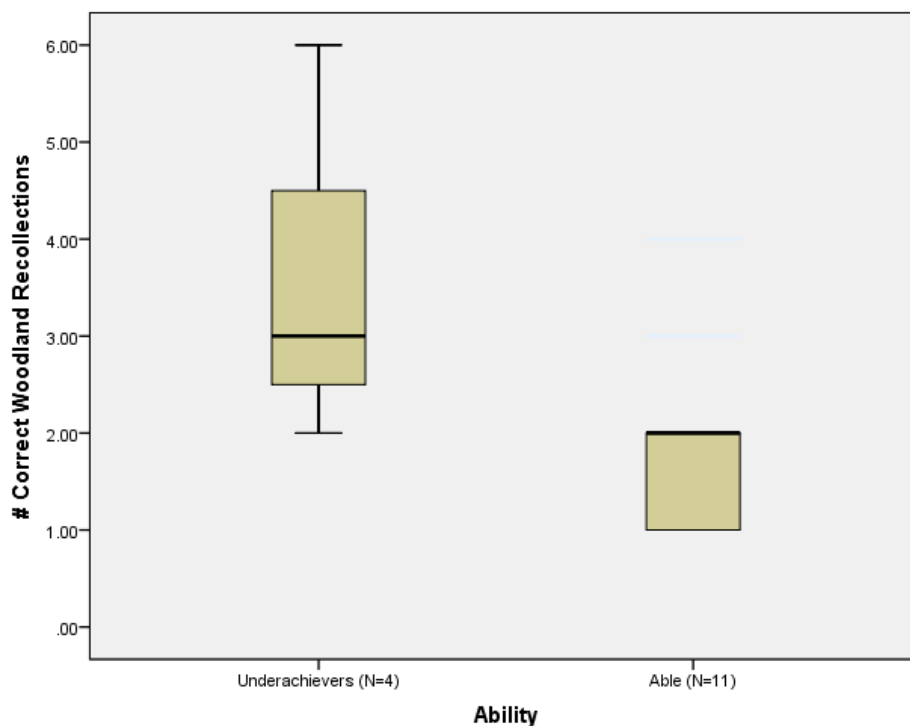


# Recollections:  
Teachers (n = 4)



**Figure 5.2 Recollections: Graph of Indoor vs Outdoor Means**

Children remembered more about tasks in a wild setting than the playground, but Mann-Whitney U tests revealed the only significant difference was between the urban wood and playground studies,  $U = 20$ ,  $p = .040$ . No differences in readiness or number of recollections in the wild settings was found between early years' and experienced groups, or between males and females.



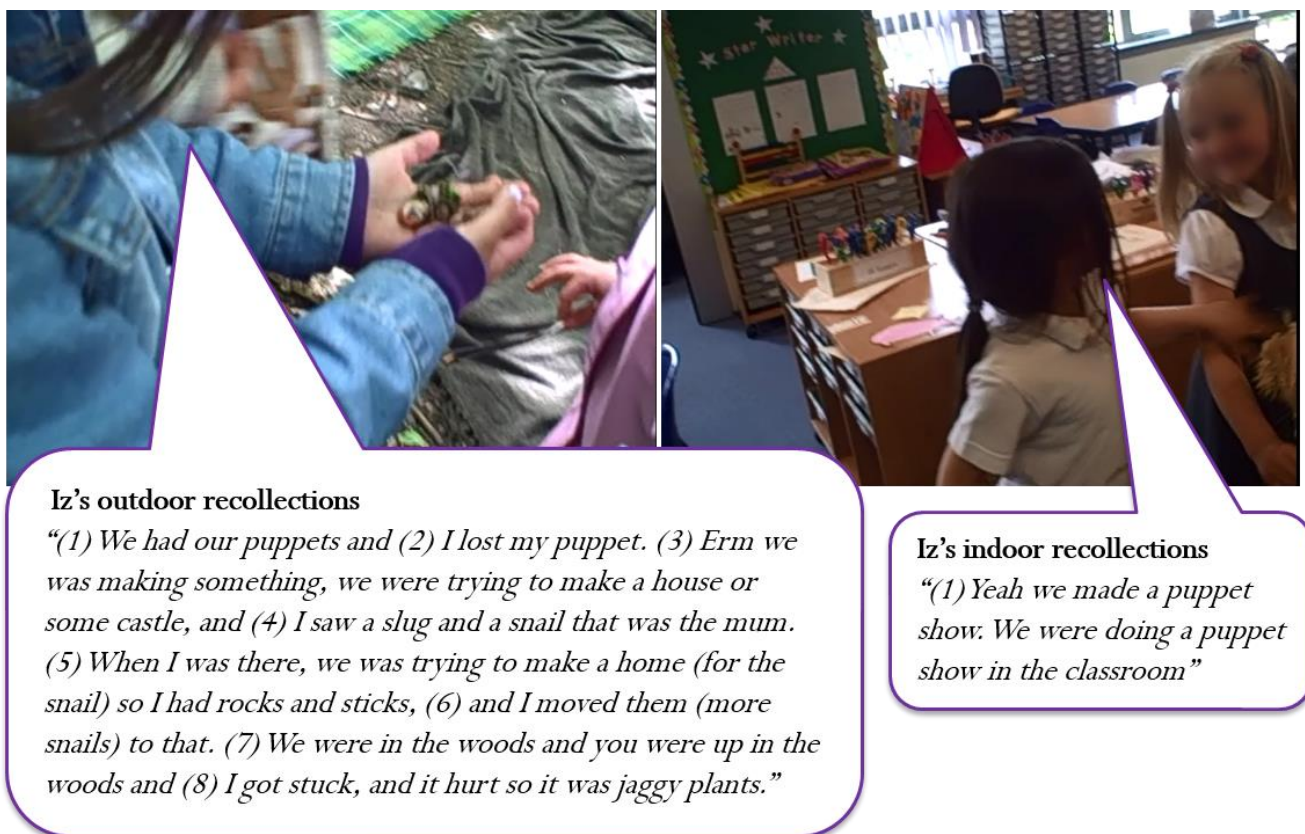
**Figure 5.3 Recollections: Boxplot of Underachievers vs Able, Wild Settings Only**

Underachievers (n=6) recalled more than their able peers (n=15) at trend levels overall ( $p = .07$ ), and significantly so on the wild setting tasks (n=4 vs n=11, respectively),  $U = 8$ ,  $p = .05$ . Figure 5.3 shows the boxplot for the second analysis.

### 5.2.2 Recollections: Three Examples

In the main, the number of recollections for each individual was neither extensive nor differed considerably between settings. However, some contributions were substantial. There follows three examples –from two underachievers and one teacher– for context, and to illustrate how ‘features of the event’ (which are numbered) were classified.

In Figure 5.4 below are the ‘Puppet Tour’ recollections of Iz, a 5 year old girl and the leader of the ‘slug and snail zoo’ touched upon in the last chapter. English was Iz’s second language, and she was categorised as an underachiever due to difficulties of attention and communication. She had one recollection of the indoor task, and seven of the one in the wild setting, the latter volunteered in the order they occurred.



**Iz's outdoor recollections**  
*“(1) We had our puppets and (2) I lost my puppet. (3) Erm we was making something, we were trying to make a house or some castle, and (4) I saw a slug and a snail that was the mum. (5) When I was there, we was trying to make a home (for the snail) so I had rocks and sticks, (6) and I moved them (more snails) to that. (7) We were in the woods and you were up in the woods and (8) I got stuck, and it hurt so it was jaggy plants.”*

**Iz's indoor recollections**  
*“(1) Yeah we made a puppet show. We were doing a puppet show in the classroom”*

**Figure 5.4 Recollections: Example 1**



#### **Tm's indoor recollections**

*"(1) We made traps for the Gruffalo and (2) we were making tents and (3) trying to get food and camps...(4) in Room 2 and (5) we used string for the traps...(5) And there were Room 2 and Room 1 (children) helping and...(6) so we also pretend and sticks and we also and (7) I had (there were) three teams and (8) I also go in the tent and this giant ...(9) and there was one on my team there was (9) two in twos and one other and that was me...I don't who their name's called but (10) I know what colour my tent was green and (11) the other tent was a bit big and blue"*

#### **Tm's playground recollections**

*"(1) I had the same team as last time and (2) I done it on the field and (3) I used a camping fish thing for it and (4) then you were doing another team which way the wind was directing and you licked your finger and you done that for the wind and that was Kt and Sr maybe and (5) Kt and Sr made their tent at the climbing frame outside and (6) I don't know it was really lots of room inside when we gone in and (7) we used sticks for it and the (8) teacher outside was the teacher from Room 2...and (9) the person I was with I know which colours their hair was - brown and peach...and (10) you know that it was about Katie Morag cause we didn't know (11) we laid traps for him and (12) I used a string for to pull him up on the tree and a little hole and I insert the string so his foot would be stuck on the tree and also cause of my (?) games and you know and (13) it was the same number of sticks from the inside too and (14) we didn't want Katie Morag's brother to get in the tent and (15) so inside we were sleeping toys so we used traps for (16) Katie Morag's little sister and we also done that and (17) the other team was maybe two girls maybe there were in my class but it was two girls and (18) there was three boys in my team...(19) Jm and the other boy with peachy hair that's his friend"*

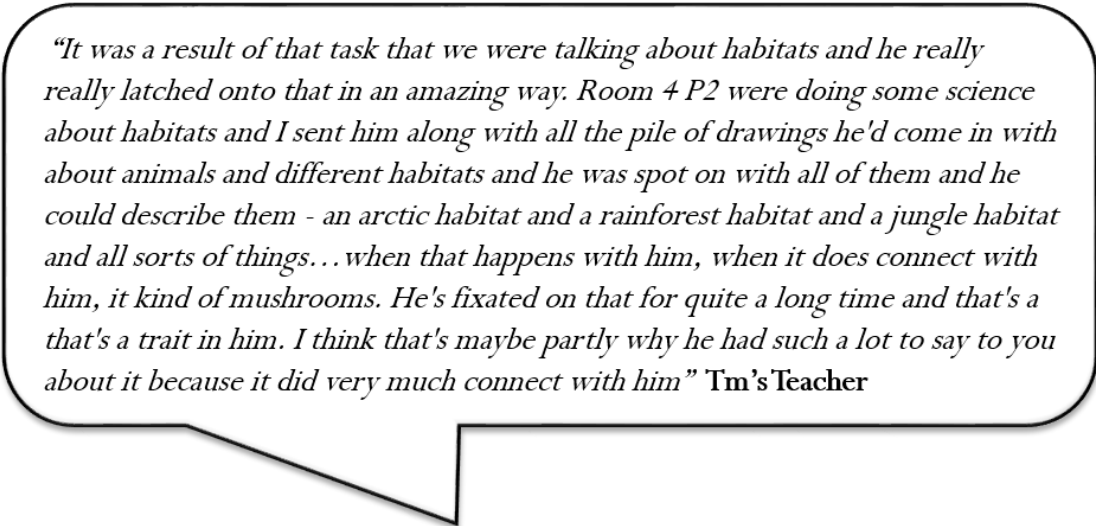
**Figure 5.5 Recollections: Example 2**

In Figure 5.5 above are Tm's recollections from the playground task, 'Build a Den'.

Tm was an underachieving boy, deemed a "challenge" by his teacher on account of his problematic attention, behaviour and language. Tm recalled over double that of any other participant for both indoor and playground settings, 11 and 19 recollections, respectively. Fine-grained narrative and factual detail are given for both components, and are recounted in the sequence they occurred. Tm's teacher, who was not a study participant, was approached for insight on his exceptional response during stage 3. In



her answer, given in Figure 5.6 below, she says that the ‘Build a Den’ theme “*did very much connect with (him)...in an amazing way*” and that this “*may be partly why he had such a lot to say*”. She believed the experience sparked a fascination in “*animal habitats*” which persisted “*for quite a long time*”, and cumulated in a presentation of his findings to older children in the school.



*“It was a result of that task that we were talking about habitats and he really really latched onto that in an amazing way. Room 4 P2 were doing some science about habitats and I sent him along with all the pile of drawings he'd come in with about animals and different habitats and he was spot on with all of them and he could describe them - an arctic habitat and a rainforest habitat and a jungle habitat and all sorts of things... when that happens with him, when it does connect with him, it kind of mushrooms. He's fixated on that for quite a long time and that's a that's a trait in him. I think that's maybe partly why he had such a lot to say to you about it because it did very much connect with him” Tm's Teacher*

**Figure 5.6 Teacher's Comments on Tm's Recollection of 'Build a Den'**

In Figure 5.7 overleaf, the third and final example is the urban wood teacher's recollections of the two tasks she supervised: ‘Make a Toy’ and ‘Puppet Tour’ –her first outdoor teaching experiences. While the difference in the number of indoor and outdoor recollection is not large –6 vs 8, respectively– the content is distinctive.

Although classroom recollections are largely general objective observations (“*they kind of started with the puppets and then abandoned the puppets*” (3)), those of the wild settings often confer the sense of reliving specific experiences (“*ooh should I let this happen*” (4)) with affective, spatial and sensorial dimensions (“*feeling* (4)”, “*fun* (5)”, and “*laughter* (4 and 5)\*”; “*huge, big* (2)”, “(*smell of*) *wild garlic* (7)”, respectively).



**Urban Wood Teacher's indoor recollections**

*"(1) Doing the puppet tour in the classroom and (2) them really using the role play area more so than they had been doing before em and really acting out the farmer duck story and (3) they kind of started with the puppets and then abandoned the puppets but you know it kind of got them going and they're all interacting with each other and role playing and getting really into it (referring to 2)...(4) and the inventing a toy in the school as well I think was really valuable and yeah they really enjoyed doing that and (5) their ideas were all really very good and (6) I remember a lot of sharing ideas across the table and one idea starting at the end that you know kind of filtered through a lot of them and I think you know they all kind of had a good kind of product at the end (same as 5)"*



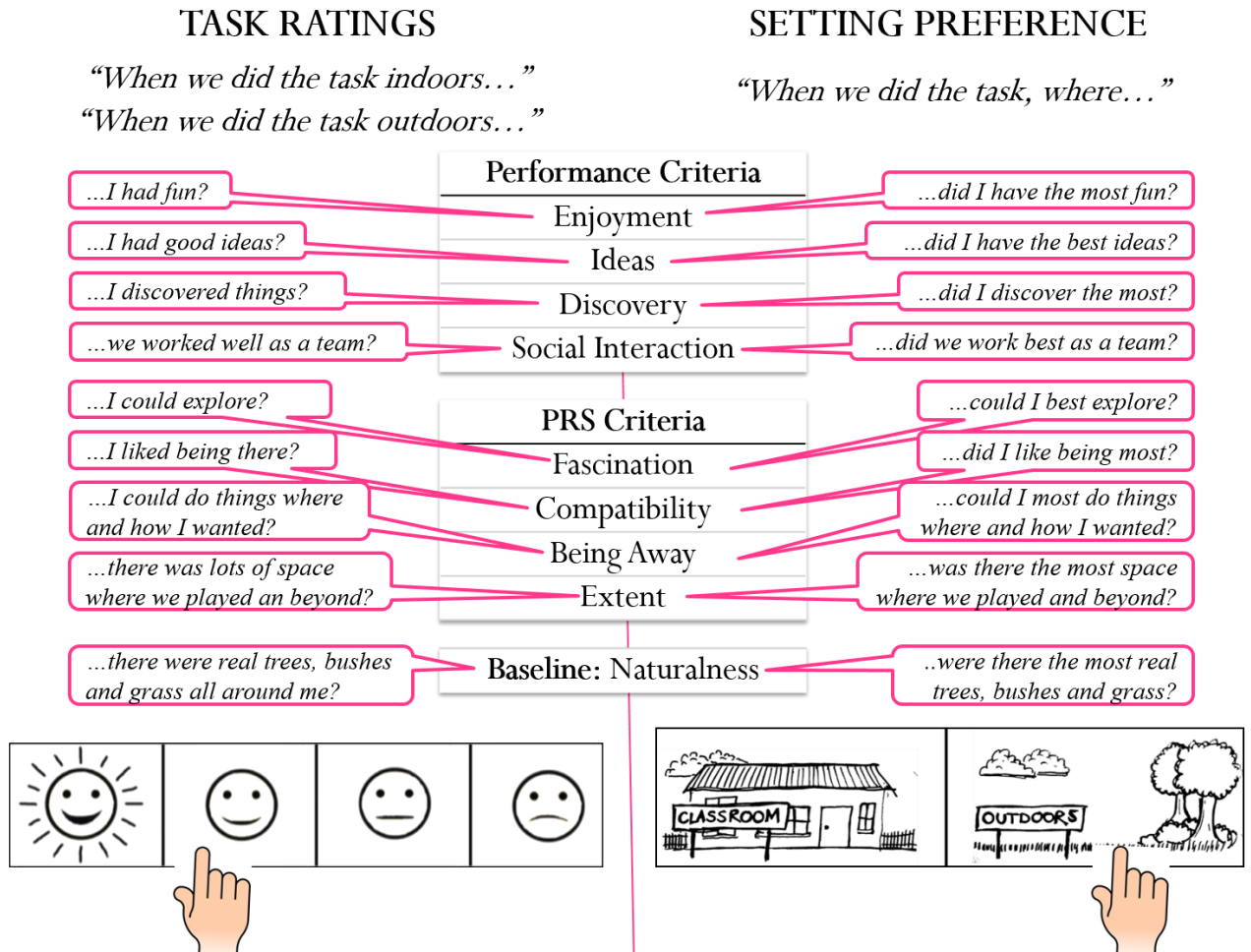
**Urban Wood Teacher' outdoor recollections**

*"(1) The first thing that comes to mind, yeah, the most memorable bit I think is going up to the woods with the invent a toy people and (2) them using their string and tying up you know huge big creations all around the trees and (3) getting inside them and acting with them and you know it was all really coming to life for them and that's the main thing I remember...also (4) feeling like it was chaos when we went to do the puppet thing in the woods \*laughs\* em feeling yeah like they'd all gone a little bit crazy and we'd just let them loose and kinda thinking "ooh should I let this happen?" (5) Em...getting stuck in the mud \*laughs\*. That was fun! (6) And them going up getting excited going up to the woods (different session to 1) for the first time and it being really muddy and (7) them smelling there was wild garlic and different things and (8) they were asking about things they could see and you know they were really excited...um...so yeah all the tasks were quite successful really"*

**Figure 5.7 Teachers' Recollections: Example 3**

### 5.3 Setting Preferences and Task Ratings

The second part of the questionnaire addressed the research questions “*did children and teachers prefer the task and setting for criteria related to performance?*” (RH1) and “*is there any association between these data and natural richness?*” (RH2).



**Figure 5.8 Procedure and Statements for Task Ratings and Setting Preferences**

This began by informing the participant they were going “*to answer some questions by pointing at pictures*”. There followed a brief introduction to the materials and requirements. For the setting, they were told to pretend one was the classroom and the other the playground or wood, and a few questions were asked to check understanding (e.g. “*where are we now?*”; “*where do I play at break time?*”, “*where might a squirrel live?*”).

Next, the Likert emoticons were explained as a unhappy-to-happy scale, together with some questions to verify understanding and calibrate responses (e.g. “*what face is*

*it...on Christmas morning (super-happy)?...on Christmas Eve? (happy)...a week before Christmas (normal)?...when its a whole year till Christmas? (unhappy)”).* When the participant had submitted a response for all four emoticons, there followed a few questions to test that the scale was also understood in a disagree-to-agree scenario (e.g. which face is... *“I’m good at football”; “I like big spiders”, “freezing rainy days are fun”*). The setting sketches and Likert Scale can be seen to the bottom right and left of Figure 5.8 above, and in Appendix 1.

The main interview then proceeded, going through each of the 9 measurement criteria in turn. These included the four performance criteria derived from the theoretical framework, four perceived restorativeness scale criteria (PRS), and a baseline ‘naturalness’ criterion.

First a rating was elicited for the particular criterion for both indoor and outdoor tasks, using the Likert scale. For example, for ‘enjoyment’, the participant would be asked, *“when we made a toy indoors, I had fun”* then *“when we made a toy outdoors, I had fun”*, or vice versa, and they responded by pointing at the emoticon they perceived most appropriate. The participant was then required to state which setting they preferred most for the particular criterion, using the sketches. For example, again for ‘enjoyment’, they were asked, *“where did I have the most fun when we made a toy?”*, and responded by indicating either the sketch of the classroom or the outdoors. All task rating and setting preference questions are shown to the left and right of Figure 5.8, respectively. The layouts of the sketches and Likert Scale were horizontally-flipped between participants, to control for primary bias, that is the tendency to select the first option in a sequence (Scott, 2008) (see Appendix 1). Whether the outdoor or indoor task was rated first remained consistent for each individual, but was varied between participants to control for order effects.

### ***5.3.1 Children’s Setting Preferences and Task Ratings***

#### *Overall*

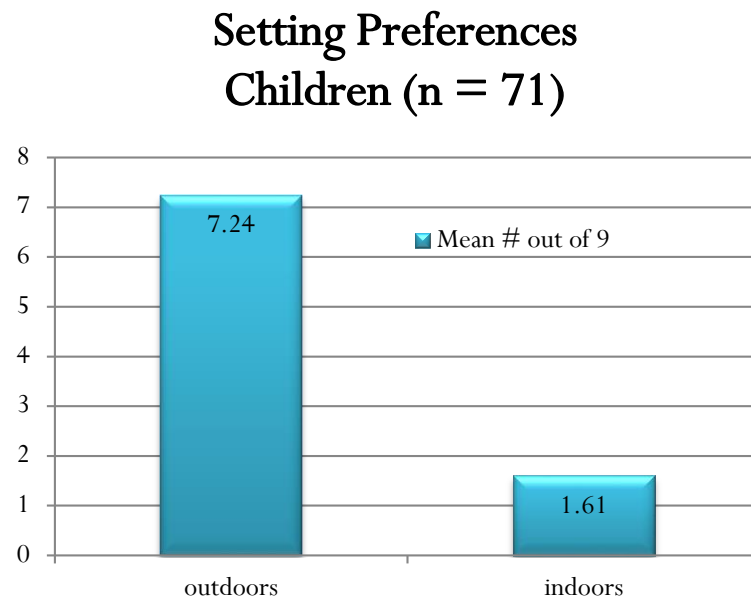
Table 5.4 below sets out the means and significant findings for children’s preferences and ratings. Wilcoxon tests revealed children (n=71) chose the outdoors as their

preferred task setting more often than the indoors,  $Z = -5.055$ ,  $p \leq .001$ , and rated the outdoor task higher by comparison,  $Z = -4.728$ ,  $p \leq .001$ , represented in Figures 5.9 and 5.10 below, respectively.

Criteria	Mean Setting Preferences			Mean Task Ratings		
	Indoors (SD)	Outdoors (SD)	Z stat; sig	Indoors (SD)	Outdoors (SD)	Z stat; sig
<b>Performance</b>	1.10 (1.148)	2.83 (1.159)	-5.055; $p \leq .001$	13.93 (1.777)	15.03 (1.236)	-4.728; $p \leq .001$
Enjoyment	0.20 (0.401)	0.80 (0.401)	-5.103; $p \leq .001$	3.61 (0.669)	3.90 (0.304)	-3.273; $p = .001$
Discovery	0.23 (0.421)	0.77 (0.421)	-4.628; $p \leq .001$	3.25 (0.921)	3.70 (0.595)	-3.604; $p \leq .001$
Ideas	0.31 (0.466)	0.69 (0.466)	-3.204; $p = .001$	3.39 (0.666)	3.63 (0.618)	-2.552; $p = .011$
Social Interaction	0.37 (0.489)	0.62 (0.489)	-2.018; $p = .044$	3.78 (0.598)	3.80 (0.469)	-1.460; $p = .144$
<b>PRS</b>	0.46 (0.939)	3.46 (0.983)	-6.899; $p \leq .001$	12.24 (2.811)	14.92 (1.771)	-6.091; $p \leq .001$
Fascination	0.04 (0.203)	0.93 (0.258)	-7.584; $p \leq .001$	2.82 (1.050)	3.78 (0.484)	-5.403; $p \leq .001$
Compatibility	0.20 (0.401)	0.80 (0.401)	-5.103; $p \leq .001$	3.45 (0.842)	3.79 (0.505)	-3.115; $p = .002$
Being Away	0.15 (0.364)	0.83 (0.377)	-5.737; $p \leq .001$	3.20 (0.957)	3.74 (0.606)	-4.635; $p \leq .001$
Extent	0.07 (0.258)	0.92 (0.280)	-7.171; $p \leq .001$	2.97 (1.007)	3.87 (0.479)	-5.198; $p \leq .001$
Naturalness*	0.03 (0.167)	0.96 (0.203)	-7.889; $p \leq .001$	1.90 (1.113)	3.74 (0.652)	-6.393; $p \leq .001$
<b>All Criteria</b>	1.61 (1.816)	7.24 (1.801)	-6.911; $p \leq .001$	27.65 (5.337)	33.211 (3.368)	-6.932; $p \leq .001$

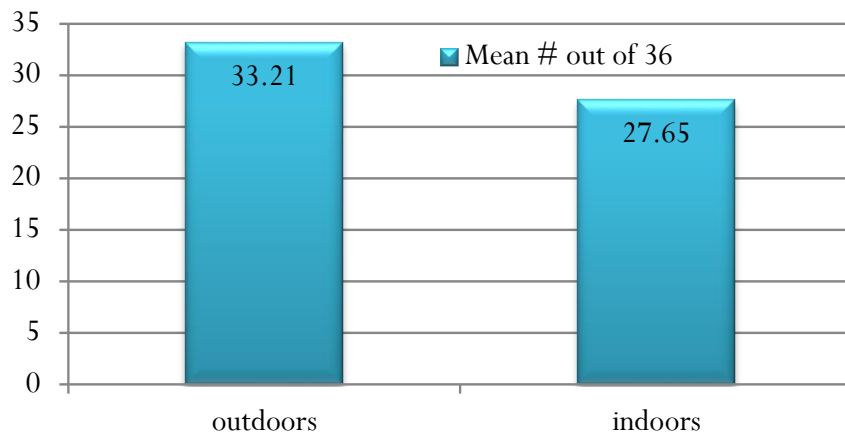
\*Not included in PRS totals

**Table 5.4 Setting Preferences and Task Ratings: Indoors vs Outdoors, Children**



**Figure 5.9 Setting Preferences: Graph of Indoor vs Outdoor Means, Children**

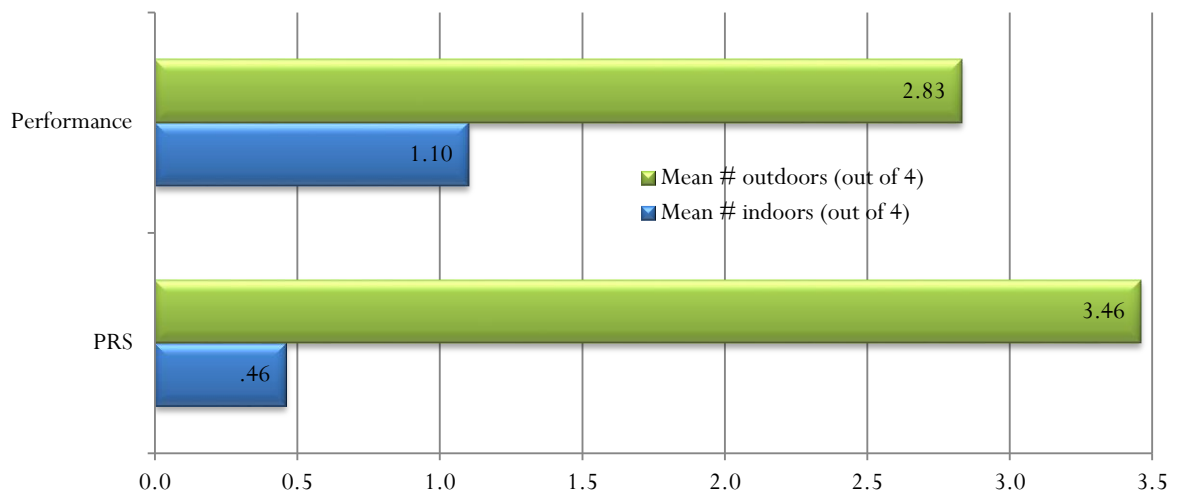
## Task Ratings Children (n = 71)



**Figure 5.10 Task Ratings: Graph of Indoor vs Outdoor Means, Children**

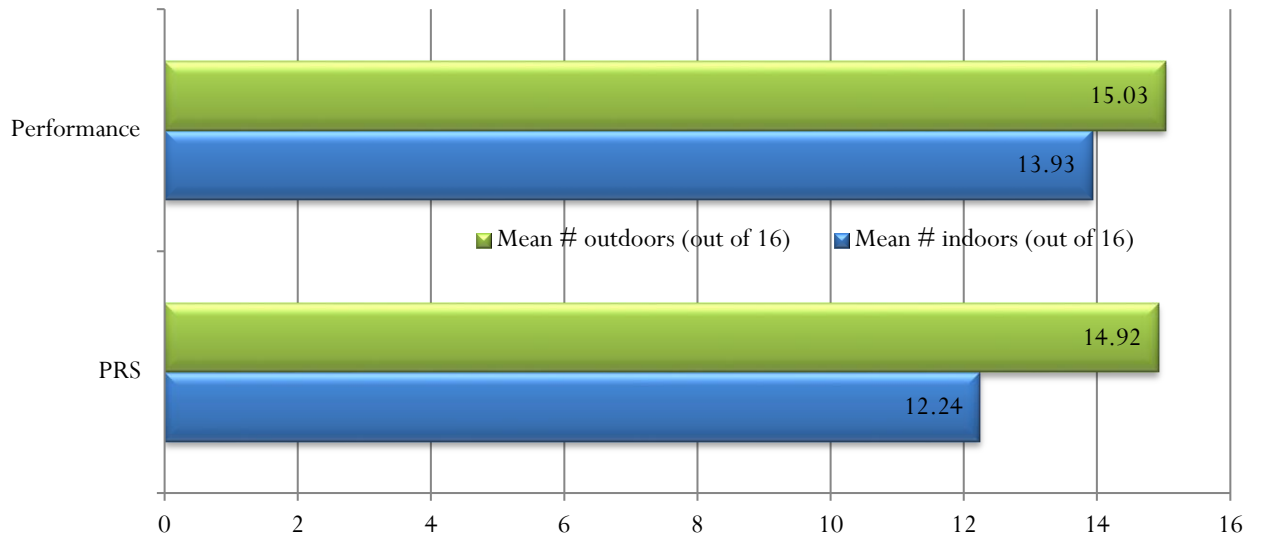
Outdoor setting preferences and task ratings are also greater for performance and PRS criteria overall, both at the highest levels of significance (see Figures 5.11 and 5.12 below). The same is true for most individual criteria, where task ratings for ‘social interaction’ is the only non-significant statistical difference between the settings ( $p = .144$ ) (see Figure 5.13 below)

## Setting Preferences Performance vs PRS (n = 71)



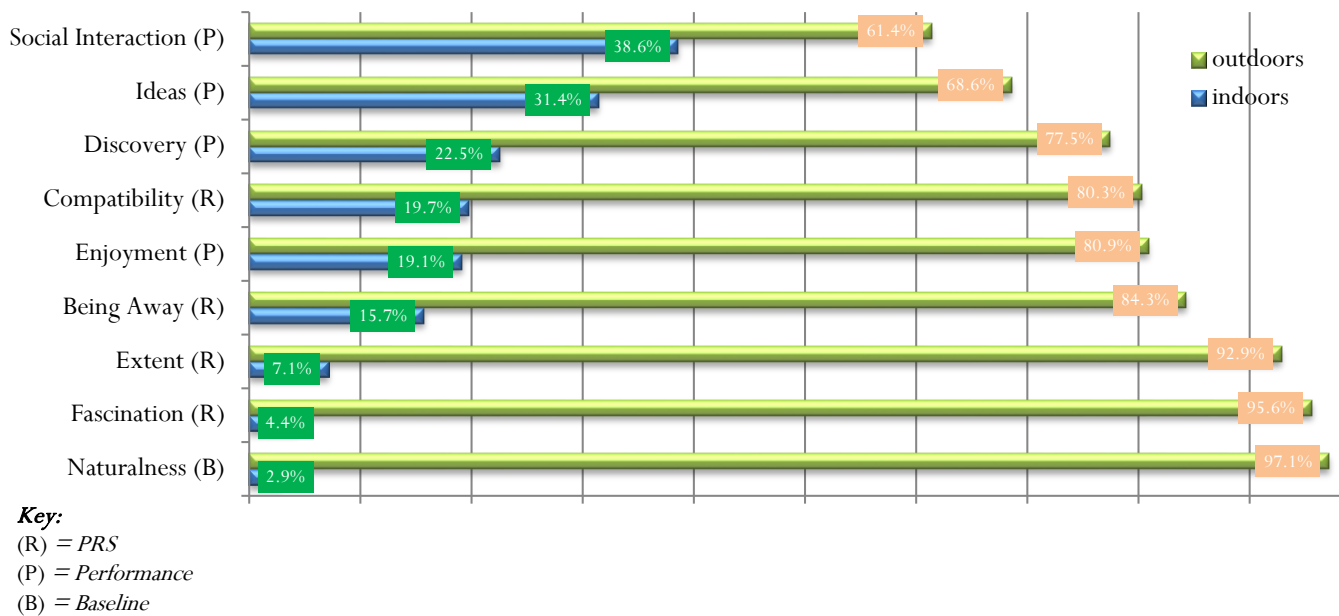
**Figure 5.11 Setting Preferences: Performance vs PRS Criteria**

## Task Ratings Performance vs PRS (n = 69)



**Figure 5.12 Task Ratings: Performance vs PRS Criteria**

## Setting Preferences Individual Criteria (n = 71)



**Figure 5.13 Setting Preferences: Indoor vs Outdoor % Split for Individual Criteria**

With the narrow exception of ‘compatibility’, setting preferences for every PRS criterion were stronger than for any performance criterion (see Figure 5.13 above). Particularly, ‘fascination’ and ‘extent’ returned negligible classroom preferences.

Respectively, the highest and lowest means for outdoors and indoors were for the baseline measure, ‘naturalness’, confirming the scale was understood and that children were cognisant of the natural surroundings.

#### *Experienced vs Early Years’*

In comparison to early years children (n = 57), the experienced group (n = 14) preferred the outdoor task setting overall, and for performance and PRS criteria (U = 198, p = .003; U = 238, p = .015; and U = 262, p = .018). They also preferred the classroom setting significantly less (U = 242, p = .019; U = 257, p = .031 and U = 291, p = .047). These findings were significant for analyses involving early years’ for the wild tasks only (n = 38) (U = 109, p = .003; U = 238, p = .021; and U = 139, p = .009).

For every performance criterion except social interaction, experienced children rated the classroom task significantly lower than early years, and significantly preferred the outdoor setting. Their strongest outdoor performance preference was for ‘discovery’ (U = 287, p = .025) and indoor dis-preference is for ‘ideas’ (U = 287, p ≤ .001). However, for wild setting only analyses, the only performance criterion for which they exhibited a significant outdoor setting preference is ‘ideas’ (U = 163, p = .020). Nevertheless, they also rated the outdoor task significantly *lower* for ‘ideas’, overall and in the wild settings only (both U=245, p=.008).

Regarding PRS criteria, the experienced group rated the classroom task lower than early years’ for ‘being away’ and ‘extent’ (U = 250, p = .024 and U = 255, p = .034), and preferred the outdoor setting for ‘compatibility’ (U = 301, p = .040), significant also for wild setting only analyses (U = 176, p = .038).

Respectively, Tables 5.5-5.7 above set out the means and significant findings for the Early Years vs Experienced analyses, showing setting preferences, task ratings, and wild settings only, respectively.



Criteria	Mean Setting Preferences					
	Indoors (SD)			Outdoors (SD)		
	E-Yrs (n=57)	Exp (n=14)	U stat; sig	E-Yrs (n=57)	Exp (n=14)	U stat; sig
<b>Performance</b>	1.26 (1.20)	0.50 (0.65)	U=257, p=.031	2.65 (1.20)	3.50 (0.65)	U=238, p=.015
Enjoyment	0.25 (0.43)	0.00 (0.00)		0.75 (0.43)	1.00 (0.00)	U=301, p=.040
Discovery	0.28 (0.45)	0.00 (0.00)		0.72 (0.45)	1.00 (0.00)	U=287, p=.025
Ideas	0.37 (0.49)	0.07 (0.27)		0.63 (0.49)	0.93 (0.27)	U=281, p=.033
Social Interaction	0.39 (0.49)	0.43 (0.51)		0.61 (0.49)	0.57 (0.51)	
<b>PRS</b>	0.60 (1.08)	0.07 (0.27)	U=291, p=.047	4.30 (1.12)	4.93 (0.27)	U=262, p=.018
Fascination	0.05 (0.23)	0.00 (0.00)		0.91 (0.29)	1.00 (0.00)	
Compatibility	0.25 (0.43)	0.00 (0.00)		0.75 (0.43)	1.00 (0.00)	U=301, p=.040
Being Away	0.18 (0.38)	0.07 (0.27)		0.81 (0.40)	0.93 (0.27)	
Extent	0.09 (0.29)	0.00 (0.00)		0.89 (0.31)	1.00 (0.00)	
Naturalness*	0.04 (0.19)	0.00 (0.00)		0.95 (0.23)	1.00 (0.00)	
<b>All Criteria</b>	1.86 (1.92)	0.57 (0.65)	U=242, p=.019	6.95 (1.87)	8.43 (0.65)	U=198, p=.003

\*Not included in PRS totals

**Table 5.5 Setting Preferences: Early Years vs Experienced**

Criteria	Mean Task Ratings					
	Indoors (SD)			Outdoors (SD)		
	E-Yrs (n=57)	Exp (n=14)	U stat; sig	E-Yrs (n=57)	Exp (n=14)	U stat; sig
<b>Performance</b>	14.29 (1.74)	12.64 (1.39)	U=181, p=.002	15.07 (1.30)	14.86 (0.95)	
Enjoyment	3.71 (0.60)	3.21 (0.80)	U=231, p=.005	3.89 (0.32)	3.93 (0.27)	
Discovery	3.35 (0.95)	2.86 (0.66)	U=236, p=.010	3.67 (0.64)	3.86 (0.36)	
Ideas	3.52 (0.67)	2.86 (0.36)	U=160, p≤.001	3.70 (0.63)	3.36 (0.50)	U=245, p=.008
Social Interaction	3.73 (0.59)	3.71 (0.47)		3.82 (0.43)	3.71 (0.61)	
<b>PRS</b>	14.40 (3.61)	12.79 (2.26)		18.46 (2.07)	19.21 (0.89)	
Fascination	2.89 (1.13)	2.57 (0.65)		3.80 (0.49)	3.71 (0.47)	
Compatibility	3.51 (0.83)	3.21 (0.89)		3.79 (0.53)	3.79 (0.42)	
Being Away	3.27 (1.04)	2.93 (0.48)	U=250, p=.024	3.75 (0.61)	3.71 (0.61)	
Extent	3.07 (1.06)	2.57 (0.65)	U=255, p=.034	3.84 (0.53)	4.00 (0.00)	
Naturalness*	2.00 (1.17)	1.50 (0.76)		3.68 (0.71)	4.00 (0.00)	
<b>All Criteria</b>	28.19 (5.59)	25.43 (3.50)	U=240, p=.021	33.00 (3.65)	34.07 (1.64)	

\*Not included in PRS totals

**Table 5.6 Task Ratings: Early Years vs Experienced**

Criteria	Wild Settings Only: Mean Setting Preferences					Wild Tasks Only: Mean Task Ratings			
	Indoors (SD)		Outdoors (SD)			Indoors (SD)		Outdoors (SD)	
	E-Yrs (n=38)	Exp (n=14)	E-Yrs (n=38)	Exp (n=14)	U stat; sig	E-Yrs (n=38)	Exp (n=14)	E-Yrs (n=38)	Exp (n=14)
<b>Performance</b>	1.07 (1.08)	0.50 (0.65)	2.82 (1.09)	3.50 (0.65)	U=238, p=.021	14.17 (1.72)	12.64 (1.39)	15.14 (1.36)	14.86 (0.95)
Enjoyment	0.24 (0.43)	0.00 (0.00)	0.76 (0.43)	1.00 (0.00)		3.58 (0.69)	3.21 (0.80)	3.92 (0.28)	3.93 (0.27)
Discovery	0.18 (0.39)	0.00 (0.00)	0.82 (0.39)	1.00 (0.00)		3.37 (0.94)	2.86 (0.66)	3.71 (0.57)	3.86 (0.36)
Ideas	0.32 (0.47)	0.07 (0.27)	0.68 (0.47)	0.93 (0.27)	U=163, p=.020	3.51 (0.56)	2.86 (0.36)	<b>**3.68 (0.71)</b>	<b>**3.36 (0.50)</b>
Social Interaction	0.34 (0.48)	0.43 (0.51)	0.66 (0.48)	0.57 (0.51)		3.73 (0.65)	3.71 (0.47)	3.84 (0.44)	3.71 (0.61)
<b>PRS</b>	0.68 (1.17)	0.07 (0.27)	4.18 (1.21)	4.93 (0.27)	U=139, p=.009	14.63 (3.96)	12.79 (2.26)	18.29 (2.27)	19.21 (0.89)
Fascination	0.08 (0.27)	0.00 (0.00)	0.89 (0.31)	1.00 (0.00)		2.92 (1.18)	2.57 (0.65)	3.81 (0.47)	3.71 (0.47)
Compatibility	0.18 (0.39)	0.00 (0.00)	0.74 (0.45)	1.00 (0.00)	U=176, p=.038	3.47 (0.83)	3.21 (0.89)	3.74 (0.60)	3.79 (0.42)
Being Away	0.26 (0.45)	0.07 (0.27)	0.79 (0.41)	0.93 (0.27)		3.27 (1.05)	2.93 (0.48)	3.70 (0.66)	3.71 (0.61)
Extent	0.11 (0.31)	0.00 (0.00)	0.87 (0.34)	1.00 (0.00)		3.14 (1.03)	2.57 (0.65)	3.81 (0.62)	4.00 (0.00)
Naturalness*	0.05 (0.23)	0.00 (0.00)	0.92 (0.27)	1.00 (0.00)		2.28 (1.26)	1.50 (0.76)	3.73 (0.69)	4.00 (0.00)
<b>All Criteria</b>	1.76 (1.84)	0.57 (0.65)	6.95 (1.87)	8.43 (0.65)	U=109, p=.003	28.05 (6.42)	25.43 (3.50)	32.63 (4.14)	34.07 (1.64)

\*Not included in PRS totals

\*\*U=245, p=.008

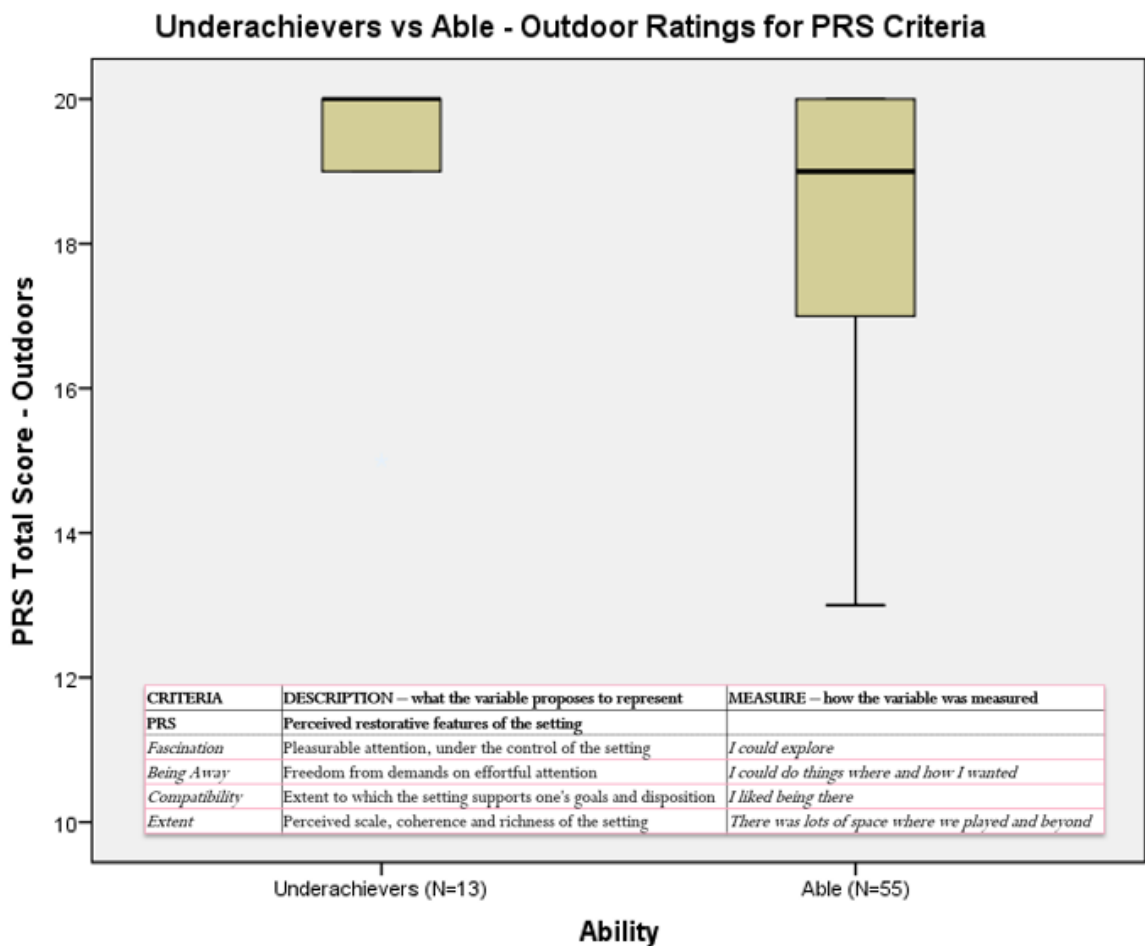
**Table 5.7 Early Years vs Experienced, ‘Wild’ Tasks Only**

### *Underachievers*

Underachievers (n=13) returned a higher overall PRS rating for the outdoor task than their peers (n=55), a finding significant across the whole study (U = 141, p = .033 – see Figure 5.14 overleaf) and within the urban wood tasks only (n=7 vs n=22), U = 39, p = .042).

### *Boys vs Girls*

The only other statistically significant difference arising from the analyses was a higher outdoor task rating for ‘compatibility’ for boys (n=35) than girls (n=36), U = 473, p = .007. The difference was also significant for early years’ only analyses, (n=29 vs 28, respectively, U = 317, p = .031), but not for those involving just the experienced group.



**Figure 5.14: PRS Task Ratings: Boxplot of Underachievers vs Peers, Outdoors**

### ***5.3.2 Setting Preferences: Conceptual Underpinnings***

To explore possible data structures underpinning children’s setting preferences, a Principal Components Analysis (PCA) was conducted, employing a Varimax rotational procedure. Setting preferences were chosen over task ratings because they offered a decisive measurement of environmental inclinations.

Criteria	Setting Preference Means (SD)	
	All Children (n=71)	Early Years (n=57)
Enjoyment (P)	1.80 (0.40)	1.75 (0.43)
Ideas (P)	1.69 (0.47)	1.63 (0.49)
Discovery (P)	1.77 (0.42)	1.72 (0.45)
Fascination (R)	1.96 (0.20)	1.95 (0.23)
Compatibility (R)	1.80 (0.40)	1.75 (0.43)
Being Away (R)	1.84 (0.36)	1.82 (0.38)
Extent (R)	1.93 (0.26)	1.91 (0.29)

*Key: (P) Performance; (R) PRS*

**Table 5.8 Principal Components Analyses: Descriptive Statistics**

Criteria	Components: All Children (n=71)		Components: Early Years (n=57)	
	Autonomy	Creative Compatibility	Autonomy	Creative Compatibility
Fascination (R)	.924		.924	
Extent (R)	.897		.900	
Being Away (R)	.616		.622	
Compatibility		.675		.676
Ideas (P)		.630		.603
Discovery (P)		.628		.583
Enjoyment (P)				

*Key: (P) Performance; (R) PRS*

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.*

*Rotation converged in 3 iterations.*

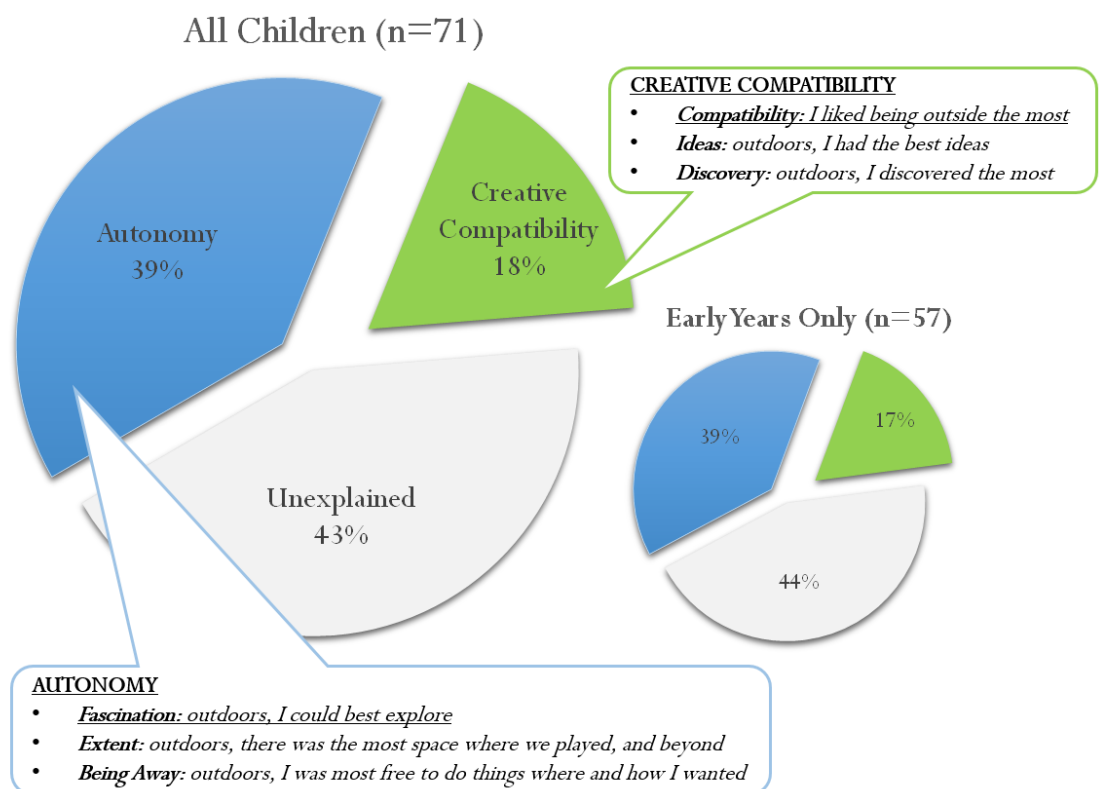
**Table 5.9 Principal Components Analyses: Rotated Component Matrices**

Table 5.8 above shows the descriptive statistics for the seven variables entered. Two setting preferences were excluded because they seemed to distort analyses. The first was the baseline measure ‘naturalness’, because it had received minimum and maximum scores for the indoor and outdoor settings, respectively.

The second omission was ‘social interaction’, the sole criterion preferred less by experienced children in the wild setting than early years’. While the difference was

non-significant, when entered into the PCA, ‘social interaction’ seemed to catalyse a component which represented the experienced group, thus concealing a more general conceptual model implied by the analyses below.

Table 5.9 details the rotational matrices for two PCA analyses. To the left, is the analysis involving all children (n=71), and to the right, the early years group only (n=57). A review of initial factor loadings suggested the approach represented a proper solution. Both analyses converged in three iterations, no warning was given that the results were non-positive definite and no communalities exceeded 1.0. The requirements of Bartlett’s test of sphericity (.664 and .642, respectively) and the KMO measure of sampling adequacy (both  $p \leq .001$ ) were also both met.



**Figure 5.15 Principal Components Analyses: Percentage of Variance Explained**

The components extracted did appear to group setting preferences in a theoretically understandable way, albeit with a relatively low cumulative variance of around 57%. Percentages of variance explained for the two analyses are represented in the two pie charts in Figure 5.15.

*“When we did the task, where...”*

CRITERIA	DESCRIPTION – what the variable proposes to represent
<i>Fascination</i>	Pleasurable attention, under the control of the setting
<i>Extent</i>	Perceived scale, coherence and richness of the setting
<i>Being Away</i>	Freedom from demands on effortful attention

*...could I best explore?*

*...was there the most space where we played and beyond?*

*...could I most do things where and how I wanted?*

**Figure 5.16 PCA Analyses: Component 1 - ‘Autonomy’**

The principal component, accounting for 39% of total variance, is termed ‘autonomy’, shown in Figure 5.16 above. Comprised of three PRS criteria, ‘autonomy’s’ strongest member is ‘fascination’, closely followed by ‘extent’. The weaker third member is ‘being away’. Other than ‘naturalness’, these were the three strongest outdoor setting preferences for children and teachers. The component is named ‘autonomy’ because the specific preference statements seem underpinned by an idea of personal freedom which combines movement, space and activity.

CRITERIA	DESCRIPTION – what the variable proposes to represent
<i>Compatibility (R)</i>	Extent to which the setting supports one's goals and disposition
<i>Ideas (P)</i>	Individual cognitive activity during the task
<i>Discovery (P)</i>	Novel input from task setting

*“When we did the task, where...”*

*...did I like being most?*

*...did I have the best ideas?*

*...did I discover the most?*

**Figure 5.17 PCA Analyses: Component 2 - ‘Creative Compatibility’**

The second component, accounting for around a fifth of variance, is named ‘creative compatibility’, shown in Figure 5.17 above. ‘Compatibility’ is its strongest member. The other two are ‘ideas’ and ‘discovery’. These have roughly equal coefficients for the overall analysis, but are lower for early years only and exhibit a weaker membership for ‘discovery’. The concept has been termed ‘creative compatibility’ because the

preference statements together conjure a picture of a task environment where a child feels comfortable, resourceful and creatively stimulated.

### 5.3.3 Setting Preferences: Association with Natural Richness

Logistic regression analyses found ‘creative compatibility’ to be a significant predictor of whether an outdoor setting was a ‘playground’ (RI=2) or ‘wild’ (RI=4) for all children, and the early years group only,  $\chi^2(1) = 12.744$ ,  $p = .015$  and  $\chi^2(1) = 12.744$ ,  $p = .041$ . For all children, Nagelkerke’s  $R^2$  revealed that around 12% of the variance in setting richness was linked to ‘creative compatibility’. The component was almost twice as likely to indicate a wild task setting over a playground (EXP(B) = 1.891) and explained three quarters of all cases. These statistics were marginally lower for the early years analysis, and those for both appear in Table 5.10 below.

*Models:	Variables in the Equation						95% C.I. for EXP(B)		Model					
	B	S.E.	Wald	df	Sig.	Exp (B)	Lower	Upper	H & L	Nagel R <sup>2</sup>	Cases Predicted	Chi-Sq	df	Sig.
<b>All Children (n=71)</b>														
Creative Compatibility	.637	.270	5.553	1	p=.018	1.891	1.113	3.212	p=.850	.116	74.6%	5.909	1	p=.015
Constant	1.082	.286	14.302	1	p<.001	2.950								
<b>Early Years (**n=55)</b>														
Creative Compatibility	.579	.293	3.909	1	p=.048	1.784	1.005	3.166	p=.838	.103	70.9%	4.173	1	p=.041
Constant	.982	.323	9.246	1	p=.002	2.670								

\*Dependent variable = outdoor task setting, either 'playground' (RI=2) or 'wild' woodland (RI=4)

\*\*2 outliers from the 'playground' sample, highlighted in the analysis by SPSS, were removed, hence slightly smaller size

**Table 5.10 Logistic Regression: ‘Creative Compatibility’ and Natural Richness**

While analyses suggested a trend level association between ‘autonomy’ and natural richness, this was not found significant for all children ( $p = .083$ ), early years only ( $p = .092$ ), or for a model which combined ‘autonomy’ and ‘creative compatibility’.

*Models:	Variables in the Equation						95% C.I.for EXP(B)		Model					
	B	S.E.	Wald	df	Sig.	Exp (B)	Lower	Upper	**H & L	Nagel R <sup>2</sup>	Cases Predicted	Chi-Sq	df	Sig.
<b>All Children (n=71)</b>														
Discovery	-1.755	.613	8.191	1	p=.004	.173	.052	.575		.162	76.1%	8.397	1	p=.004
Constant	1.504	.350	18.509	1	p<.001	4.500								
<b>Early Years (n=57)</b>														
Discovery	-1.383	.621	4.950	1	p=.026	.251	.074	.848		.118	70.2%	5.079	1	p=.024
Constant	1.131	.364	9.679	1	p=.002	3.100								

\*Dependent variable = outdoor task setting, either 'playground' (RI=2) or 'wild' woodland (RI=4)

\*\*Hosmer & Lemeshow goodness-of-fit tests were blank for "Discovery", which may mean sample adequacy requirements weren't met for these analyses

**Table 5.11 Logistic Regression: 'Discovery' and Natural Richness**

Setting preference totals for performance criteria were also significantly stronger for the wild setting over the playground for all children,  $U = 328$ ,  $p = .038$ . Of the individual criteria, only 'discovery' predicted whether a response was in a playground or a wild setting, a finding significant for all children and early years only,  $\chi^2(1) = 5.079$ ,  $p = .024$  and  $\chi^2(1) = 8.397$ ,  $p = .004$ , respectively. Outcome statistics from both these analyses are set out in Table 5.11 above.

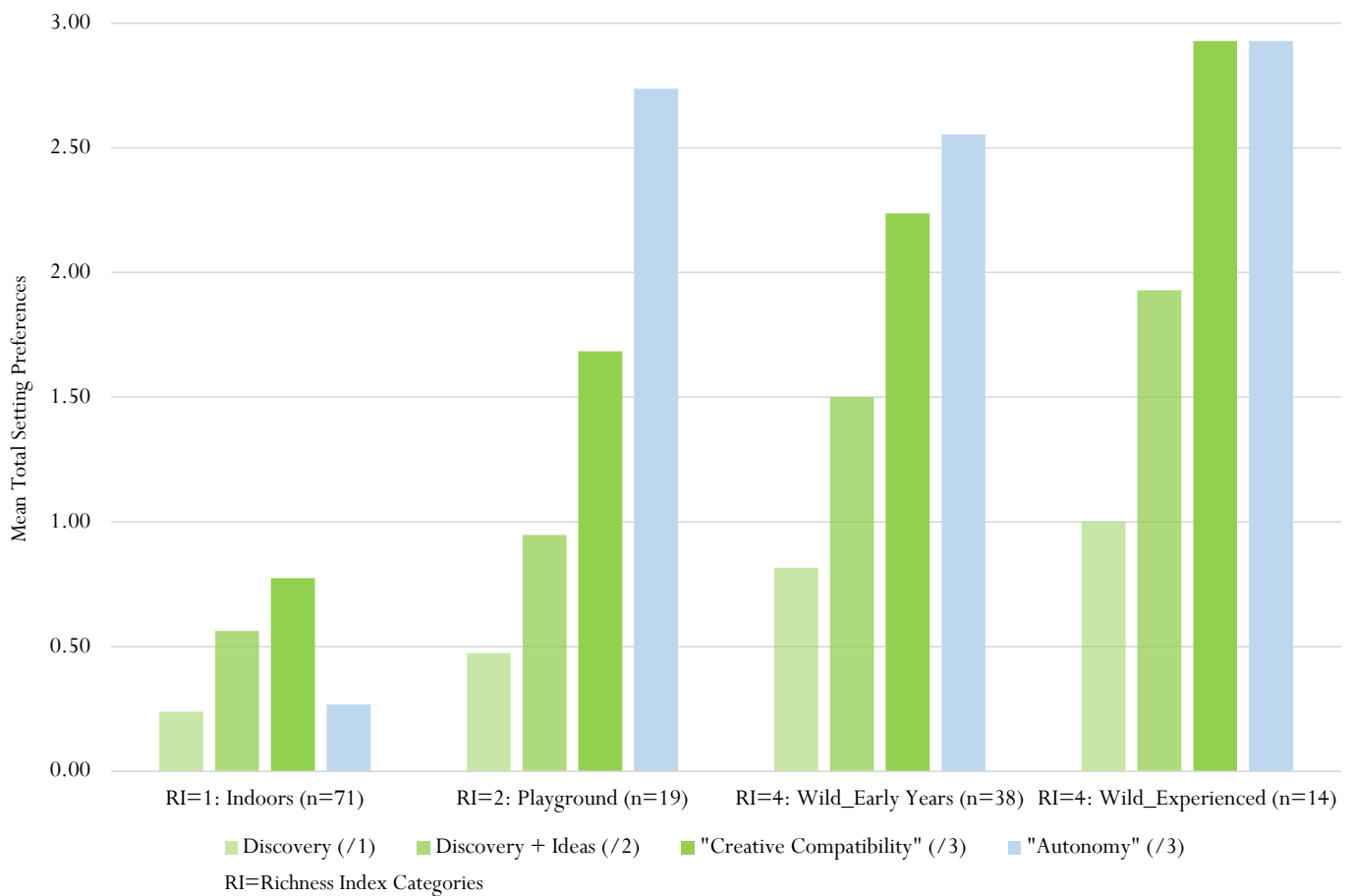
Mann-Whitney U tests provide further empirical support for the association between RI score and 'discovery'. These revealed a preference for 'discovery' at every categorical step of the RI: in the playground (n=19) over the classroom (n=71) ( $U = 29$ ,  $p \leq .001$ ); and for early years in the wild setting (n=38) over the playground (n = 19) ( $U = 242$ ,  $p = .014$ ). They are also at trend levels for experienced over early years in the wild setting ( $U = 217$ ,  $p = .087$ ). The same pattern is revealed by a factor which combines the setting preference means for 'discovery' and 'ideas', which returns significant differences at every step of the RI for early years, and for experienced over early years in the wild setting. 'Ideas' alone also exhibits this graduated trend against RI and experience, but the only significant difference is for experienced over early years in the wild setting ( $U = 163$ ,  $p = .020$ ).

The bar graph in Figure 5.18 below summarises in green the strongest associations between preference criteria and RI score. This shows the means for 'discovery', 'discovery' and 'ideas', and 'creative compatibility' (i.e. 'discovery', 'ideas', and



‘compatibility’) for study settings in order of natural richness from left to right, and including the experienced group as a separate wild setting group.

The blue bars show the same for ‘autonomy’, that is a combination of preference means for ‘fascination’, ‘extent’ and ‘being away’ for each RI category. Although it exhibits no significant difference between playground and wild settings, or between early years and experienced groups, ‘autonomy’ is an unequivocal indicator of indoors versus outdoor setting preferences.

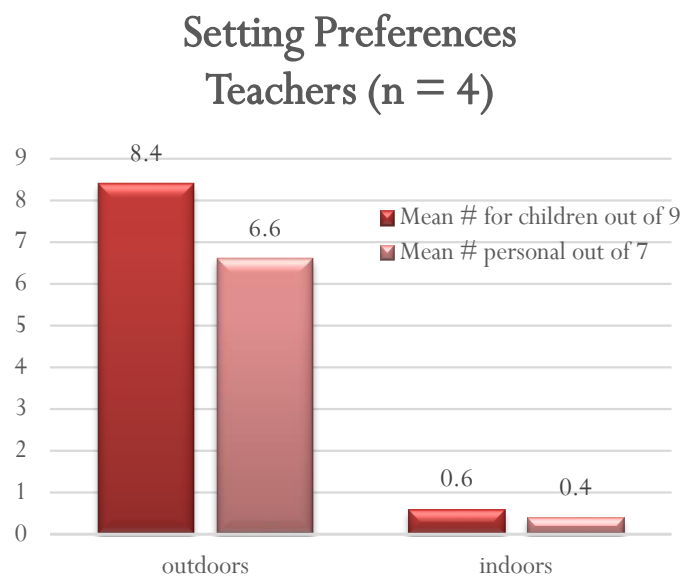


**Figure 5.18 Graph of Natural Richness and Experience against Preference Means**

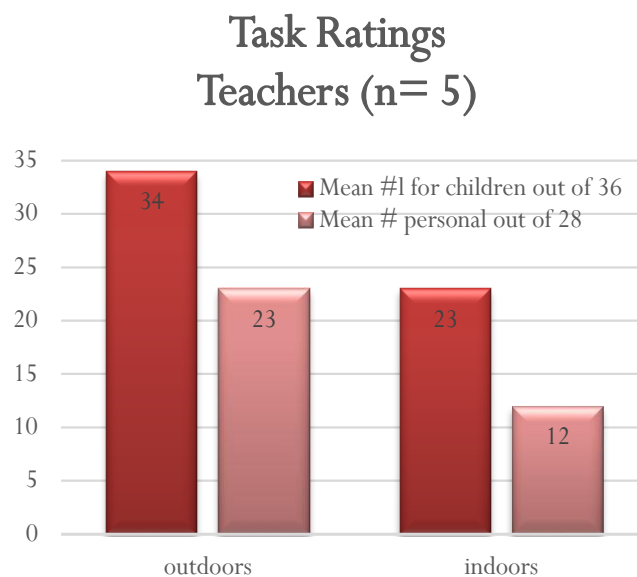
### 5.3.4 Teachers' Setting Preferences and Task Ratings

*Did teachers prefer the outdoor setting and task?*

All four teachers regarded the outdoors to be the best task setting for the children,  $Z = -2.060$ ,  $p = .039$ , and personally preferred it over the classroom,  $Z = -2.070$ ,  $p = .038$  (see Figure 5.19 below). They also rated the outdoor task higher than the indoor for learning benefits and for themselves personally,  $Z = -2.023$ ,  $p = .043$  and  $Z = -2.041$ ,  $p = .041$  (see Figure 5.10 below).



**Figure 5.19 Setting Preferences: Graph of Indoor vs Outdoor Means, Teachers**



**Figure 5.20 Task Ratings: Graph of Indoor vs Outdoor Means, Teachers**

Criteria	Mean Setting Preferences: For Children			Mean Task Ratings: For Children		
	Indoors (SD)	Outdoors (SD)	Z stat; sig	Indoors (SD)	Outdoors (SD)	Z stat; sig
<b>Performance</b>	0.60 (0.89)	3.40 (0.89)	<i>-1.890, p=.059</i>	12.40 (1.67)	15.20 (1.30)	<i>-1.841, p=.066</i>
Enjoyment	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	3.60 (0.55)	3.80 (0.45)	<i>-1.890, p=.059</i>
Discovery	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	3.00 (0.71)	4.00 (0.00)	
Ideas	0.20 (0.45)	0.80 (0.45)		3.20 (0.45)	3.80 (0.45)	
Social Interaction	0.20 (0.45)	0.80 (0.45)		2.69 (0.90)	3.60 (0.55)	
<b>PRS</b>	0.00 (0.00)	5.00 (0.00)	-2.236, p=.025	10.60 (1.95)	18.80 (2.68)	-2.032, p=.042
Fascination	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	2.60 (0.55)	4.00 (0.00)	-2.070, p=.038
Compatibility	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	3.00 (0.71)	4.00 (0.00)	<i>-1.890, p=.059</i>
Being Away	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	3.20 (0.84)	4.00 (0.00)	
Extent	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	1.40 (0.89)	4.00 (0.00)	-2.070, p=.038
Naturalness*	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	1.00 (0.00)	3.60 (0.89)	-2.121, p=.034
<b>All Criteria</b>	0.60 (0.89)	8.40 (0.89)	-2.060, p=.039	23.00 (1.87)	34.00 (3.08)	-2.023, p=.043

\*Not included in PRS totals

*Italics indicate trend level results*

**Table 5.12 Preferences and Ratings: Teacher's Assessments for Task / Children**

Criteria	Mean Setting Preferences: Personal			Mean Task Ratings: Personal		
	Indoors (SD)	Outdoors (SD)	Z stat; sig	Indoors (SD)	Outdoors (SD)	Z stat; sig
<b>Performance</b>	0.40 (0.55)	1.60 (0.55)		6.67 (0.58)	8.00 (0.00)	
Enjoyment	0.20 (0.45)	0.80 (0.45)		2.80 (0.45)	3.40 (1.34)	
Social Interaction	0.00 (0.00)	1.00 (0.00)	-2.236, p=.025	3.60 (0.55)	4.00 (0.00)	
<b>PRS</b>	0.00 (0.00)	5.00 (0.00)	-2.236, p=.025	8.00 (2.12)	18.20 (1.79)	-2.023, p=.043
Fascination	0.00 (0.00)	5.00 (0.00)	-2.236, p=.025	1.69 (0.55)	4.00 (0.00)	-2.070, p=.038
Compatibility	0.00 (0.00)	5.00 (0.00)	-2.236, p=.025	3.00 (1.00)	3.40 (1.34)	
Being Away	0.00 (0.00)	5.00 (0.00)	-2.236, p=.025	1.00 (0.00)	3.20 (1.30)	<i>-1.890, p=.059</i>
Extent	0.00 (0.00)	5.00 (0.00)	-2.236, p=.025	1.40 (0.89)	4.00 (0.00)	-2.070, p=.038
Naturalness*	0.00 (0.00)	5.00 (0.00)	-2.236, p=.025	1.00 (0.00)	3.60 (0.89)	-2.121, p=.034
<b>All Criteria</b>	0.40 (0.55)	6.60 (0.55)	-2.070, p=.038	12.00 (5.66)	23.00 (4.90)	-2.041, p=.041

\*Not included in PRS totals

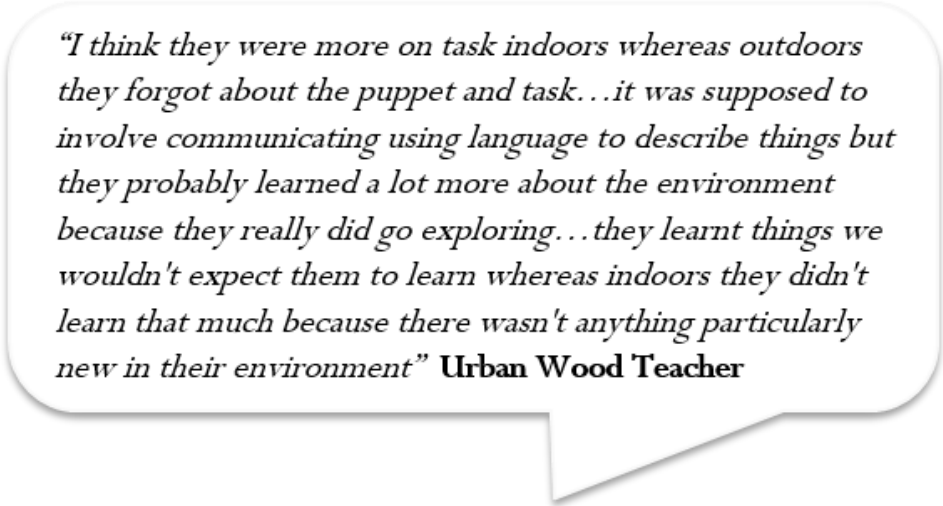
\*\*For teacher's personal questions no responses were required for 'discovery' and 'ideas' criteria

*Italics indicate trend level results*

**Table 5.13 Preferences and Ratings: Teacher's Personal Assessments**

Teachers' setting preferences and task rating statistics from their objective and personal assessments are set out above in Tables 5.12 and 5.13, respectively. In both

assessments, they unanimously preferred the outdoor setting for all PRS criteria, rating the outdoors task significantly higher for ‘fascination’ and ‘extent’ (both  $Z = -2.070$ ,  $p=.038$ ). For performance criteria, there are also unanimous setting preferences for ‘discovery’ and ‘enjoyment’ for the children, and for their own personal ‘social interaction’ with the class in comparison to the classroom, (all  $U = -2.236$ ,  $p=.025$ ).



*“I think they were more on task indoors whereas outdoors they forgot about the puppet and task...it was supposed to involve communicating using language to describe things but they probably learned a lot more about the environment because they really did go exploring...they learnt things we wouldn't expect them to learn whereas indoors they didn't learn that much because there wasn't anything particularly new in their environment”* **Urban Wood Teacher**

**Figure 5.21 Urban Wood Teacher reflects on her ‘Puppet Tour’ Assessment**

All but one of the performance criteria dis-preferences for the outdoor setting pertained to the urban wood teacher’s assessment of ‘Puppet Tour’. During her focused interview she was probed on this. The answer she gave is in Figure 5.11, and suggests her preferences were not because she thought ‘Puppet Tour’ outdoors entailed the weaker impacts, but rather that performance was less directed towards the specific task objectives than in the classroom. She states:

*“(Outdoors) they learned things we wouldn't expect them to learn, whereas indoors they didn't learn that much because there wasn't anything particularly new in their environment.”*

While it is acknowledged that the teachers’ small group size constitutes a weak basis for statistical comparison, Table 5.14 overleaf sets out the results of Mann-Whitney U tests which compared their data with the children’s. These found that teachers ( $n=4$ ) rated the classroom task significantly lower than the children ( $n=71$ ) for PRS criteria overall

( $U = 22, p = .001$ ), for ‘fascination’ and ‘extent’, and for the performance criterion ‘enjoyment’ ( $U = 61, p = .013$ ;  $U = 47, p = .004$ , and  $U = 53, p = .002$ , respectively).

Criteria	Mean Setting Preferences				Mean Task Ratings				
	Indoors (SD)		Outdoors (SD)		Indoors (SD)			Outdoors (SD)	
	Teachers	Children	Teachers	Children	Teachers	Children	U stat; sig	Teachers	Children
<b>Performance</b>	0.40 (0.55)	1.10 (1.148)	1.60 (0.55)	2.83 (1.159)	6.67 (0.58)	13.93 (1.777)		8.00 (0.00)	15.03 (1.236)
Enjoyment	0.20 (0.45)	0.20 (0.401)	0.80 (0.45)	0.80 (0.401)	2.80 (0.45)	3.61 (0.669)	U=53, p=.002	3.40 (1.34)	3.90 (0.304)
Discovery	N/A	0.23 (0.421)	N/A	0.77 (0.421)	N/A	3.25 (0.921)	N/A	N/A	3.70 (0.595)
Ideas	N/A	0.31 (0.466)	N/A	0.69 (0.466)	N/A	3.39 (0.666)	N/A	N/A	3.63 (0.618)
S-Interaction	0.00 (0.00)	0.37 (0.489)	1.00 (0.00)	0.62 (0.489)	3.60 (0.55)	3.78 (0.598)		4.00 (0.00)	3.80 (0.469)
<b>PRS</b>	0.00 (0.00)	0.46 (0.939)	5.00 (0.00)	3.46 (0.983)	8.00 (2.12)	12.24 (2.811)	U=22, p=.001	18.20 (1.79)	14.92 (1.771)
Fascination	0.00 (0.00)	0.04 (0.203)	5.00 (0.00)	0.93 (0.258)	1.69 (0.55)	2.82 (1.050)	U=61, p=.013	4.00 (0.00)	3.78 (0.484)
Compatibility	0.00 (0.00)	0.20 (0.401)	5.00 (0.00)	0.80 (0.401)	3.00 (1.00)	3.45 (0.842)		3.40 (1.34)	3.79 (0.505)
Being Away	0.00 (0.00)	0.15 (0.364)	5.00 (0.00)	0.83 (0.377)	1.00 (0.00)	3.20 (0.957)		3.20 (1.30)	3.74 (0.606)
Extent	0.00 (0.00)	0.07 (0.258)	5.00 (0.00)	0.92 (0.280)	1.40 (0.89)	2.97 (1.007)	U=47, p=.004	4.00 (0.00)	3.87 (0.479)
Naturalness*	0.00 (0.00)	0.03 (0.167)	5.00 (0.00)	0.96 (0.203)	1.00 (0.00)	1.90 (1.113)		3.60 (0.89)	3.74 (0.652)
<b>All Criteria</b>	0.40 (0.55)	1.61 (1.816)	6.60 (0.55)	7.24 (1.801)	12.00 (5.66)	27.65 (5.337)		23.00 (4.90)	33.211 (3.368)

\*Not included in PRS totals

\*\*For teacher's personal questions no responses were required for 'discovery' and 'ideas' criteria, hence N/As and lower means

**Table 5.14 Preferences and Ratings: Teachers (Personal) vs Children**

## 5.4 Impacts of Variables other than Setting and Experience

The factor other than setting which seems most likely to have influenced early years’ findings is novelty, this being the first outdoor learning experience for the majority of the sample. However, two findings undermine an argument based on the novelty factor. Firstly, the strongest outdoor statistics are associated with the experienced group, the children for whom outdoor learning was least novel. Secondly, there are no statistical differences the rural wood early years’, who had 6 (n=5) or 18 (n=4) months outdoor learning exposure, and the urban wood early years’ for whom it was a wholly novel experience. These two findings would imply other between-setting findings were overriding any novelty effects.

The consistency of wild setting statistics for the early year' group across two different schools and settings, and three task scenarios, would also suggest the extraneous factors highlighted at the start of the chapter, did not exert a strong influence on related findings. Differences in these factors between the wild setting tasks include between-setting activity time, and the requirement for workgroups or end presentations.

There is no apparent statistical effect of setting order within or between any of the experiments, despite components being up to 3 months apart ('Build a Den'). The consistency of findings within-setting for 'Build a Den', and between wild settings for 'Puppet Tour' and 'Make a Toy', would imply ad hoc adult observers had minimal impact.

The two urban wood tasks presented the study's most viable option for testing task open-endedness, and no significant differences were found between them. The comparison was chosen because these tasks were matched for teacher, school and settings, and 'Puppet Tour' scored marginally higher than 'Make a Toy' both indoors and out. Moreover, 'Puppet Tour' entailed the classroom condition second, so stronger outdoor impacts couldn't be attributed to recency effects.

Nevertheless, task open-endedness may have been a factor in differences between the playground and wild setting tasks. Although 'Build a Den' outdoors featured prescribed outcomes and workgroups, which in the context of the wild setting tasks seems to have had negligible effect, it was still the only one where materials were also prescribed.

## **5.5 Summary of Task Recollections and Preferences**

This chapter set the findings of Stage 2 of data gathering and analysis, which compared the task recollections, task ratings and setting preferences between indoor and outdoor settings as recorded using a follow-up questionnaire. Stage 2 aimed to resolve the thesis's third objective and hypotheses by answering three research questions:

*1. Did the children and teachers better recall the outdoor task over the indoor?(RH1).*  
Outdoor tasks were more readily and richly recalled than the classroom. The urban

wood teacher's wild setting recollections seemed more experiential in character outdoors, whereas indoors they tended to be general objective observations.

*2. Did children and teachers prefer the task and setting for criteria related to performance? (RH1).* Children and teachers preferred the outdoor task and setting over the indoor. Results were highly significant overall, and for performance and PRS criteria, where the effect was stronger for the latter. Of all tests involving the nine measurement criteria, only the outdoor task rating for 'social interaction' was not significantly stronger than the classroom.

The experienced group returned consistently stronger outdoor preferences for setting and task, and indoor dis-preferences than the early years'. For PRS criteria, underachievers rated the outdoor task higher than their peers, and the teachers rated the indoor task lower than the children. Boys gave a higher outdoor task rating than girls for 'compatibility' ("*where was I most free to do things where and how I wanted?*").

Analyses suggest novelty and other extraneous variables had little overall impact on findings, compared with the effects of setting and experience. However the prescribed materials for 'Build a Den' may be a factor in differences between playground and wild setting.

*3. Is there any association between these data and natural richness? (RH2).* Children's stronger recollections in the wild setting over the playground imply a possible association with natural richness. Underachievers also remembered more than their peers about the wild settings, significantly so for urban wood tasks.

A PCA analysis revealed a two-component structure underlying children's setting preferences. The dominant component, 'autonomy', seems underpinned by increased perceived self-agency outdoors. The second, 'creative compatibility', implies greater congruence between task-related cognition and the outdoor settings. Logistic regression analyses revealed an association between 'creative compatibility' and natural richness, where the 'discovery' and 'ideas' criteria are strongly implicated.

## CHAPTER 6: ANALYSES OF THE TEACHERS' PERSPECTIVE

### 6.0 Introduction

This chapter details findings related to focused interviews with the four participating teachers, all of whom had designed and supervised both components of at least one task. The two rural wood teachers had extensive experience teaching outdoors, and the urban wood and playground teachers had none. The interviews took place 6-7 months after the tasks, and were the main focus of the third and final stage of the research.

Like Stage 2, Stage 3 had the goal of establishing a stronger base for cross-task generalisation. However, these interviews were not motivated by specific research questions, but rather the desire for a richer, more complete dataset, and an integrative context for prior findings. Specifically, they sought *to capture a whole task 'expert' perspective from the four participating teachers, and then use common themes to construct a general model of cognitively-relevant features and dynamics.*

This chapter first outlines the approach to the interviews and data, before setting out the findings arising from the two stages of the analyses. The first details the outcomes of the thematic analysis in order of theoretical framework category –i.e. the qualitative variables (QVs)– and ends on a summary of these. The second describes the results of the systems-based causal loop analysis. These entail three ‘closed loops’, or dynamics of interest involving the QVs, which seem implied by the data. The chapter ends on the total causal loop diagram (i.e. the ‘general model’) and an overview of main findings.

#### *Procedural Overview*

Each focused interview took around 45 minutes. All entailed the same 11 question guide, informed by the categories of the theoretical framework (see Figure 3.9). They were conducted one-to-one in quiet classrooms during the teachers’ lunch hours, immediately after their questionnaire.



Each began with a brief introduction, where I told the interviewee my overarching aim for our interview was to understand their perspective on the tasks. Additionally, I advised they should feel free to request clarification on any ambiguous questions, or to refuse to answer a question, or end the interview, if it caused them to feel uncomfortable in any way. While the order and wordings of the main questions were consistent for all, the time spent on each varied between individual interviewees according to what seemed personally vivid or important to them. Interviews were recorded using a discreetly-placed Flip™ Camera and later transcribed within Nvivo™.

There were three stages to the analysis. In the first, utterances were provisionally coded within Nvivo™ according to the framework category for which they had most relevance. In the second, a thematic analysis was conducted of each framework category to identify its specific *axes of difference between indoors and outdoors*, or QVs. Those QVs identified are summarised in Figure 6.1 and are detailed in order of category in the sections that follow. The last stage sought to build a general model of task behaviour, through the construction of a causal loop diagram (CLD) using the QVs. A CLD is a diagrammatic tool for thinking about complex situations, where features of a situation are expressed as noun variables linked by arrows to represent hypothetical positive and negative relations between them, and reinforcing or balancing dynamics,

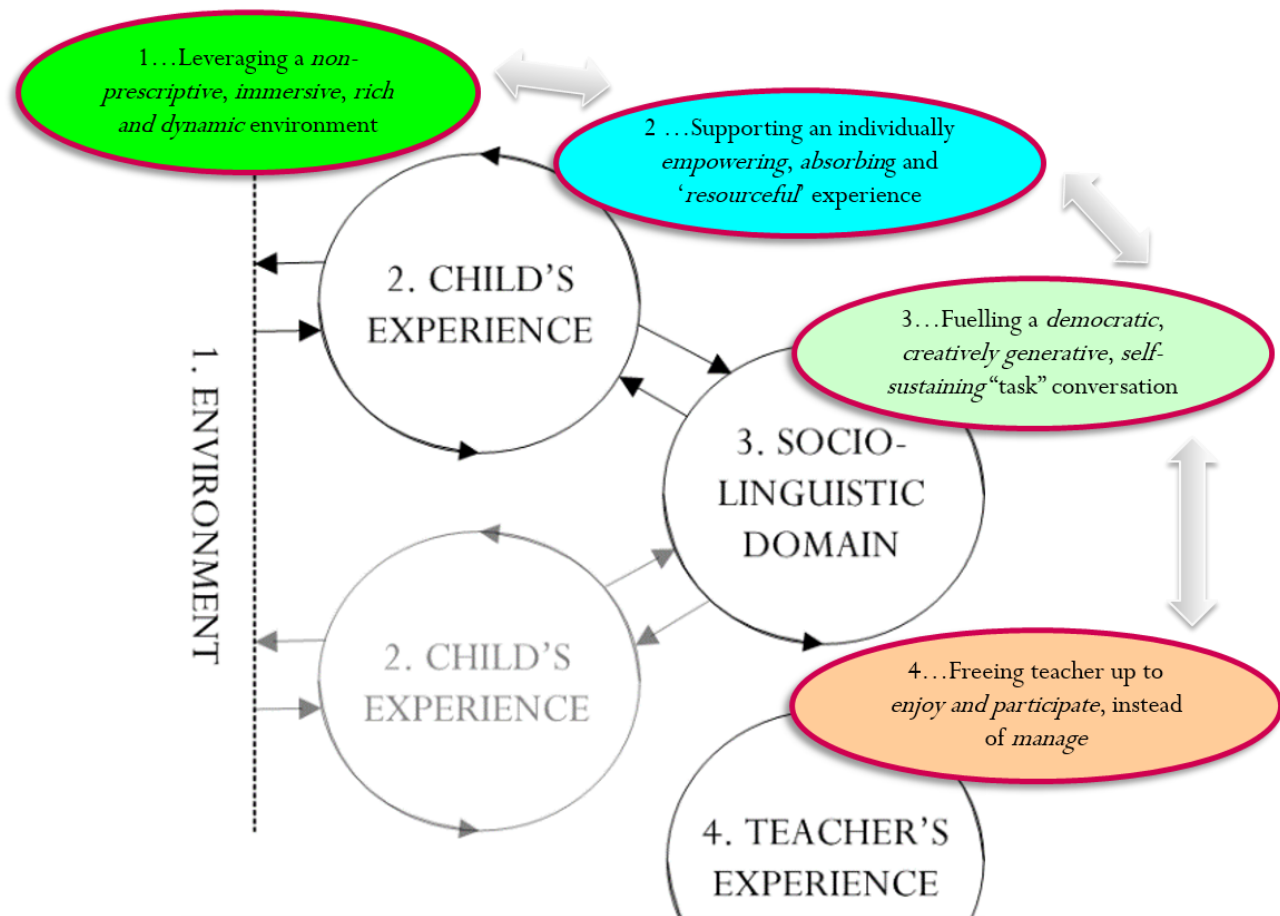
#### *Other Data informing the Thematic Analysis*

Although the thematic analysis is founded on interview data, it also draws on two additional sources. The first is transcripts of the longest conversations between the urban wood teacher and children –two individual, and one group– during the ‘Puppet Tour’ experimental components. These bolster empirical support for differences in teacher-child relationships between indoor and wild settings, and related performance implications. ‘Puppet Tour’ is used because it was the only wild setting experiment where a teacher carried a recording device for both components.

The second source is some supplementary responses from the rural wood children. During their questionnaires, when the stronger outdoor preference of the experienced group became apparent, a spontaneous decision was made to ask the remaining interviewees (n=8) an additional open question:

“So imagine I'm a teacher who doesn't take children for lessons down the woods. Tell me why I should? What will they learn there? Why is it a good place to learn?”

As their responses seem strongly supportive of some QVs, they are included for additional support. There follows a description of all QVs and their empirical support, by each theoretical framework category in turn.



Framework Domains	Qualitative Variables	Description: <i>the level...</i>
1. Environment	<i>Prescriptiveness</i>	...to which setting promotes or inhibits creative options
	<i>Dynamic Novelty</i>	...of inherent continuous environmental novelty
	<i>Immersiveness</i>	...to which the setting supports an immersive task experience
2. Child's Experience	<i>Empowerment</i>	...of perceived agency and personal confidence during the task
	<i>Resourcefulness</i>	...of ideas available to individual children in fulfilling the task
	<i>Absorption</i>	...of individual task motivation, engagement and persistence
3. Socio-Linguistic	<i>Democracy</i>	...of general, inclusive task collaboration
	<i>Generative Conversation</i>	...of new ideas generation through conversation and co-creation
	<i>Self-sustenance</i>	...of sustained task-directed attention
4. Teacher's Experience	<i>Enjoyment</i>	...of personal enjoyment, relaxation and sense of freedom
	<i>Management</i>	...task management burden

Figure 6.1 Summary of Qualitative Variables with Theoretical Framework

## 6.2 Findings: Environment

The thematic analysis identified three QVs pertaining to setting qualities and affordances which appear relevant to children's performance: *degree of prescriptiveness, dynamic novelty, and immersiveness.*

### 6.2.1 Prescriptiveness

All teachers alluded to the capacity of outdoor affordances to promote creative possibilities, where indoor affordances seemed inhibitory by comparison.

*"In the classroom we gave them the resources, particularly for Invent a Toy. We said this is what you can use, so we'd kind of constrained it before we'd even started, whereas outdoors it was completely up to them the space they use, the size of things they used, all that kind of stuff... yeah I think that kind of determines why it's different behaviour, and what they do"* **Urban Wood Teacher**

*"It sounds really daft but it feels much more prescriptive (in the classroom) even though I'm asking them to do the same thing, and I think always in my head it's about the confines of the walls as opposed to we're outdoors and there is space"* **Rural Wood Teacher 2**

In the example quotes, two teachers refer to how the *prescriptiveness* of space and materials may have inhibited creativity in the classroom. The urban wood teacher perceives the 'junk' used for 'Make a Toy' constrained the children's options "*before we'd even started*". On the other hand, she views the "*space*" and "*size of things*" in the wild setting as promoting creative freedom, and thinks this may be a key determinant of the differences in outdoor behaviour.

The rural wood teacher suggests she perceives the "*confines of the (classroom) walls*" as prescriptive in both a sense which is both physical, and possibly psychological or metaphorical. By contrast, she implies "*there is space*" in the wild setting to move and think creatively.

*“The toys in the classroom slightly inhibited their need to use their imagination. Because the material was already there they didn't have to come up with an alternative in any way. Outside they had to use their imagination to come up with something to represent the material object, so I would say on that basis they were maybe limited slightly inside as to how much they could really use their imagination for the task”*

**Urban Playground Teacher**

*“Outdoors the thing was never going to look realistic so it begs for your imagination more. Whereas indoors they became concerned with making it look ‘right’, outdoors it's unlikely to ever really look right... you can have something actually quite a basic shape, but they're pretending it's a castle, or a car, or whatever, and they're enjoying using it”*

**Urban Wood Teacher**

Another aspect of the QV relates to the *prescriptiveness of the meaning* of classroom objects, which some teachers imply may have limited children's creative options. Two example quotes are given above. In the first, the urban playground teacher talks about how children didn't need to *“come up with an alternative”* for available classroom affordances (e.g. toys), whereas in the playground they were required *“to use their imagination to come up with something to represent the material object”*.

In the second quote, the urban wood teacher implies that the prescriptiveness of the 'Make a Toy' junk may have caused children to become preoccupied with making a single production *“look right”*. Conversely, she believes the wild setting *“begs for your imagination more”* because affordances are *“never going to look realistic”*, while also noting the creative possibilities which *“basic shapes”* enabled for children.

### **6.2.2 Dynamic Novelty**

All teachers referred to the greater inherent novelty of the outdoor settings, compared to the classroom. Three illustrative quotes are given overleaf.

For the urban wood teacher, there was *“more variety outdoors”*, and learning as the children *“worked through it”*, whereas indoors *“they didn't learn that much because there wasn't anything new in their environment”*.

The urban playground teacher talks about how dynamic environmental qualities –e.g. ground hardness, or wind direction and strength– may have supported “*automatic (and) opportunistic*” learning in the playground, which could not have occurred indoors.

*“They probably learned a lot more about the outdoor environment because they really did go exploring ... they were asking lots of questions about the environment, and finding bugs, and you know all these things and so they learnt things we wouldn't expect them to learn... whereas indoors on that second task they didn't learn that much because there wasn't anything new in their environment ... There was more variety outdoors, and more change as they worked through it”* **Urban Wood Teacher**

*“They did get a chance to feel the grass, and stick the poles into the grass, and what surface is grass, and why can we get the pole in the grass today but we can't get it in next week.... which way is the wind blowing? Things like that prompted a lot of opportunistic learning that we wouldn't have had necessarily in the classroom, things that you talk about automatically arise from working outside, that wouldn't arise from working inside”*  
**Urban Playground Teacher**

*“If they're finding something and they think no one's ever found it before, or you've been talking about something in class and suddenly it's there and you didn't plan it... or let's have a look at it, if they find animals – they just get so excited about seeing these things in their natural environment”*  
**Rural Wood Teacher 2**

In the third quote, the rural wood teacher describes the children's excitement at discovering things and animals down the woods, which “*they think no-one's ever found before*”.

Three responses from the rural wood children, shown above, suggest environmental novelty is the main reason they consider the wild setting is better for learning than the classroom, providing support for their teacher's view. An experienced girl and an early years' boy prefer the outdoors because they “*see*” or “*learn*” new things there, respectively.

Another early years' girl states, “*if we had a classroom in the woods...for me there would be something new every day*”, whereas indoors, “*we can't find things...like a certain coloured leaf or a tree branch*”.

*"Because you get to like see new things"*

**Rural Wood Girl "Experienced"**

*"Because you learn new things"*

**Rural Wood Boy "Early Years"**

*"Because we can go and search for things that we can't find in the classroom like a certain coloured leaf or a tree branch... if we had a classroom in the woods or we lived in the woods for me there would be something new every day"* **Rural Wood Girl "Early Years"**

### 6.2.3 Immersiveness

The last of environmental QVs implied by all teachers was the greater capacity of the outdoors, particularly the wild settings, to support a more immersive task experience than the classroom.

*"In the classroom I don't think any of them used any stimulus as a part of the story unless it was something that was on the wall from our space topic, but when they were in the woods they actually used their environment within the story, they actually had tangible things to reimagine. Can you remember? Tunnels, castles, hidey places, dark places? They were building, they were actually creating"*

**Rural Wood Teacher 2**

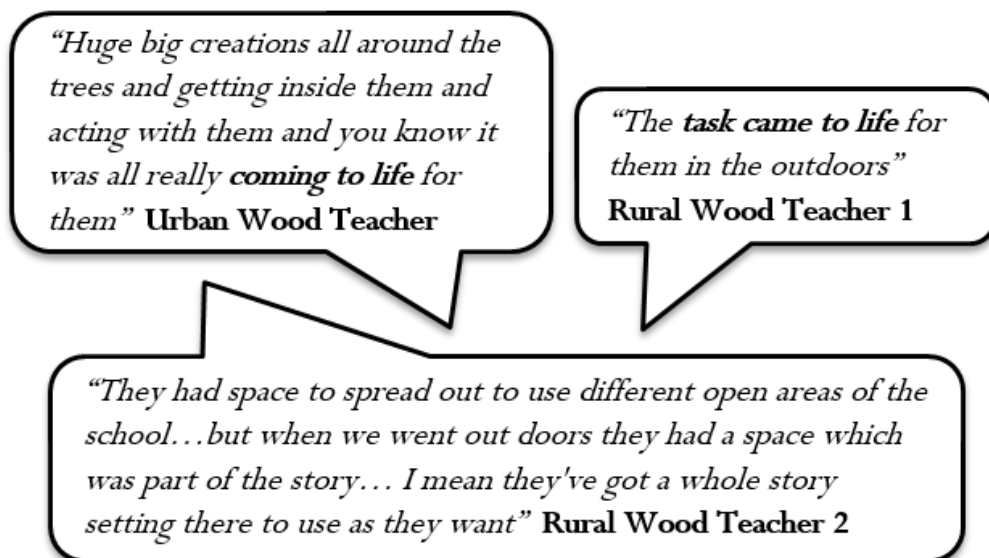
*"In the classroom the things were there, maybe as the stimulus, as a reminder, whereas imagination went that bit further in the outdoors, despite the class area having a lot more resources to use"*

**Rural Wood Teacher 1**

In the two quotes above, the rural wood teachers allude to the role immersiveness may have played in the creation of the 'Alien Adventure' wild setting stories. Teacher 2 talks about how reimagined woodland affordances were used "*within*" children's stories as "*tunnels, castles, hidey places, dark places*". She describes this creative process as "*building...actually creating*". By contrast, she believes no classroom

affordances were employed in story creation “*unless it was something on the wall from our space topic*”. Teacher 1 makes a similar point, noting that despite “*having a lot more resources*” in the classroom, these were not used except as “*maybe...a reminder*”, whereas “*imagination went that bit further in the outdoors*”.

Three further quotes below suggest the capacity of wild setting affordances to put the children *inside* their creations, physically and imaginatively. The urban wood teacher describes how children were “*getting inside*” their “*huge big creations*” and “*acting with them*”. Both she and the first rural wood teacher refer to how in the wild setting, the task “*came to life*” for the children.



In the third quote, the second rural wood teacher alludes to the immersive quality of wild setting space, which she believes was an active “*part of the story*”, constituting “*a whole story setting to use as they want*”. Indoors, she views space rather as something to “*spread out*” in and find a place to work.

The responses from two experienced rural wood boys, shown below, suggest they perceive the wild setting is better for learning primarily because it has “*more space than the classroom*”.

*“Because there's more space than there is in the classroom”*  
**Rural Wood Boy “Experienced”**

*“Because you get more space than the classroom”*  
**Rural Wood Boy “Experienced”**

A final aspect of immersiveness touched upon by two teachers was the absence of task distractions outdoors, compared with the classroom. Their related quotes are given below.

*“There wasn't distractions coming from anywhere in the school, there wasn't noise...there was nobody coming to the door, there was nobody walking past, there wasn't any toys over there...it was just purely the task they had outside, no distractions, nothing to distract their engagement from what they had to do”* **Urban Playground Teacher**

*“(Outdoors) they weren't being distracted by other children and the surrounding things in the near proximity”* **Rural Wood Teacher 1**

In the first, the playground teacher speaks about how outdoors, *“it was purely the task they had outside, no distractions”*. She contrasts this with the *“noise...toys...or (people) coming to the door / walking past”* which may have diverted attention in the classroom. In the second, the rural wood teacher observes that in the wild setting, individual *“weren't being distracted by other children and the surrounding things in the near proximity”*, as may have been the case in the classroom.



### 6.3 Findings: Child's Experience

The thematic analysis identified three experiential QVs relevant to individual performance: *degree of empowerment, resourcefulness, and absorption*.

#### 6.3.1 Empowerment

Possibly, the strongest common theme to emerge from the interview data is children's higher levels of confidence and perceived agency outdoors, compared to the classroom.

Below are the responses from the four teachers to the question "*which setting do you think was the best overall for the task and why?*" All refer to the greater "*freedom*" they perceived the outdoors afforded the children. The urban playground teacher talks about the freedom for children "*to use their own imagination*", which she links to "*better ideas*" and using higher "*levels of thinking*".

*"Outside was the best classroom for the activity, and one key reason? The **freedom** that it gave the children to use their own imagination...it gave them an opportunity for greater exploration and greater discovery, and to that extent they probably did have better ideas because they were able use that level of thinking"*  
Urban Playground Teacher

*"The **freedom**...in the classroom it might feel a bit more confined, or that there's a right or wrong. You know, it was very clear to them up there that this is completely creative and open, and so they just dived in and got on with it"*  
Urban Wood Teacher

*"They had the **freedom** to move around and do their own thing so they were more engaged in the outdoors"*  
Rural Wood Teacher 1

*"My class don't see things they do in the woods as working... Whereas I give them the exact same task in the classroom and it's work, even when it's sometimes play based, the minute you're in an environment where they feel they've got more **freedom**, I think they view the task completely differently...I think from a child's perspective, **freedom** (is the key benefit of the outdoor setting). They think that they're more free down there"*  
Rural Wood Teacher 2

For the urban wood teacher, children perceived the wild setting task as “*completely creative and open, and so they dived in and got on with it*”, whereas the classroom “*might feel a bit more confined, or that there’s a right or wrong*”. Rural wood teacher 2 implies the sense of freedom occurs naturally in the wild setting, stating “*they think they’re more free down there (and) don’t see things they do in the woods as working*”, whereas “*I give them the exact same task indoors and it’s work*”. For her colleague, the wild task setting was superior because children had “*the freedom to move around and do their own thing*”.

*“Sometimes I think it’s the fact that I can’t see them so it feels a little like – even doing what she wants me to do – I’m doing something which is maybe just a little bit adventurous”* **Rural Wood Teacher 2**

*“Because we can explore more”*  
**Rural Wood Boy “Experienced”**

*“As a parent even, we can go overboard – “don’t do that” – whereas children learn that if I climb up there and I get hurt, well, I’ll not do it again. So I think the (children’s own) risk assessment part’s a big thing – giving (them) the confidence to go and do it for themselves”* **Rural Wood Teacher 1**

The three rural wood quotes overleaf above also imply an association between self-agency and self-confidence outdoors. Teacher 2 suggests that being out of the sight of the teachers may cause the children to feel “*a little bit adventurous*”, while teacher 1 believes that taking responsibility for their own risk assessments gives children “*the confidence to go and do it for themselves*”. Finally, an experienced boy states the reason why he thinks the wild setting is best for learning is because “*we can explore more*”.

In the four quotes above, the experienced rural wood teachers also recall situations where they felt wild setting experiences had enabled learning for young children experientially or dispositionally ill-equipped for the classroom setting. Teacher 1 talks about how outdoor experiences have helped individuals with poor language skills to

*“talk about what they’ve been doing in an animated and exciting way”*. She also refers to *“a bright wee boy”* who *“hates to sit still”*, but who is able to *“go and do”* tasks outdoors while also *“getting to move (and) run about”*.

*“If there’s a child who has poor language skills in terms of writing, if their development in that area is not where it should be, they can still talk about what they’ve been doing (outdoors) in an animated and exciting way... then there’s always somebody else in the group that can write it for them”*

**Rural Wood Teacher 1**

*“Some of them don’t get a lot of storybooks read to them so they don’t have a great bank of knowledge but when they go out there it allows them to open up - its giving them the experience to tell their story”*

**Rural Wood Teacher 2**

*“You can actually refer to things that they’ve done and been enthusiastic about, and where they’ve had successes outdoors doing things. You can bring it into the classroom and say remember how you could do such and such, how did you manage that? Even at that stage you can get them to think about what skills they’ve got and about how they could use them?... The skills they learn outdoors. I can bring that learning and self-confidence back in”*

**Rural Wood Teacher 2**

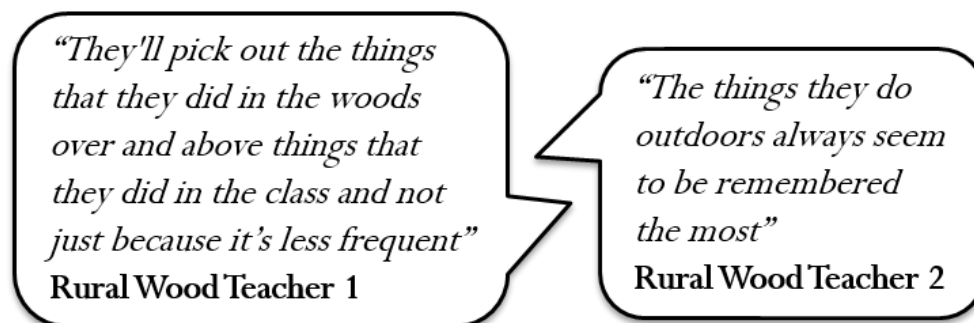
*“(One) bright wee boy: he learns well but he hates to sit still, and he tries hard to be on task in class...but (outdoors) you’re taking that constraint of sitting down, and having to do it, away from him. So he can still go and do it, but there’s that bit of ‘I’m getting to run about, I’m getting to move, I don’t have to sit at a desk”*

**Rural Wood Teacher 1**

Teacher 2 speaks about how outdoor experiences give children who *“don’t get a lot of storybooks read to them...the experience to tell their story”*. She also mentions times she has reminded a child of their *“successes outdoors (and the) things they’ve done and been enthusiastic about”*, so as to *“that learning and self-confidence back in (by getting) them to think about what skills they’ve got and how they could use them”*.

Three of these quotes imply the use of children’s recollections of outdoor experiences to support learning in a classroom context. In two further quotes below, both teachers also propose strong recollections to be a general characteristic of wild setting lessons.

Teacher 2 says *“the things they do outdoors always seem to be remembered the most”*, while her colleague states that *“they’ll pick out the things that they did in the woods over and above things that they did in the class and not just because it’s less frequent”*.



In the final two quotes overleaf, the two novice outdoor teachers remark upon the enhanced confidence of underachieving or diffident children on the outdoor task. Talking about the underachievers during ‘Make a Toy’ in the wild setting, the urban wood teacher describes Ro as *“like a wee leader giving people instructions”*, and Mn *“who was always very quiet in the classroom”*, working in a group who *“came to life, their confidence was just brilliant”*.

Similarly, the playground teacher refers to two children who were typically *“very quiet”* in the classroom, but who seemed transformed on the outdoor task: a boy, Lt, who was *“quite happy to stand up and share his ideas with everybody (and) came across very confidently”* and Jn, whose *“confidence certainly shone more outside...presenting her ideas”*.

She also comments on the *“fabulous”* outdoor ideas of Rn, an underachieving girl whose own teacher described as *“hard to engage”*, without *“the focus or the self-discipline”* to *“start...focus on (or) finish”* classroom tasks.

*“Ro was like a wee leader giving people instructions... Mn I remember as well, who was always very quiet in the classroom... and her and a few other girls made a car, and you know they were really pretending they were driving, so they just they came to life, their confidence was just brilliant ... Ro, Sr Al and Mn you know you saw them as new characters and I really do think you see their potential to see them do so well at something and enjoying it and being confident”*

**Urban Wood Teacher**

*“It was a very quiet boy in P1 but working in that small group and, maybe, the environment – I’m not sure – he certainly was quite happy to stand up and share his ideas with everybody, and he came across very confidently ... Jn was a very very quiet little girl as well and her confidence certainly shone more outside again presenting her ideas” Rn had fabulous ideas outside. I don’t have a clear memory of her inside the classroom in any way. Her ideas must have been more outstanding outside for me to remember them”*

**Urban Playground Teacher**

*“Rn was hard to engage in anything very focused. Rarely would she see a task through to the end without adult intervention. She didn’t have either the focus or the self discipline to start a task and focus on the task and finish that task”*

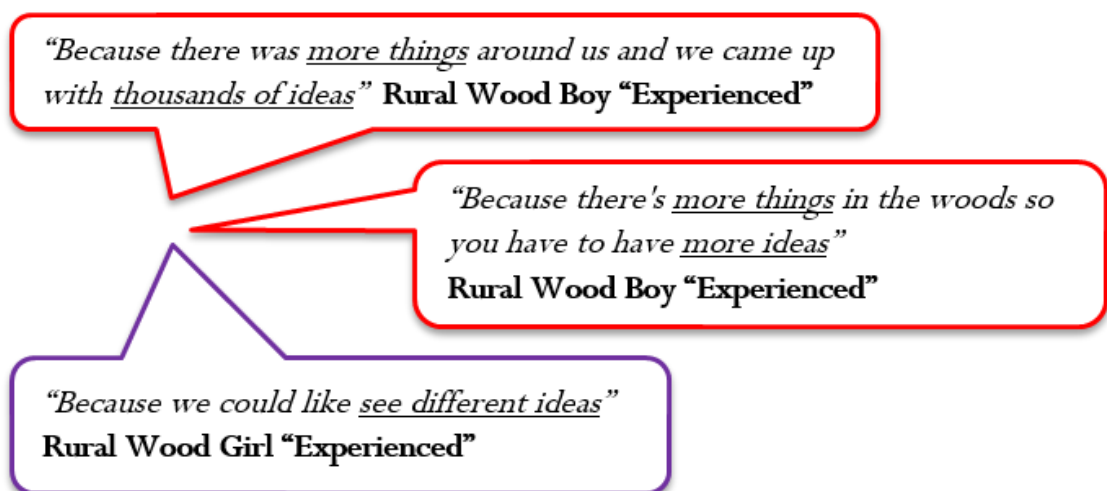
**Rn’s Teacher**

An implication of both quotes is that the teachers’ better appreciated the potential of underachieving children outdoors, and for some, perhaps saw it for the first time. Particularly, the urban wood teacher comments that she saw her underachievers as “*new characters*”, and adds “*I really do think you see their potential to see them do so well at something and enjoying it and being confident*”. The playground teacher also refers to Rn’s contribution as being “*outstanding outside*”, but that she doesn’t “*have a clear memory of her inside the classroom in any way.*”

### 6.3.2 Resourcefulness

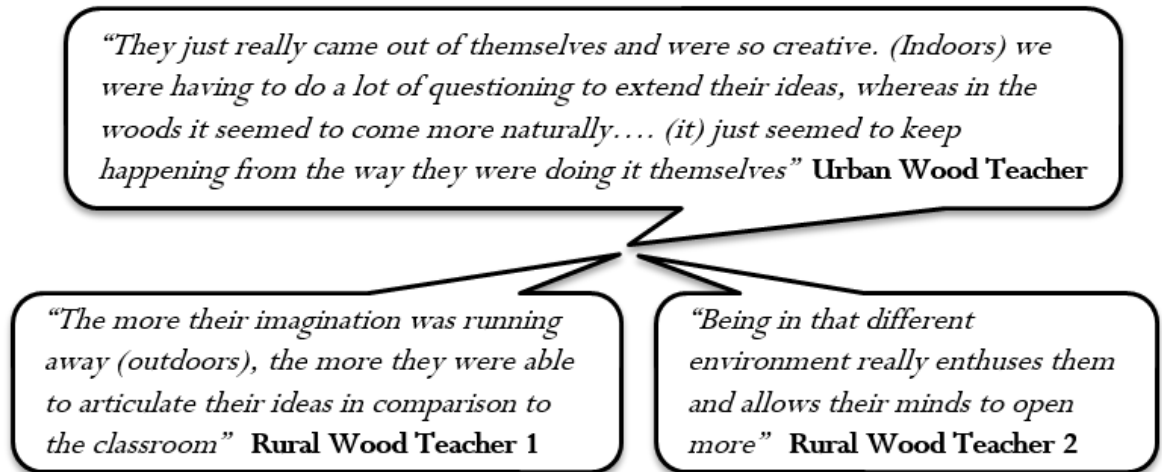
The second common interview theme related to the child's experience is the higher levels of resourcefulness perceived in the wild settings, compared to the classroom.

Shown below are the responses of three experienced children regarding the main reasons why they thought the wild setting was best for learning. All imply the capacity of the wild setting to enable imagination and ideas, with two boys connecting this to there being "*more things*" around them, while a girl refers to "*seeing different ideas*".



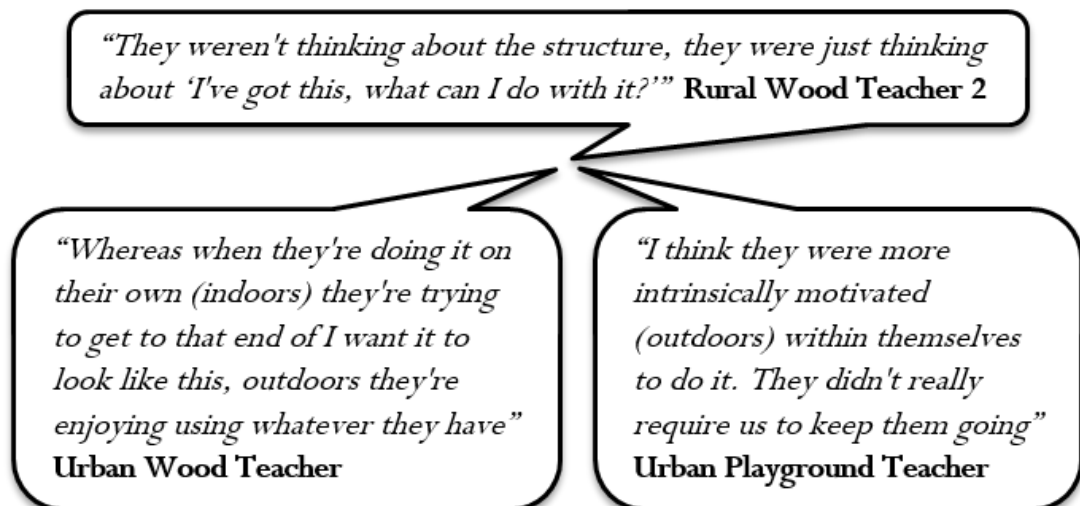
In the quotes overleaf, each of the three teachers who supervised wild setting tasks also appears to allude this capacity. The urban wood teacher talks about how children "*really came out of themselves and were so creative*". She notes that ideas "*seemed to come more naturally...from the way they were doing it themselves*", as opposed to the classroom, where she was "*having to do a lot of questioning to extend their ideas*". Rural wood teacher 1 states "*the more their imagination was running away (outdoors), the more they were able to articulate their ideas in comparison to the classroom*", while her colleague perceives that the wild setting "*really enthuses (the children) and allows their minds to open more*".

Although 'imagination' was a term often associated with this QV, 'resourcefulness' seemed to capture more accurately the effortless emergence of ideas these data imply.



### 6.3.3 Absorption

The third and last experiential QV relates to data suggesting more sustained task absorption in the outdoor settings, compared to the classroom.



Three example quotes are given above. The playground teacher speaks about how children *“were more intrinsically motivated”* outdoors, where *“they didn't really require us to keep them going”*. The urban wood teacher describes how children in the

wild setting were “*enjoying using whatever they have*”, as opposed to the classroom, where they seemed to be more preoccupied with “*trying to get to that end of I want it to look like this*”. The rural wood teacher’s makes a similar observation, noting that outdoors children were “*just thinking...I’ve got this, what can I do with it?*” and seemed less concerned with “*thinking about the (story structure*” than they were indoors.

The QV was named ‘absorption’, instead of ‘attention’ or ‘motivation, because the latter seemed to imply an internal locus of action, whereas the data implies more the sense of a moment-to-moment environmental interaction, particularly in the wild setting.

*“To a child (in the classroom), if they have to act out (something) can become quite inhibited because there’s people so close by watching. Whereas with the space outdoors, children can be in their area working and really feel the freedom to get into the part of whatever it is they’re doing”*

**Rural Wood Teacher 1**

*“In class, if they’re to sit down and do something for a length of time, they wander, therefore it causes a bubbling under the surface of their behaviour... (outdoors) I feel that they’re less disruptive... I think for certain learning styles the children are more motivated”*

**Rural Wood Teacher 1**

*“I don’t know if its they equate not being able to do something with being in school, and when they’re outdoors it’s a different environment so maybe I can do something, but I find with mine – it’s mostly been boys that are the lower achievers – that they are much more willing to join in and give it a try than if I ask them to do something similar in class”*

**Rural Wood Teacher 2**

In the three quotes above, the experienced teachers allude to a further aspect of wild setting ‘absorption’, namely, the absence of extrinsic preoccupations which may impair some children’s performance in the classroom.

Teacher 1 refers to children who “*can become quite inhibited (in the classroom) if they have to act out something...because there’s people so close by watching*” but “*with the space outdoors...really feel the freedom to get into the part of whatever they’re doing*”.



She also talks about how extended sedentary classroom work can cause some individuals to “wander (and) a bubbling under the surface of their behaviour”, whereas outdoors they are “more motivated (and) less disruptive”. Her colleague gives the example of underachieving boys who may “equate not being able to do something with being in school (but) are much more willing to join and give it a try” during wild setting lessons.

#### 6.4 Findings: Socio-Linguistic Domain

Three QVs are proposed which pertain to the Socio-Linguistic Domain: *degree of democracy (systemic integrity), generative conversation, and self-sustenance.*

##### 6.4.1 Democracy

The first common QV relates to data suggesting more effective, equitable and inclusive collaboration outdoors, in comparison to the classroom.

*“I think they all worked together really well...they all seemed a bit more equal...it wasn't clear who was the high achiever, they were all an even playing field, and they all worked with people they don't normally tend to work with in the class naturally. I think that was the main thing”* **Urban Wood Teacher**

*“In the classroom I think that a lot of the learning is coming from the older ones...but in the outdoors it was much more a shared outcome, a shared story because of the experiences they were in in at that moment”*

**Rural Wood Teacher 2**

*“I think when all children contribute there's that shared and mutual respect...for the children who find things more difficult for their self esteem, they then feel one of the team...so, definitely yeah, children will work better together when everyone has a say”*

**Rural Wood Teacher 1**

Above are three illustrative quotes from the teachers who supervised the wild setting tasks. For the urban wood teacher, *“the main thing”* outdoors was how all children *“worked together really well (and) with people they don’t normally work with in class, naturally”*. She notes the class *“seemed a bit more equal...an even playing field”*.

Rural wood teacher 2 considers the wild setting stories to be *“more a shared outcome”* between buddies, attributing this to *“the experiences they were in in that moment”*. She contrasts this with the classroom, where she sees *“a lot of the learning is coming from the older ones”*. Her colleague feels children work *“work better together”* outdoors, because there is *“shared and mutual respect...everyone has a say (and) children who (indoors) find things more difficult for their self-esteem...feel one of the team”*.

*“You know sometimes in the classroom, there’ll be a natural kind of hierarchy – someone who is quite a leader in the class, and they all look up to them because they know they’re clever, and you know that kind of thing? It wasn’t really like that (outdoors). People who aren’t normally like that in class, people who normally sit back in the shadows a little bit, came forward and were leaders, and it changed the dynamics quite a lot”* **Urban Wood Teacher**

*“I think the children listened better outside about what the others had to say but, if anything, I would say it was their confidence, their self-confidence, to stand up and, in front of everybody, share their ideas. I saw that a lot more outside than in the classroom”* **Urban Playground Teacher**

The two quotes above from the novice teachers imply they perceived an association between enhanced confidence outdoors and levels of collaboration. The urban wood teacher talks about how children *“who normally sit back in the shadows...came forward and were leaders, and it changed the dynamics quite a lot”*. She notes that the classroom has a *“natural kind of hierarchy”*, but *“it wasn’t really like that”* in the wild setting. In the playground, the teacher describes how children exhibited more *“self-confidence to stand up and, in front of everybody, share their ideas (and also) listened better...to what others had to say”*.

The implication that general non-hierarchical participation outdoors may have been driven by the enhanced confidence of individuals and marginal groups is why the term ‘democracy’ was chosen for this QV.

#### **6.4.2 Generative Conversation**

The second common theme related to the Socio-Linguistic Domain is the degree to which outdoor collaboration fuelled new ideas, compared to the classroom.

Below are two illustrative quotes from the novice outdoor teachers. In the first, the urban wood teacher describes how children’s ideas in the wild setting “*tended to develop further (through) play and conversation...because someone else brings in this idea and it’s turned into a new thing, and you start to use it in a different way*”. She contrasts this with the classroom, where children often required support with their ideas to “*try to take it beyond the simple thing*”.

*“The ideas tended to develop further when doing it (outdoors) because someone else brings in this idea and it’s turned into a new thing, and you start to use it in different way, so that it develops their ideas through their play and their conversation. You know indoors, we were ‘what could this be?’, and getting them to try and take it beyond the simple thing”* **Urban Wood Teacher**

*“The team building skills (outdoors): working with a team, sharing their ideas with their classmates...I felt inside we were having to feed their ideas a little bit – ‘have you thought about this? have you tried this? could you do this? what about if we do it over here?’ They didn’t really seem to need that stimulus outside...the dens they produced were brilliant and they managed quite well independently. They needed a wee bit of help to tie knots and things like that, but it was really their ideas that we helped them to execute...they were certainly able to carry through their ideas outdoors better than they did indoors”* **Urban Playground Teacher**

In the second quote, the playground teacher marks a key distinction of the outdoor task to be “*team building skills: working with a team (and) sharing their ideas with their*

*classmates*". She then goes onto say "*the dens they produced were brilliant and they managed quite well independently (and) were certainly able to carry through their ideas outdoors better than they did indoors*". In the classroom, on the other hand, she felt she was "*having to feed (children's) ideas a little bit*".

*"How well they worked together (outdoors) and the language that they used. How they negotiated, they discussed, they shared ideas – I think about that"*  
**Rural Wood Teacher 1**

*"The indoor stories were much more what you'd expect, but when they went into the outdoors and they could build. I remember there was one that was a princess caught in a castle and they had to rescue her, and wizards, and things, you know, actually just using a wooded area...they didn't suddenly develop a new vocabulary but it was just there was more depth and richness to their stories...I felt doing (the task) indoors first would curb the experience outdoors...we've done this already...but they were still really enthusiastic to develop their stories (and) what a lot of their stories were so different!"* **Rural Wood Teacher 2**

The experienced teachers also allude to more productive collaboration in the wild setting, and both emphasise the richness of children's language. In the first of the two quotes above, teacher 1 talks about "*the language they used...how they negotiated...discussed...shared ideas*" and "*how well they worked together*". For her colleague, there was "*more depth and richness*" to the wild setting stories. She mentions one where "*a princess caught in a castle and they had to rescue her, and wizards, and things*" which arose from "*just using a wooded area*". She remarks on how different these were from the classroom stories, which for her, "*were much more what you'd expect*".

### 6.4.3 Self-sustenance

The last of the QVs proposed for the Socio-Linguistic Domain is the higher levels of self-sustaining task engagement outdoors, compared to the classroom. In the quotes below, all four study teachers allude to aspects of ‘self-sustenance’.

*“Some of them enjoyed it (indoors) and they were showing the puppets around the classroom and developed little play things on their own. Others just moseyed around and didn't really find much to do, so the difference between them for that task was much greater...it was almost sullen for some of them in the classroom, or engaged. There were two types of mood in the classroom and just one big frantic mood (laughs) in the woods”***Urban Wood Teacher**

*“When they did get distracted, it was quite easy to pull them back again – ‘oh have you seen this? have you tried this? have you looked at this?’ – whereas that was more challenging inside to keep their interest, I would say...I don't think they were as engaged at the end inside as they were outside”*  
**Urban Playground Teacher**

*“They were an energetic class anyway but the energy levels are higher out of doors...we trust them very much to just go. They're not always in sight but you know that they're ok, you know that they're doing something meaningful”*  
**Rural Wood Teacher 2**

*“The challenge of doing it indoors is keeping the class more focused in the smaller space. Then children tend to think ‘well the toilet's just along the road, I'll go for the toilet’. Very rarely will children ask for the toilet out in the woods”*  
**Rural Wood Teacher 1**

The urban wood teacher describes how ‘Puppet Tour’ outdoors was characterised by “*just one big frantic mood*”, as opposed to the classroom where children were either “*engaged (and) developed little play things on their own (or) sullen (and) just moseyed around or didn't really find much to do*”. The playground teacher recalls how outdoors “*it was quite easy to pull (the children) back again when they did get distracted*”, whereas indoors it was “*more challenging...to keep their interest*”, and they were “*not as engaged at the end...as they were outside*”. The first rural wood teacher talks about how “*very rarely will children ask for the toilet out in the woods*”, something which indicates lapsing interest in the classroom, and remarks on the challenge of “*keeping the*

*class more focused in the smaller space*". Lastly, her colleague talks about how she knows children are *"doing something meaningful"* in the wild setting, even when she cannot see them, and notes that their *"energy levels are higher out of doors"*.

## 6.5 Findings: Teacher's Experience

The final two QVs relate to common aspects of the teachers' outdoor experiences, namely, their *reduced management burden* and *increased enjoyment*. The section also includes additional data from the interviews, and 'Puppet Tour' transcripts, which suggest the positive impacts of these factors on children's performance.

### 6.5.1 Management Burden

In the quotes below, all four teachers imply they perceived a reduced management burden outdoors, with the novices implying this was contrary to their expectations.

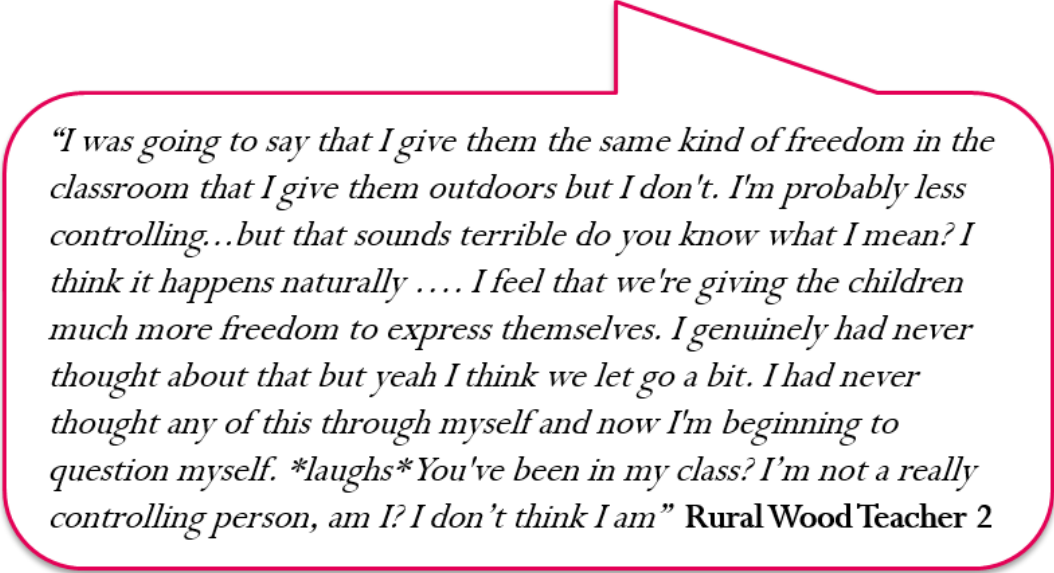
*"In the classroom you're trying getting a lot of ideas from them, but at the same time you're trying to help them all, and you're aware of time, and you're aware of mess, and you're aware of business, and noise, and you know all that kind of thing, whereas in the woods I felt a lot more free and relaxed...when it's happening (inside) it's more of a challenge, whereas (outdoors) it's more the preparation, and then its kind of fine once you're there"* **Urban Wood Teacher**

*"Outdoors it's easier to work"*  
**Rural Wood Teacher 1**

*"It's the reverse of what you'd expect, you would think the health and safety concerns would be outside, not inside...the only management outdoors like I say is if one group of children was over there, and one group of children was over there...you'd be cutting yourself in half and running across the playground, but with the exception of that it's easier to manage outside than it is inside"*  
**Urban Playground Teacher**

*"When I first started doing it, I thought I'd feel less in control but I don't. I don't feel any loss of control in that I don't feel that they're going to go and do something or something's going to happen to them. I feel as much in control, but in a different way."* **Rural Wood Teacher 2**

The urban wood teacher states that in the wild setting she felt “*a lot more free and relaxed (and that) it’s kind of fine once you’re there*”, suggesting a link between her reduced management and her enjoyment. By contrast, she considers the classroom task “*more of a challenge (because) you’re trying getting a lot of ideas from them, at the same time you’re trying to help them all, you’re aware of time, mess, business and noise*”. The playground teacher talks about the outdoor task being “*easier to manage outside than inside*” and involving less “*health and safety concerns*”, which is the reverse of what she’d expected. The first rural wood teacher also concludes that “*outdoors, it’s easier to work*”. Her colleague admits that prior to her first outdoor lessons “*I thought I’d feel less in control*”, but discovered that “*I feel as much in control, but in a different way*” and now trusts that children aren’t “*going to go and do something or something’s going to happen to them*”.

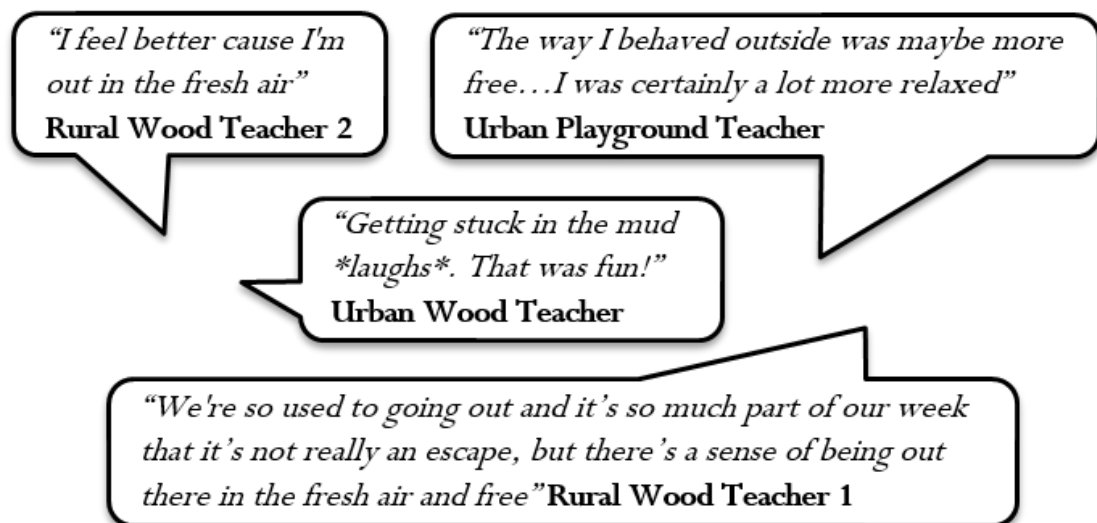


*“I was going to say that I give them the same kind of freedom in the classroom that I give them outdoors but I don't. I'm probably less controlling...but that sounds terrible do you know what I mean? I think it happens naturally .... I feel that we're giving the children much more freedom to express themselves. I genuinely had never thought about that but yeah I think we let go a bit. I had never thought any of this through myself and now I'm beginning to question myself. \*laughs\* You've been in my class? I'm not a really controlling person, am I? I don't think I am”* **Rural Wood Teacher 2**

When asked to expand on what she meant by “*control*”, the teacher gave the further comment shown above. Reflecting on her approach in the wild setting, ostensibly for the first time, she realises that she doesn’t “*give (the children) the same kind of freedom in the classroom*”. She wonders if she may “*let go a bit*” outdoors and implies this may be something which “*happens naturally*”. The idea that she is more “*controlling*” indoors evidently conflicts with her own perception of her teaching style, because she seeks my reassurance (“*I’m not a really controlling person, am I? I don’t think I am?*”).

### 6.5.2 Enjoyment

The second QV pertaining to the teacher's experience is their increased enjoyment of the outdoor task, compared with the classroom. In the example quotes given above, all four teachers refer to the positive emotional benefits they derived from the outdoor tasks, including feeling "better" and "more relaxed", having "fun", or being "out in the fresh air" and "free".



Some data, shown in the quotes overleaf, also imply teachers felt more themselves outdoors, and perceive this may have promoted better relationships with the children.

The first rural wood teacher describes how, in the wild setting, they enjoy seeing her get her "hands dirty" working with them, and as "a teacher and a human being...a normal person". Her colleague states that "outdoors it's completely different...I'm still the same teacher to them but I probably feel a wee bit more free myself".

The urban wood teacher suggests the outdoor task may have given children "a new thing to relate to school life and their teacher". Finally, the playground teacher says that outdoors, "I could be myself".



*“You can be seen to get down and get your hands dirty with the children, and they enjoy seeing that side of you, that aspect, although you’re mucking in and you’re working with the children...as a teacher, anyway, (I) always try and give my children a little bit of me, because in their eyes then you are teacher, but a teacher and a human being \*laughs\* – you know, as a normal person?”* **Rural Wood Teacher 1**

*“Outdoors it’s completely different...I’m still the same teacher to them but I probably feel a wee bit more free myself”*  
**Rural Wood Teacher 2**

*“I could be myself”*  
**Urban Playground Teacher**

*“Before that kind of experience, probably, school was the classroom, and structure, but (the outdoor experience) was a new thing to relate to school life and their teacher \*laughs\*”* **Urban Wood Teacher**

In a last quote from one of the rural wood teachers, there is an almost childlike quality to the way she expresses the thrill of sharing the children’s wild setting discoveries (“and you’re like WOW!”; “my goodness it was so exciting”).

*“They find something that they’re desperate to show you, and the excitement. ‘Look what I’ve found, look what I’ve found’. And you’re like WOW! You don’t have that experience in class because they’re not finding these new things. ‘Look I’ve found a pencil’. I’ve seen a pencil – do you know what I mean? They’ve seen a pencil. But ‘oh look we’ve found something!’ I remember one time we found a skull. My goodness it was so exciting because the children got so excited. ‘It’s a bear, it’s a dinosaur’. Their imaginations!”* **Rural Wood Teacher 2**

### 6.5.3 Positive Teacher Feedback

The teachers also proposed ways in which the above two QVs may have impacted positively on class performance in the outdoor settings, four examples of which are given overleaf. Here the playground teacher says she believes “*children would pick up on (and) reflect*” an outdoor mood which was more “*positive and enthusiastic (or) relaxed*”. The second rural wood teacher feels children “*respond better and give more*” when they see her as “*a normal person*” in the wild setting. Her associate notes that when participating in children’s outdoor activities, she doesn’t tend to ask them so many questions. While indoors, she says this is “*the natural teacher-thing to do*”, she acknowledges “*it’s much better not to (because) you’re interrupting the flow of their thought (and) quite often they’ll find answers themselves just through the discussion*”. Finally the urban wood teacher states that if she’s “*more enthusiastic, it rubs off on the children*”, and admits also that she was “*probably more enthusiastic, encouraging (and) excited*” on the wild setting tasks.

*“The more positive you feel about the environment, the more positive and enthusiastic you would be about (the task), and the children would pick up on that and that they would reflect that behaviour accordingly...I certainly feel I was more relaxed outside than I was inside, so I would imagine that they behaved similarly”* **Urban Playground Teacher**

*“I think I was just a bit more excited by the outdoors. So I was probably more enthusiastic and encouraging them to be a bit more creative...if the teacher's more enthusiastic, it rubs off on the children, so it may have rubbed off on them”* **Urban Wood Teacher**

*“So (outdoors) they know where the teacher line is, and they see me as a normal person, and I always feel when the children can see that of you, they respond better and give more”* **Rural Wood Teacher 2**

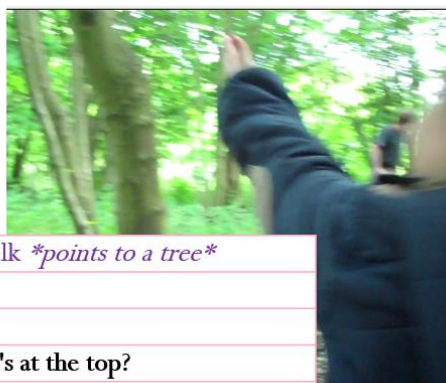
*“Indoors when you’re working with a group of children, the initial, or the natural, teacher-thing to do is to stop them and question them about something you’ve just heard and you’re interrupting the flow of their thought. It’s much better not to interrupt, and allow the children to go on (as) quite often they’ll find answers themselves just through the discussion. But if you’re busy, and you’re down with them and your hands are dirty, and you’re doing whatever it is you’re doing, and you’re imagining, then you’re not questioning as much outdoors”* **Rural Wood Teacher 1**

A between-setting comparison of exchanges between the urban wood teacher and children during ‘Puppet Tour’ also suggest they were more sustained, enthusiastic and participatory in the wild setting. In Figures 6.2 and 6.3 below feature transcripts of the three longest exchanges for each component –two private and one group, respectively– with the wild setting on the left and the classroom on the right.

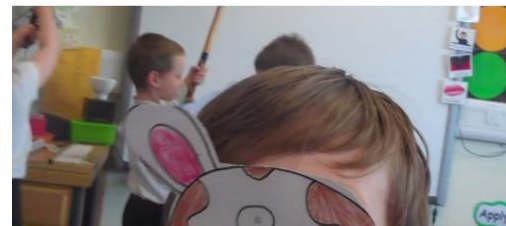
Jm	I picked up a dinosaur bone. A dinosaur bone
T	Oh it is like a bone. WOW!
Jm	It is
T	You think its a dinosaur?
Jm	Yeah
T	What kind of dinosaur?
Jm	I've put I've got it's got a foot on the bottom
T	So it's like from his leg? His ankle?
Jm	Yeah and he's dead
T	Oh wow what a good find!



Zn	<i>*reading off the board*</i> "go" "you" "there" "do" "be" "are" "she"
T	Wow does that farmer actually know those words?
Zn	<i>*nods*</i>
T	So he's quite a clever farmer? Very good.



Er	We made a beanstalk <i>*points to a tree*</i>
T	Wow!
Er	We made it
T	What do you think's at the top?
Er	Erm...a giant's castle
T	Wow!
Er	We've climbed it
T	Is he a friendly giant or not?
Er	A friendly giant
T	Thank goodness for that!
Er	We went up and look and he's really friendly
T	Right
Er	Isn't he puppet (to puppet)?
T	Ah you're getting on well with your puppet?
Er	<i>*giggles*</i> Let's go and make a giant...
T	What you going to make?
Er	Castle
T	A giant's castle!



T	Are you being the cow?
Gb	Yeah
T	Like a mask?
Gb	Yeah
T	And what would you say when you're being the cow?
Gb	Moo

Figure 6.2 ‘Puppet Tour’ Exchanges between Teacher and Individuals



Er	We're having coffee and chocolate cake
T	Oh yum yum yum
Er	And for dinner we're having cheese pizza
T	Cheese pizza. OK
Jm	That's for the dinners and do you know what's for the tea party? Coffee and juice
Er	For pudding and for pudding there is ice-cream and jelly and chocolate cake
T	Yum
Er	Alright now let's eat
Ch	I'm already eating the chocolate cake, I'm already eating the chocolate cake
T	Oh yeah
Jm	I'm already eating the chocolate cake <i>*feeding earth to puppet*</i>
Ch	I'm already eat... <i>*baby voice*</i> Mummy I already eaten the chocolate cake <i>*laughs*</i>
Jm	And me
Er	Alright then you need to pick a pudding. Jm what are you having for pudding? Jelly, ice-cream, or chocolate?
Jm	Jelly and ice-cream
Er	Right what are you having Ch? We've got some more...Miss, you've not had your pudding
T	Oh sorry. I thought I was having cake. Was that the main course?
Er	Yeah
T	What's for pudding then?
Er	Erm you could either have chocolate cake, ice cream or jelly. You need to pick. It's OK if you want two or three...or one
T	OK erm I'll have ice-cream please
Er	OK... <i>*acts out serving*</i> ...it's in it and I'll put it in a wee bowl. Do you want chocolate or strawberry or vanilla?
St	<i>*whispers in teacher's ear*</i> Chocolate
T	Yeah I'll always choose chocolate
St	Hey that's my favourite
T	Mine too
Er	Here <i>*hands her pudding*</i>
T	Thank-you
Er	I want to have chocolate cake
St	Can I have chocolate?
T	Yum <i>*eating*</i>
St	Chocolate ice-cream?
Er	Thank-you for coming to the tea party
T	Yeah!



T	Are you busy working?
Ch	No (speaking as the "farmer")
T	How's that lazy farmer?
Cn	It's bad <i>*shakes his farmer puppet*</i>
T	Oh what's the lazy farmer doing today?
Ch	I'm getting down
Cn	How goes the work? (from the story)
T	Is saying how goes the work?
Cn	<i>*nods*</i>
T	Is he doing some work. Is he?
Cn	<i>*nods*</i>
Jk	Miss, I'm doing work
Cn	No. The ducks
T	The ducks?
Ch	How goes the work (to Cn)?
Cn	How goes the work (to Ch)?
Ch	Quack
Jk	Quack
T	Oh there's the duck
Jk	Farmer lets duck that they want their own work. Farmers staying on in the bed
T	Oh no that lazy thing Jk I can't believe it. And what is the cow going to do about it?
Jk	Cow do do do. We going to scare them away <i>*goes away and wakes up Ch "the farmer"*</i> waaah!
Ch	I'm sleepy and asleep
T	Oh sleepy and tired?

Figure 6.3 'Puppet Tour' Exchanges between Teacher and Groups

That the wild setting exchanges are more sustained is plainly evident. The teacher's increased enthusiasm outdoors is perhaps also suggested by a total of four "*WOWs!*" versus only one indoors.

While less obvious, however, possibly the most significant difference is the manner of her participation. In the wild setting, interaction seems largely child-led, and the teacher seems to engage with their imaginary situations from *within*, without ever questioning their reality. For example, she asks of the 'dinosaur bone' "*so it's like from his leg? His ankle?*"; of the 'giant' "*is he friendly or not? Thank goodness for that!*"; and of the 'tea party' "*oh I thought I was having cake. Was that the main course?*"

Conversely, classroom interaction seems more teacher-led. Moreover, she also tends to presume the nature of the child's imaginary situation, and then talk about it from the *outside*. Some examples include questions such as "*are you being the cow?...and what would you say when you're being the cow?*" or "*are you busy working?...is (the farmer puppet) saying 'how goes the work'?*"

In short, outdoors the urban wood teacher seems immersed in the children's worlds, participating in them non-disruptively. In the classroom, however, she seems more an external observer, presuming these worlds, and interrogating and objectifying them on that basis. It is nontrivial in this respect that in unnamed 'Puppet Tour' transcripts, it is often difficult to distinguish between teacher and child in the wild setting –at the 'tea party', for example (Figure 6.4)– something which is rarely the case in the classroom.

## **6.6 Summary of Qualitative Variables**

Data from focused interviews with the four teachers who supervised the experimental tasks were provisionally coded according to the categories of the theoretical framework. Each category was then thematically analysed with the purpose of identifying common axes of difference between indoors and outdoors relevant to task performance, termed 'qualitative variables' (QVs).

Eleven QVs are proposed and these are set out in Table 6.1 below. These QVs and colour conventions will be taken forward for the Systems Analyses in the next section. A tangential finding relevant to the performance gap was the strength of wild setting recollections, and how rural wood teachers use these as an experiential and emotional resource to support disadvantaged learners in a classroom curricular context.

Framework Domains	Qualitative Variables	Description: <i>the level...</i>
1. Environment	<i>Prescriptiveness</i>	...to which setting promotes or inhibits creative options
	<i>Dynamic Novelty</i>	...of inherent continuous environmental novelty
	<i>Immersiveness</i>	...to which the setting supports an immersive task experience
2. Child's Experience	<i>Empowerment</i>	...of perceived agency and personal confidence during the task
	<i>Resourcefulness</i>	...of ideas available to individual children in fulfilling the task
	<i>Absorption</i>	...of individual task motivation, engagement and persistence
3. Socio-Linguistic	<i>Democracy</i>	...of general, inclusive task collaboration
	<i>Generative Conversation</i>	...of new ideas generation through conversation and co-creation
	<i>Self-sustenance</i>	...of sustained task-directed attention
4. Teacher's Experience	<i>Enjoyment</i>	...of personal enjoyment, relaxation and sense of freedom
	<i>Management</i>	...task management burden

**Table 6.1 Qualitative Variables by Framework Category**

## 6.7 Systems Dynamics

This section sets out the third stage of the interview analysis. This employed a thinking tool from the Systems Dynamics Methodology (SD) (Morecroft, 2010) to construct a general model of features and dynamics relevant to children's performance. The approach chosen offers a way of conceptualising and thinking about a complex situation as a whole, and of meeting the objective of a theoretical thematic analysis, that is, to propose interrelationships between constructs (Saldana 2012).

Specifically, a causal loop diagram (CLD) was constructed using QVs for its features, and dynamics between them which seem implied by interview data. The CLD, which appears in full in the chapter summary (Figure 6.16), was then investigated for reinforcing or balancing dynamics, termed closed loops (CL). The section will give an

overview of SD conventions sufficient for the reader to understand the diagrams, before moving onto describe the three CLs of interest which arose from the analysis.

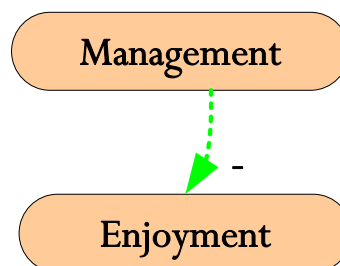
### 6.7.1 Closed Loops (CL): Diagramming Conventions

In a CLD, features of a situation are expressed as noun variables, shown as ellipses. These variables are then linked by arrows which represent hypothetical relationships between them, marked with plus or minus signs to indicate positive and negative relations.



**Figure 6.4 A Positive Relation (CLD)**

A connecting arrow with a *plus* sign indicates a *positive relation*. This signifies two variables which vary in the same direction – i.e. an increase or decrease in the variable at the arrow's tail results in a corresponding increase or decrease in the variable at the arrow's head, respectively. Figure 6.4 above gives one example from the CLD, which proposes that the *more* absorbed in a task children are, the *more* self-sustaining the task will be for the class as a whole; or the *less* absorbed they are, the *less* self-sustaining the task will be.



**Figure 6.5 A Negative Relation (CLD)**

Conversely, an arrow with a *minus* sign indicates a *negative relation*. Here two variables vary in an opposite direction –i.e. if the variable at the arrow’s tail increases then the one at the head decreases, or if the variable at the tail decreases, then the one at the head increases. Figure 6.6 shows one from the CLD, which proposes that a *reduction* of a teacher’s management burden, *increases* their enjoyment of a task; or if a task requires *greater* management, then the teacher enjoys it *less*.

The central purpose of a CLD is the identification of closed loops, either reinforcing or balancing (Morecroft, 2010; Wright & Meadows, 2009). A *reinforcing loop* is a cycle of variables where a change in one propagates through the others to reinforce the *same* change in the original variable, thus creating virtuous or vicious cycles of circular chain reactions, and is represented by the symbol in Figure 6.6 below.



**Figure 6.6 A Reinforcing Loop (CLD)**

A *balancing loop*, on the other hand, is a cycle which seeks equilibrium, where a change in one variable propagates through the loop to cause the *opposite* change in the original variable, the symbol for which appears in Figure 6.7 below.

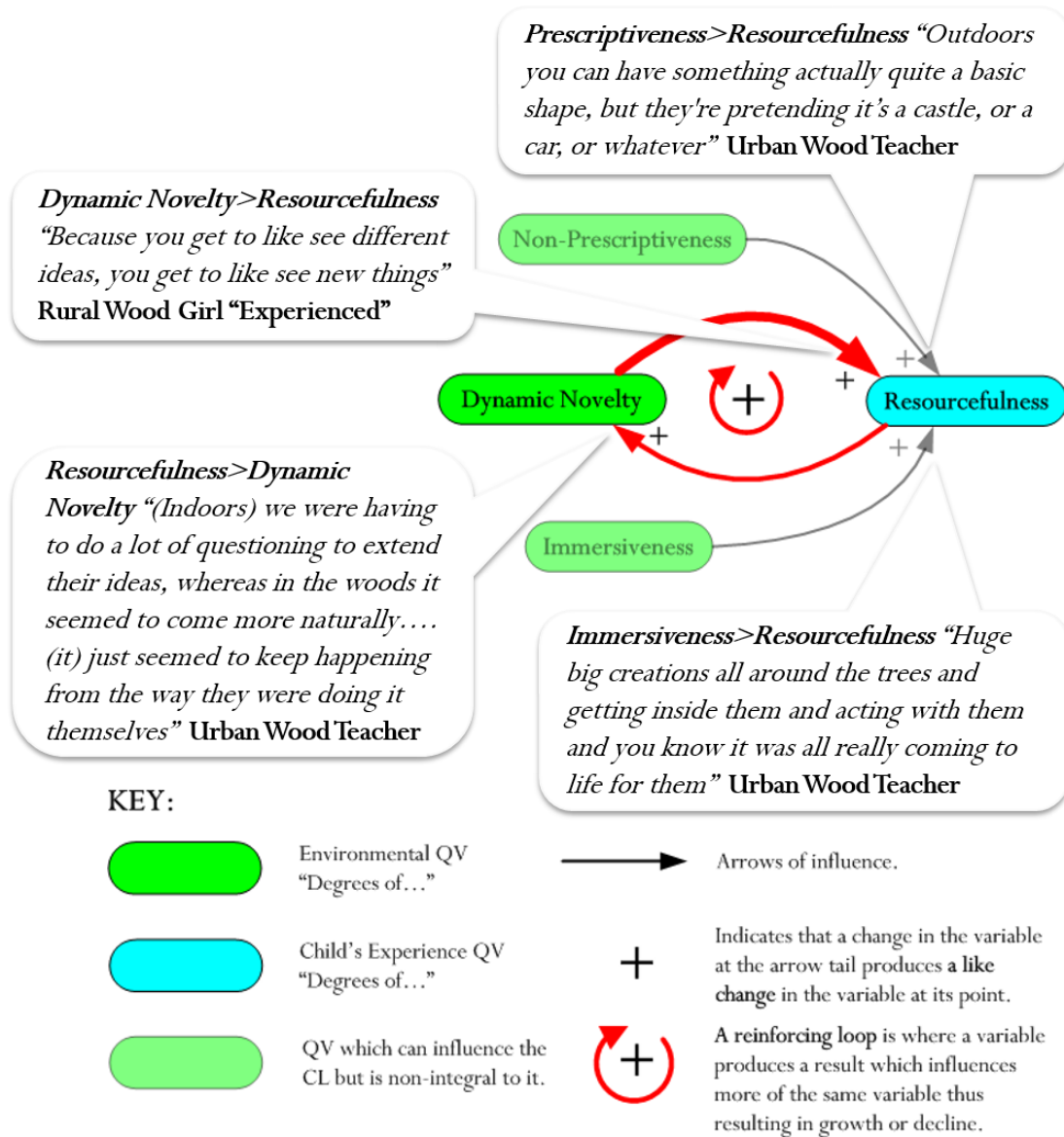


**Figure 6.7 A Balancing Loop (CLD)**



### 6.7.2 Closed Loop 1: ‘The Cognitive Engine’

The first CL arising from the analysis is a pair of reinforcing loops, termed ‘the cognitive engine’ for its implied role in fuelling children’s performance.



**Figure 6.8 Closed Loop 1a: ‘Dynamic Novelty’ and ‘Resourcefulness’**

The first loop appears in Figure 6.8 above. QVs are coloured according to framework category, and the proposed CL itself comprises ‘dynamic novelty (environment: green)’ and ‘resourcefulness (child’s experience: blue)’. The two greyed-out environmental QVs indicate that while, theoretically-speaking, they may promote or inhibit the CL’s behaviour, they are not integral to the dynamic. For readability, the polarity, but not the meaning, of one QV, ‘prescriptiveness’, has been reversed to ‘non-prescriptiveness’, so

all arrows of influence in the diagram are positive relations (+). For each relation proposed between two QVs here and henceforward, a representative quote is given in support, and which is viewed to implicate both of them.

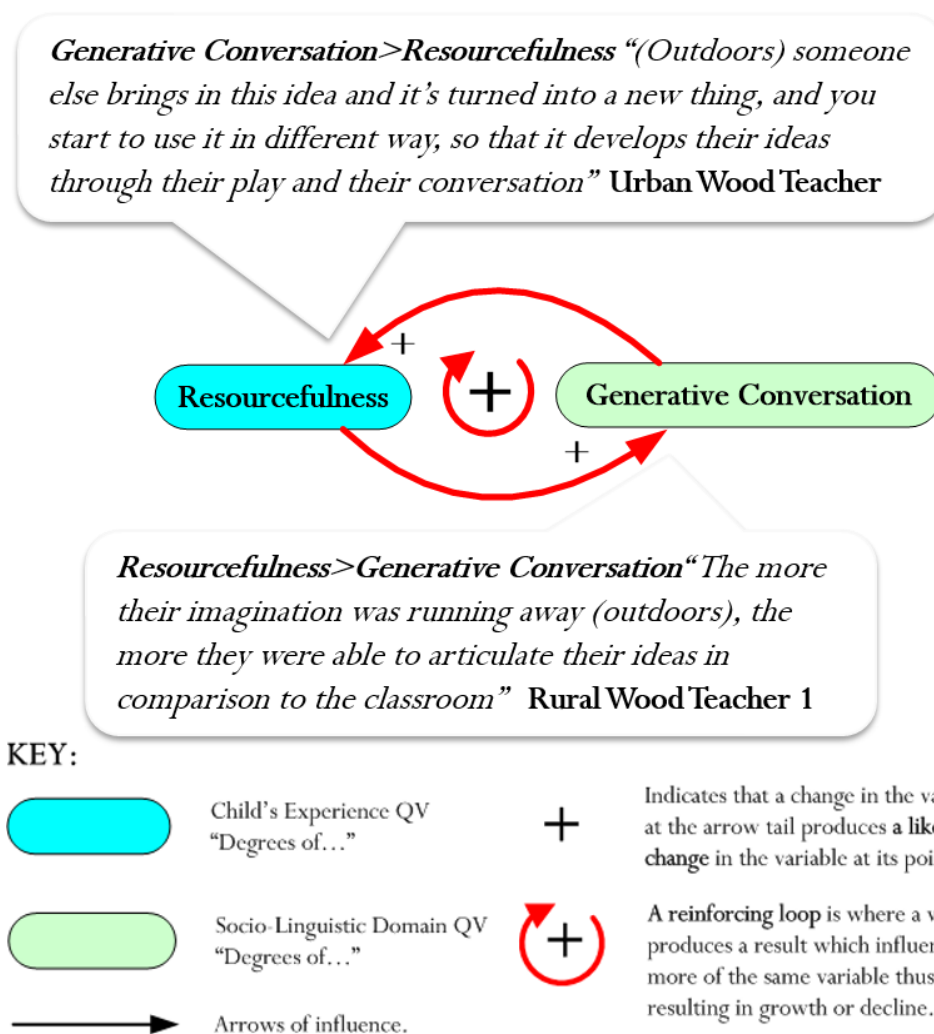
The closed loop in 6.8 proposes that *the supply of inherent novelty in a task setting* ('dynamic novelty') *both promotes, and is exploited by, the imaginative resources of individual children* ('resourcefulness') *when fulfilling the task.*

When 'dynamic novelty' levels are high (represented by the thick red arrow), such as is implied for the outdoors, and particularly the wild settings, it is put forward that the CL may be self-propagating (i.e. reinforcing). In other words, inherent environmental novelty enriches the individual with ideas, which, in turn, enables them to perceive, and capitalise on, more inherent novel possibilities, and so forth. Conversely, the lower the levels of 'dynamic novelty' become, the more the individual must draw on their own personal resources to fulfil the task requirements (i.e. in the absence of other systemic elements).

It is further put forward that environmental affordances could promote or inhibit this dynamic by their impacts on creative expression (non-prescriptiveness), or their capacity to support an immersive task experience (immersiveness).

Figure 6.9 overleaf represents the second of 'the cognitive engine's' reinforcing loops. Diagrammatic conventions are the same as the first, though this includes a cream Socio-Linguistic Domain QV.

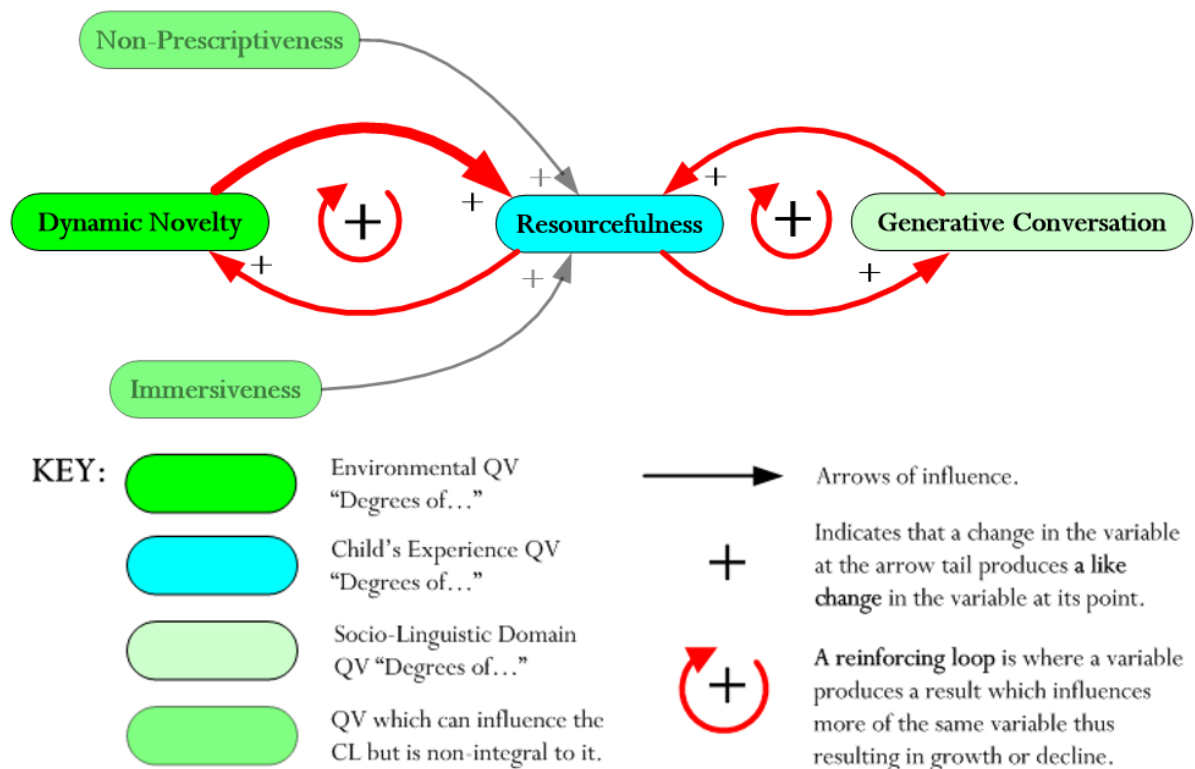
The loop proposes that *the greater the imaginative resources of individuals* ('resourcefulness'), *the more productive their creative collaboration* ('generative conversation'), *which in turn generates new ideas for participants to exploit* ('resourcefulness'), and so forth, in a self-propagating cycle. As with the first loop, the dynamic also implies that the lower the levels of 'generative conversation', the more individuals must draw on their own, or other, resources to sustain collaboration or fulfil task requirements.



**Figure 6.9 Closed Loop 1b: ‘Resourcefulness’ and ‘Generative Conversation’**

Figure 6.10 overleaf represents the complete ‘cognitive engine’ which combines the two loops into a single mutually-reinforcing dynamic. Here, individual task ‘resourcefulness’ is promoted or inhibited by the availability of new ideas from the setting (‘dynamic novelty’) or collaborative context (‘generative conversation’), where new ideas, in turn, unlock new environmental and collaborative possibilities.

It is proposed that the main difference in this dynamic between indoors and outdoors, and playground and wild settings, is the degree to which inherent ‘dynamic novelty’ supplies and sustains the flow of ideas through the system. The CLD implies that the less ‘dynamic novelty’ there is, the more individuals must rely on other sources of ideas to fulfil the task, e.g. teacher, peers, or their own imagination or past experience.

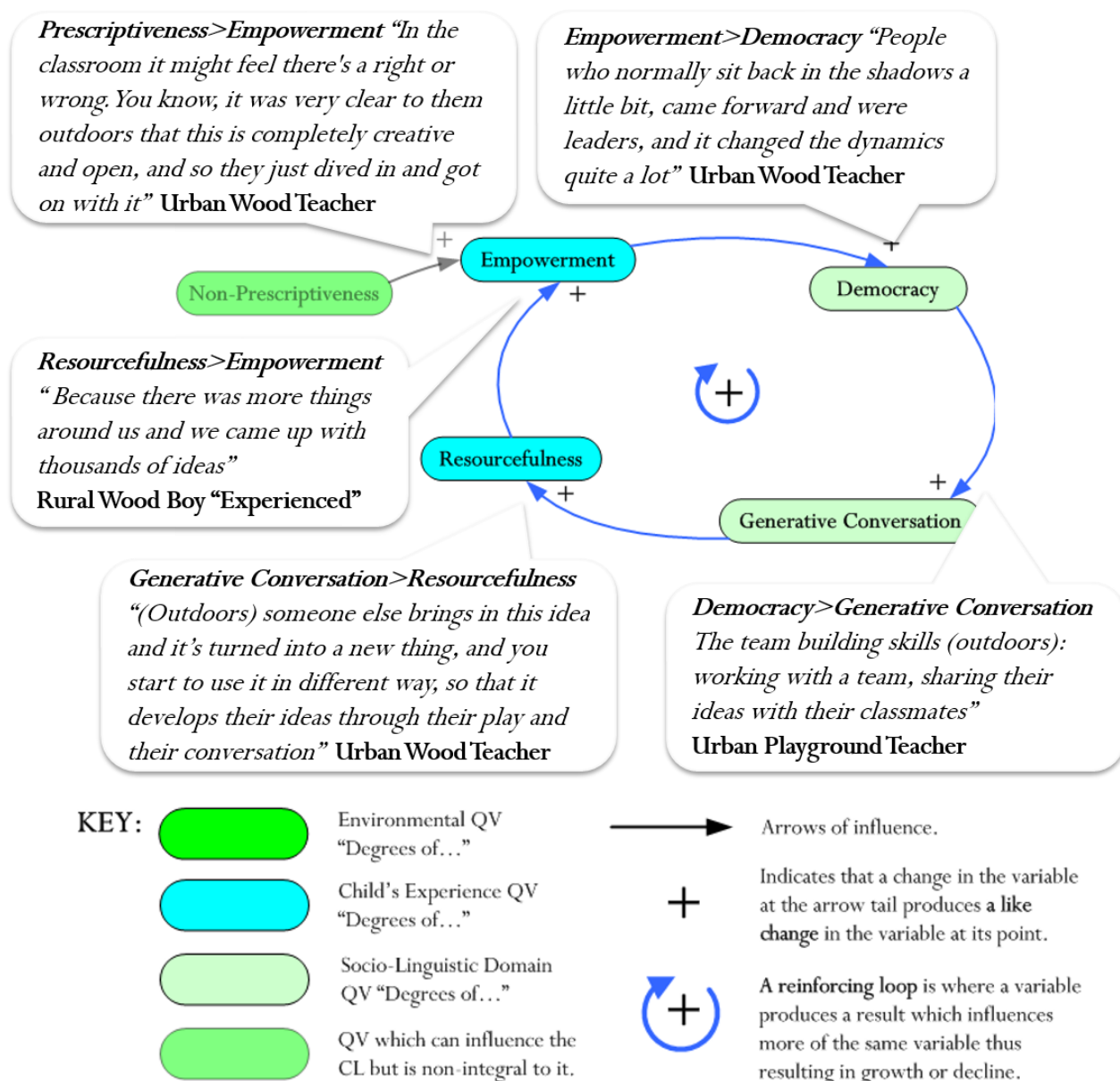


**Figure 6.10 Closed Loop 1: The 'Cognitive Engine'**

### 6.7.3 Closed Loop 2: 'Regulatory Aspects'

The second proposed CL is termed 'regulatory aspects', because the dynamic appears to facilitate the flow of ideas enabled by 'the cognitive engine'. This also entails a pair of reinforcing loops, the first of which is shown in Figure 6.11 overleaf.

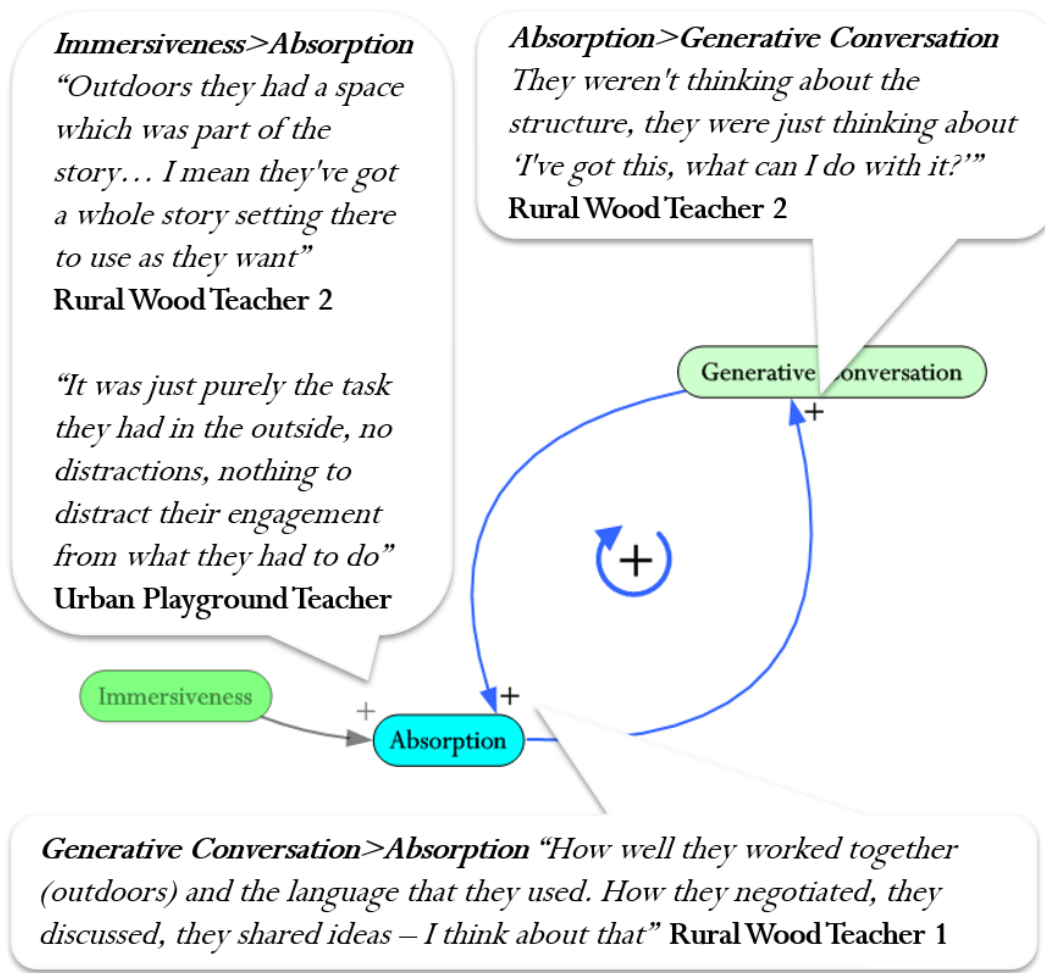
The CL includes four QVs. Beginning with 'empowerment', in its positive aspect, the loop proposes *that the more confident and autonomous a child feels* ('empowerment'); *the more disposed toward active contribution they become* ('democracy'). This, in turn, *promotes more productive collaboration* ('generative conversation') which, via the same relation as CL1, *enhances individual 'resourcefulness'*. This then *reinforces self-confidence and perceived self-agency* ('empowerment') which completes the cycle, and begins it again. Conversely, in its negative aspect and taking the same route, the dynamic implies that reduced participation due to lack of confidence or perceived autonomy will have negative consequences for the overall productivity of task collaboration. This in turn, means less ideas are available for children, which reinforces low levels of confidence and perceived autonomy.



**Figure 6.11 Closed Loop 2a: 'Empowerment' and 'Democracy'**

While no environmental QVs are essential components of the loop, it is proposed that 'non-prescriptiveness' can influence its behaviour through its relation with 'empowerment'. This influence is perhaps easier to conceptualise as an inhibitory factor, where affordances which limit personal creativity impact negatively on confidence or perceived self-agency, with self-propagating effects proposed.

'Dynamic novelty' can also influence this loop through its stimulating or disabling effects on individual 'resourcefulness'. As the relation has already been described in 'the cognitive engine', it is not included in these diagrams.

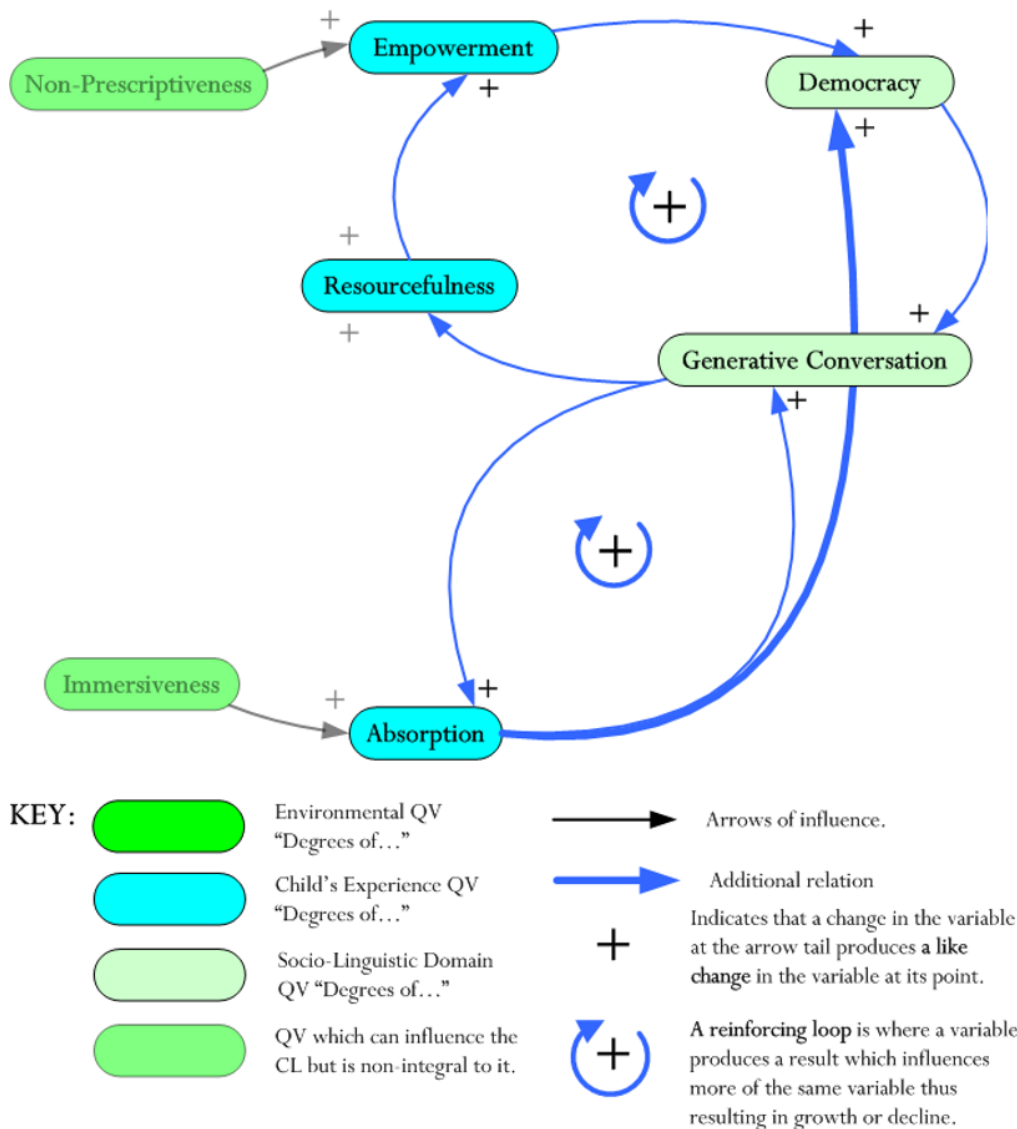


**Figure 6.12 Closed Loop 2b: ‘Absorption’ and ‘Generative Conversation’**

In the second loop, illustrated in Figure 6.12 above, it is proposed that *that the fruitfulness of task collaboration* (‘generative conversation’), *both reinforces, and is influenced by, the engagement of its participants* (‘absorption’).

While not an essential component of the loop, it is also put forward that ‘immersiveness’ can influence its behaviour, and might be thought of as the capacity of a setting to support the child’s moment-to-moment immersion in their activities (‘absorption’).

Figure 6.13 overleaf combines the two loops into a single reinforcing dynamic, linked via shared Socio-Linguistic Domain QVs. One further reinforcing relation between ‘absorption’ and ‘democracy’ appears here (the thick blue arrow), which proposes that *the more immersed an individual is in moment-to-moment activities* (‘absorption’), *the less their extrinsic preoccupations inhibit collaboration* (‘democracy’).



**Figure 6.13 Closed Loop 2: 'Regulatory Aspects'**

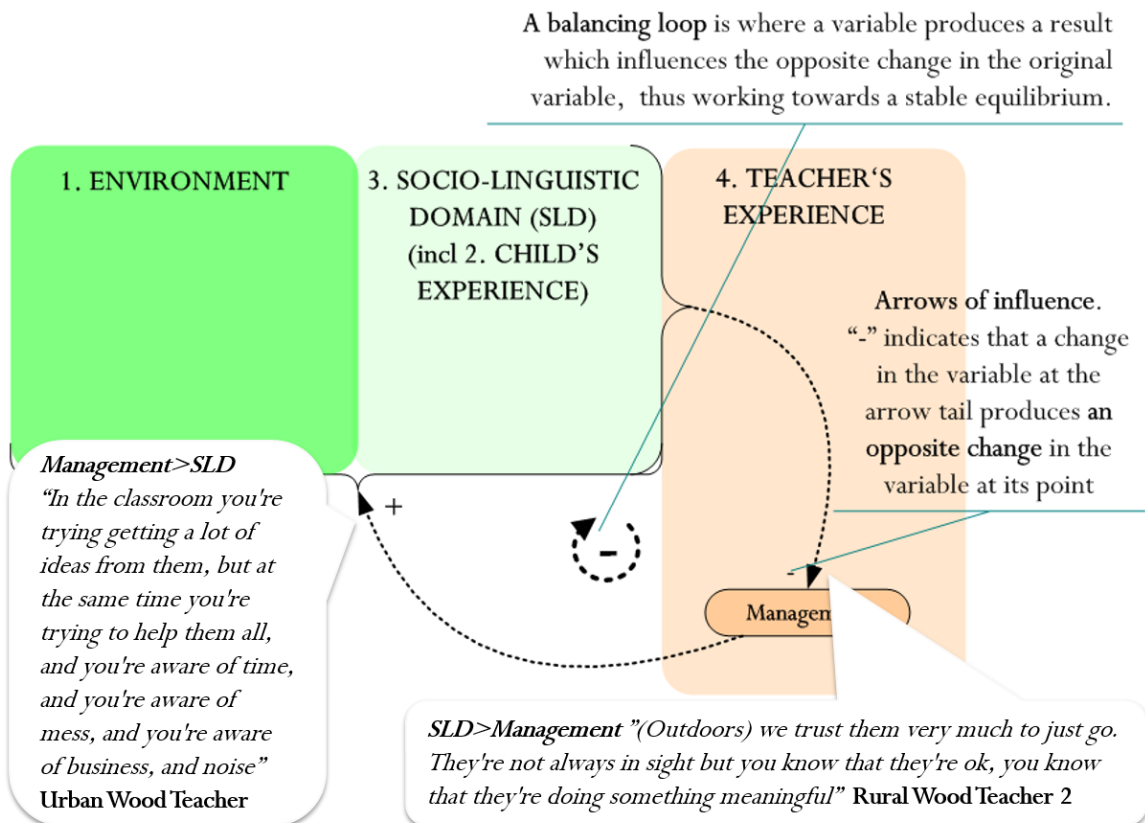
In summary, CL2 would seem to represent regulatory aspects of task-related cognition, as opposed to those enabling aspects suggested by 'the cognitive engine'. The regulatory dynamic hinges on a reinforcing enabling interrelationship between social phenomena and individual confidence, autonomy and attention. The CLD also implies environmental QVs can support and promote this dynamic through their enabling and regulating effects on the individual. Equally, as levels of these QVs decrease, the implication is that their effects may need to be achieved by other means to maintain CL2, for example, through better organisation of the Socio-Linguistic Domain, encouragement of less confident individuals, or the greater application of attention by children.

### 6.7.4 Closed Loop 3: Teacher Feedback Effects

The last CL pertains to the teacher’s experience, and is termed ‘teacher feedback effects’ on account of its performance implications.

CL3 is also composed of multiple loops, the first of which appears in Figure 6.14 overleaf. This entails the CLD’s sole negative relation (-), which also gives rise to its only balancing loop, or a dynamic which works towards a stable equilibrium.

The loop proposes that *levels of overall task self-sufficiency, individual and group, are inversely related to the teachers’ task management burden*. Stated simply, to the extent that children cannot or will not fulfil task requirements, the teacher must take compensatory action, for example, by supplying ideas and support, or managing behaviour and the environment. The implication is that this may have been more the case in the indoor settings.

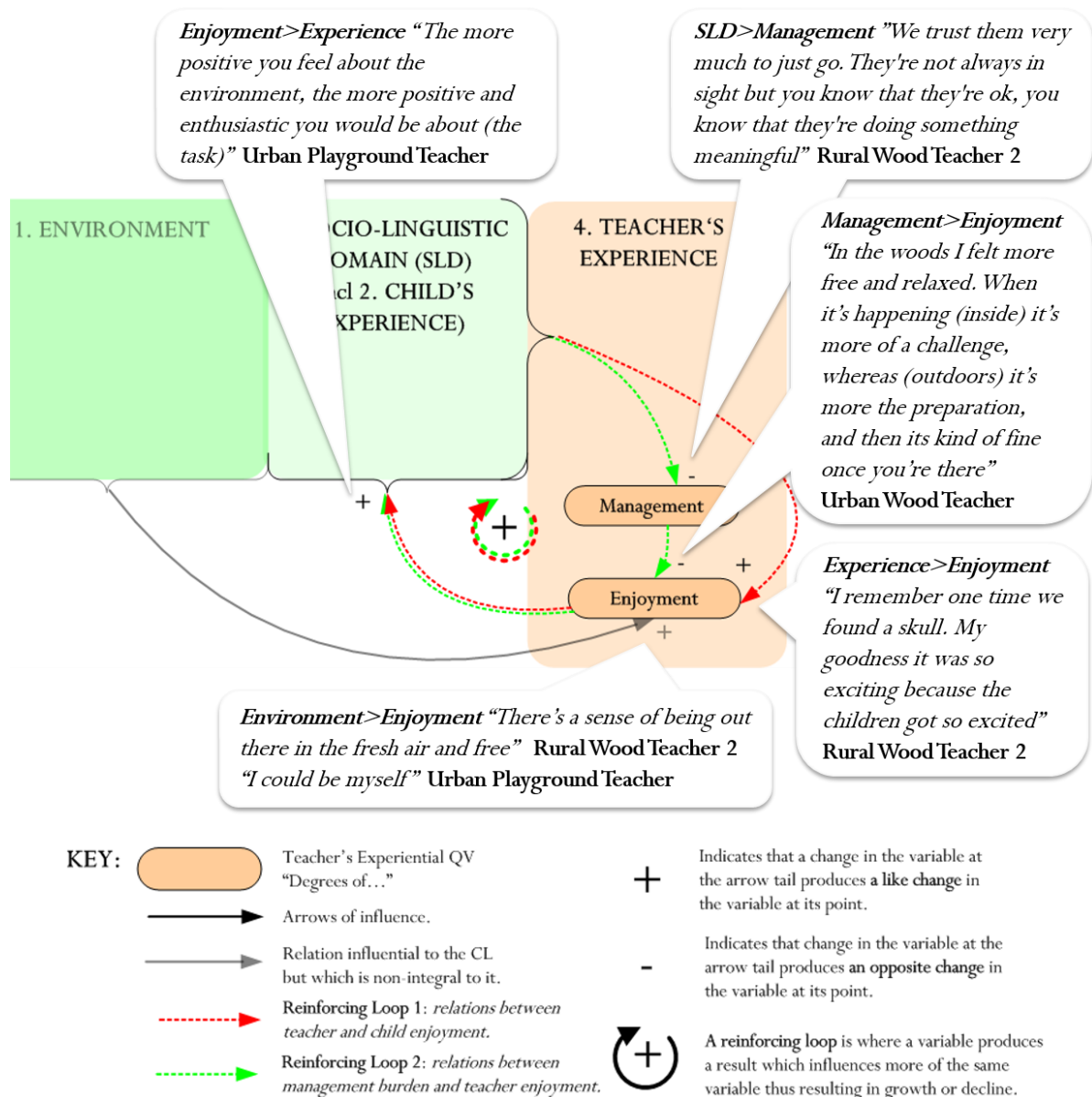


**Figure 6.14 Closed (Balancing) Loop 3a: Management Burden**

Figure 6.15 overleaf completes CL3 through the addition of two reinforcing loops related to teacher enjoyment. The first, indicated by the red arrows, proposes that



positivity in a task scenario is mutually reinforcing. In other words, the more positively engaged the children are in a task, the more the teacher enjoys their participation ('enjoyment'), and vice versa.



**Figure 6.15 Closed (Reinforcing) Loop 3b: Teacher Enjoyment**

The second reinforcing loop, represented by the green arrows, postulates that *the lower the task management burden (management), the more enjoyable the teacher's experience (enjoyment)*, where their enjoyment may then serve to regulate management burden, indirectly, by promoting children's performance.

While no environmental QVs are integral to CL3, some interview data suggest teachers' enjoyment outdoors may have entailed aspects of 'immersiveness' (e.g. "*you're doing whatever it is you're doing, and you're imagining*") and 'non-prescriptiveness' (e.g. "*I could be myself*"; "*being out there in the fresh air and free*"). On the assumption that these factors may have had regulatory implications similar to those proposed for the children in CL2, CL3 also supposes a positive relation between 'environment' and 'enjoyment'. This represents *the teacher's inherent enjoyment of the task setting*, which it is proposed may have influenced these dynamics outdoors.

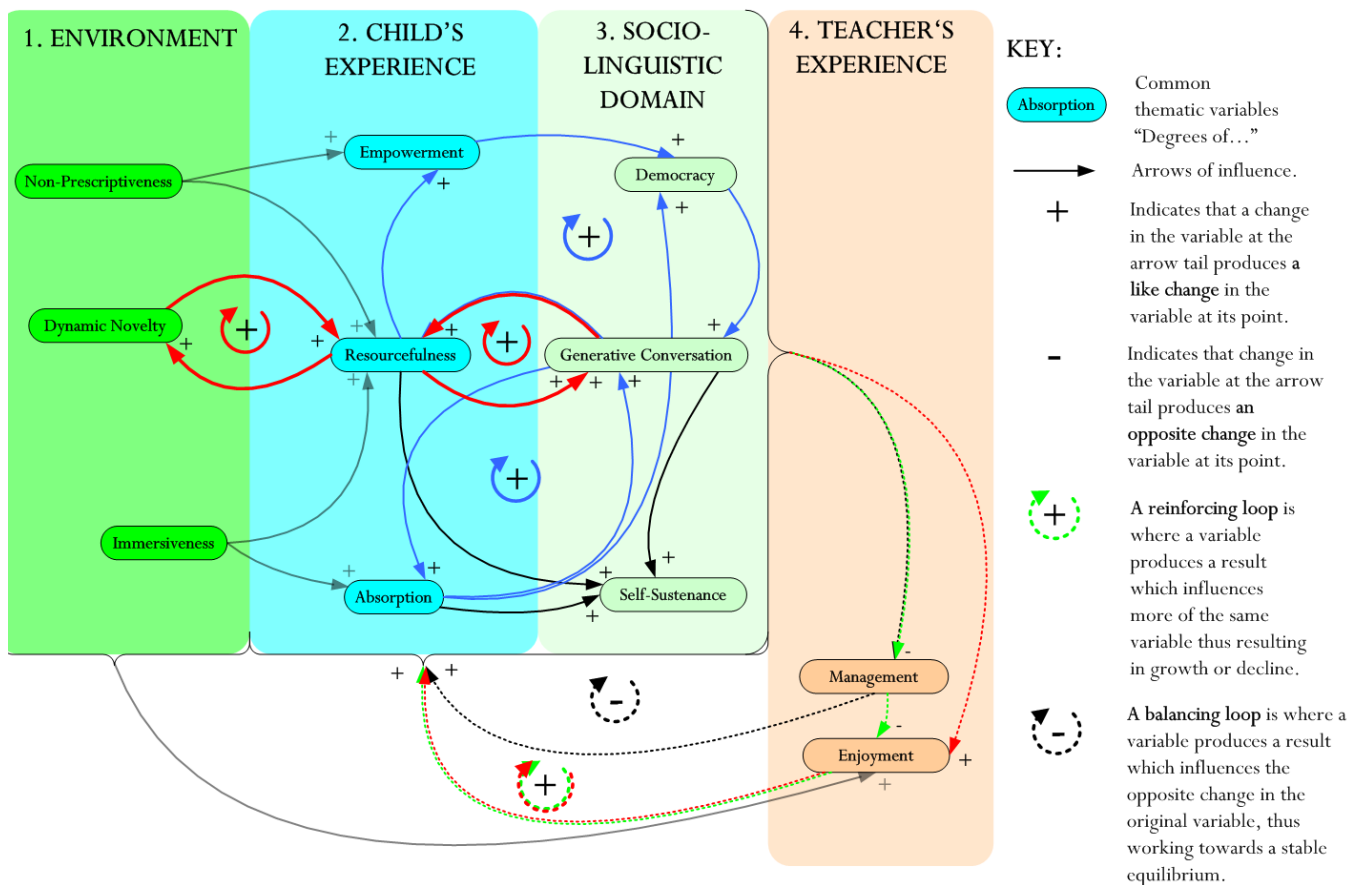
## 6.8 Summary of Analyses of the Teachers' Task Perspective

This chapter set the findings of Stage 3 of data gathering and analysis, which entailed focused interviews with the 4 teacher participants, and with a guide informed by the categories of the theoretical framework. Stage 3 sought to address the thesis's third objective and research hypotheses by enriching the dataset and providing an integrative context for prior findings. Specifically, the aim was *to capture a whole task 'expert' perspective from the teachers, and then use common themes to construct a general model of cognitively-relevant features and dynamics*.

This was achieved by a three stage approach. The first was a provisional coding of interview data by the categories of the theoretical framework. The second was a thematic analysis of the data allocated to each category to identify common features, or axes of difference between indoor and outdoor phenomena, termed 'qualitative variables (QVs)'. Finally a systems analysis was performed which sought to explore relationships and dynamics between the QVs. The main findings of the subsequent two stages are:

*Thematic analysis:* Eleven QVs were identified as relevant to children's performance. These QVs and how they relate to the theoretical framework were introduced at the chapter outset in Figure 6.1.

*Systems Analysis:* Employing thinking tools from the Systems Dynamics Methodology, a hypothetical causal loop diagram (CLD) was constructed from the 11 QVs, using interview data which implied promotive or inhibitory relationships between specific pairings. The complete CLD appears in Figure 6.16 overleaf.



**Figure 6.16 Causal Loop Diagram involving all Qualitative Variables**

An analysis of the CLD identified three closed loop dynamics (CLs 1-3) which may offer holistic insights regarding differences between indoor and outdoor phenomena.

CL1, termed ‘the cognitive engine’ entails a virtuous cycle of ideas generation and propagation. It has implications at an individual and a group level, and suggests inherent environmental novelty may be a significant driver in the outdoor settings.

CL2, named ‘regulatory aspects’ entails reinforcing dynamics between social phenomena and individual confidence, autonomy and attention, which serve to facilitate ‘the cognitive engine’. While environmental QVs are not integral to CL2, the CLD implies it could be promoted by enabling and regulating aspects of the outdoor settings.

Finally, CL3 is called ‘teacher feedback effects’, and involves a mutually-reinforcing relationship between teacher and children enjoyment of the outdoor task and setting. It also implies teachers’ reduced management burden outdoors may arise from children’s greater task self-sufficiency, and that this may be a factor in their enhanced enjoyment.

## CHAPTER 7: DISCUSSION OF ENVIRONMENTAL FACTORS

### 7.0 Introduction

This chapter and the four that follow constitute the thesis's main discussion. These set out to resolve the two main research hypotheses:

- **RH1.** *The performance of primary schoolchildren on a curriculum task will be better in a natural setting than a classroom.*
- **RH2.** *There will be a positive association between the natural richness of the task setting and the children's performance.*

They also seek to address the fifth and sixth thesis objectives, respectively, *to discuss findings and their relationship to cognitive factors and the theoretical framework* (for an explanation of cognitive factors see 2.0 p.13) and *to draw conclusions and recommendations regarding the value of outdoor learning to primary school educational and policy objectives*, the latter which is only relevant to Chapter 11.

Chapters 7-9 will each tackle a different framework category, beginning with the physical *environment*. Chapter 8 pertains to the *child's experience*, while Chapter 9 deals with the *socio-linguistic domain* and the *teacher's experience*. Each chapter is broken down into discrete discussion of cognitive factors relevant to the particular framework category. Chapter 10 has a specific focus on memory, treated separately on account of its importance to school learning, and because the discussion of previous cognitive factors supports the explanation of related findings. Chapter 11 addresses objective 6, summarising the educational and policy implications of prior discussion, and proposing recommendations. Each CF and framework category has its own summary and these build over the course of the chapters into a general model of relationships between environment and cognition across all experiments, which is presented in Chapter 11.

This chapter focuses predominantly on the first CF, *affordances*, and empirical support for RH2. After an overview of related findings, there is discussion of three environmental variables –*novelty*, *(utilitarian) complexity*, and *extent*– which may be of

significance to these findings, and the CFs that follow. The chapter ends on a summary of discussion outcomes.

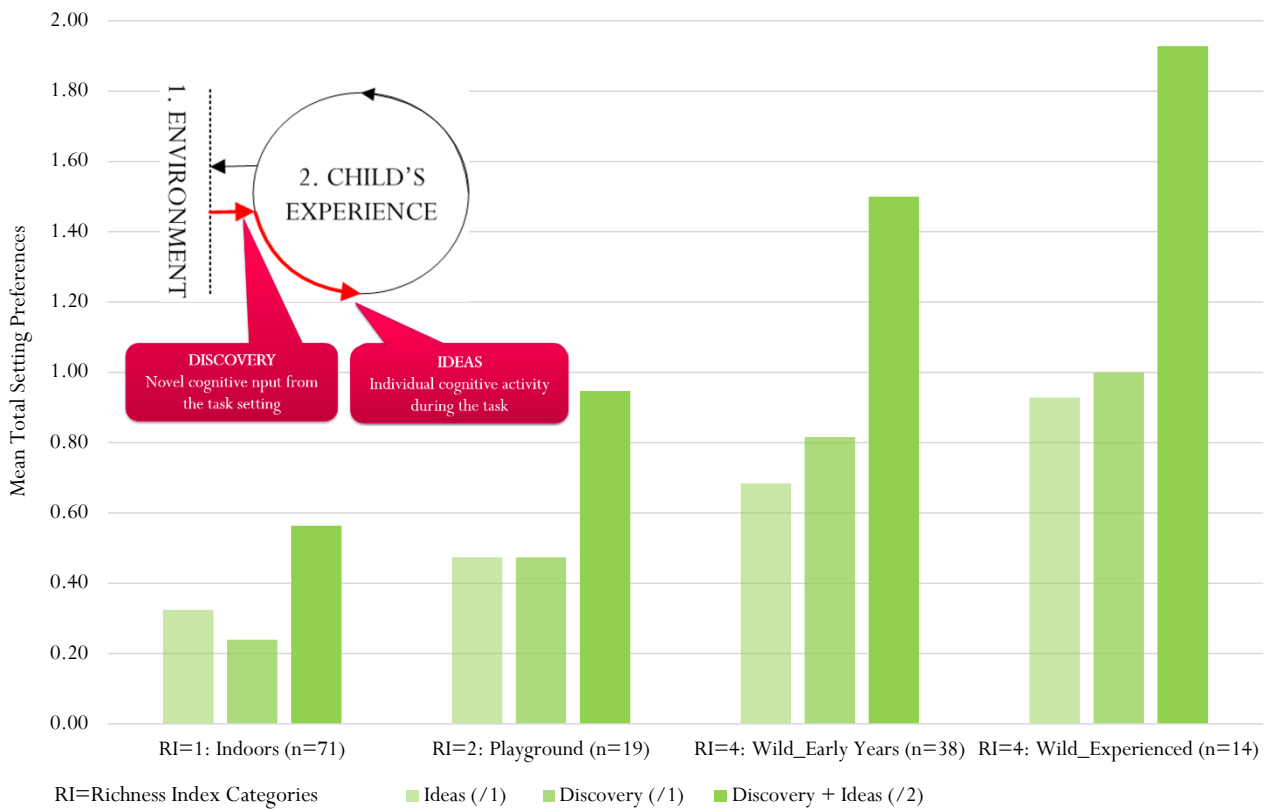
### *Empirical support for RH2*

Findings from across Stages 1-3 imply an association between natural richness and performance, and support RH2. A common theme of Stage 1 observations was the richer diversity of task outcomes and interpretations in the wild setting, particularly notable on the urban wood tasks, where they were also linked to environmental novelty. This is illustrated by the ‘Puppet Tour’ interactions analysis, where a third of the activities in the first 10 minutes were categorised as specific concrete or imaginative discoveries. These activities featured the richest content of those observed, and appeared to have no explicit classroom or playground equivalents.

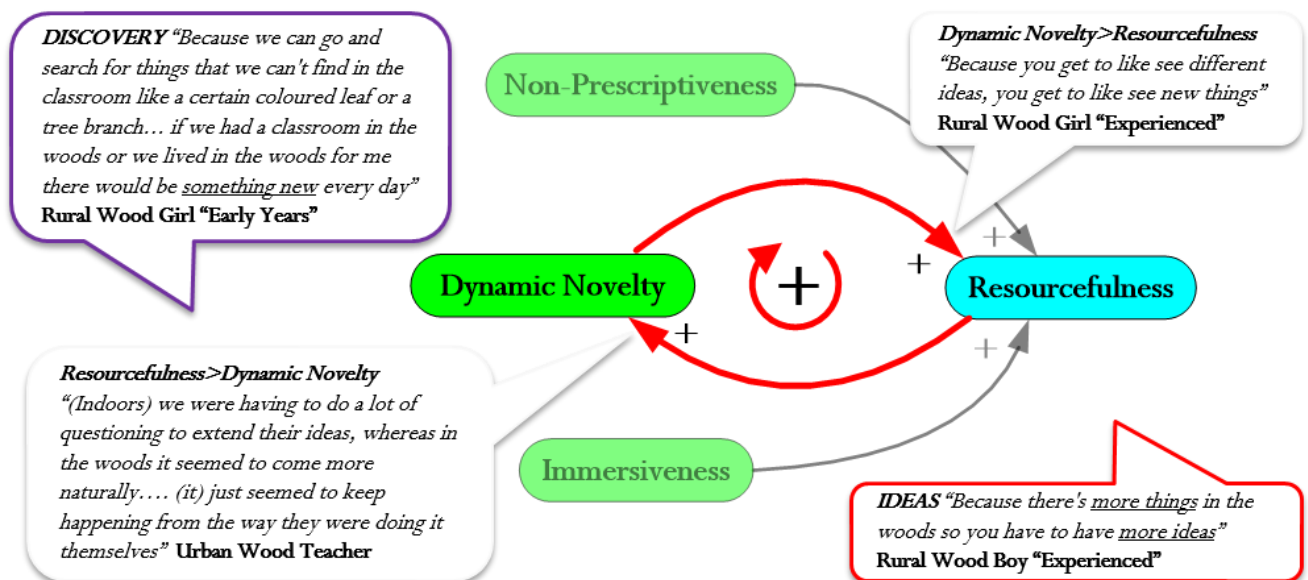
For Stage 2, although performance setting preferences were significantly stronger for wild settings than the playground overall, the key statistical association between natural richness and performance was between the outdoor categories of the Richness Index (RI) and the PCA component ‘creative compatibility’. ‘Creative compatibility’ is proposed to be underpinned by a concept of active task cognition where a child feels creatively enabled, stimulated and comfortable, and is comprised of the PRS criterion ‘compatibility’ (“*where I liked being the most*”), and the performance criteria, ‘discovery’ (“*where I discovered most*”) and ‘ideas’ (“*where I had the best ideas*”).

Data for all three criteria exhibited a graduated relationship across all RI categories, and stronger preferences for the experienced children over the early years’ in the wild setting. Particularly, differences were significant for ‘discovery’ for the outdoor settings, and at trend levels for ‘ideas’.

The graph in Figure 7.1 overleaf illustrates this relationship, showing mean setting preferences for the two criteria against RI categories in increasing order of richness, with wild setting values separated for experienced and early groups. In the theoretical framework, ‘discovery’ and ‘ideas’ are closely related to environment and to each other, as shown in the inset in Figure 7.1, representing levels of novel environmental input and cognitive activity, respectively.



**Figure 7.1 Effects of Natural Richness on ‘Discovery’ and ‘Ideas’**



**Figure 7.2 ‘Dynamic Novelty’ and ‘Resourcefulness’**

Although the experienced group returned the strongest preferences, the consistency of the early years' wild setting statistics across distinctive tasks and schools, and including novice and apprentice outdoor learners, is perhaps the study's most potent basis for analytical generalisation in relation to RH1. Notwithstanding a relatively small sample, that the only notable within-group difference for 'creative compatibility' criteria pertained to RI score, seems compelling support for an environmental effect.

Lastly, a closed loop arising from the Stage 3 analyses, 'the cognitive engine', was proposed to represent a virtuous relationship between inherent environmental novelty and the resourcefulness of individual children. 'The cognitive engine' is shown in Figure 7.2 with quotes supportive of the relationship, including comments from the rural children corresponding to 'discovery' and 'ideas', respectively.

Overall, these findings are broadly consistent with previous research reporting the greater diversity or creativity of children's activities in natural settings. Particularly pertinent, are those studies which have highlighted environmental discovery as a relevant factor (Waite & Davis, 2007), compared natural settings with built or playground ones (Grahn et al, 1997; Kirkby, 1989), or have observed relationships between behaviour and landscape features or qualities (Taylor, Wiley, Kuo, & Sullivan, 1998; Fjørtoft, 2004; Fjørtoft, 2001; Frost & Strickland, 1985; Miller, 1984).

## 7.1 Novelty

One of the more remarkable study findings is the conceptual agreement between 'creative compatibility' and 'the cognitive engine'. Although outcomes of epistemologically-distinct higher-level analyses, both share the idea of an enabling relationship between inherent environmental *novelty* and children's imaginative resources. This section seeks first to ground this relationship in concrete interactions observed in relation to the RI's categories and items, before moving onto examine the role of novelty in cognition through several theoretical lenses.

### ***7.1.1 Relationships between the Richness Index, and Discovery and Ideas***

#### *Affordance category*

Task observations would suggest that any association between the Richness Index and imaginative resourcefulness in the wild settings, was primarily attributable to affordance category item 2, “*the variety of loose objects and materials*”. This was particularly so for the urban wood tasks, where a significant majority of wild setting interactions appeared related to the item, for example, the ‘limbo’ pole, ‘Scotland’ stone, and materials for construction. The observation is consistent with Miller’s study, which reported the heavy use of loose materials as a key distinction in children’s behaviour in a woodland setting, compared with a playground (Miller, 1984).

Gibson emphasises the value of ‘detached objects’ which “*afford an astonishing variety of behaviours, especially to animals with hands*” (Gibson, 1986, p.133). A link between item 2 and experiential novelty is also suggested by Nicholson’s “Theory of Loose Parts”. Based on observations of child’s play, the Theory proposes that:

*“In any environment, both the degree of inventiveness and creativity, and the possibility of discovery, are directly proportional to the number and kind of variables”* (Nicholson, 1971).

Other items from the RI’s affordance category in the wild setting which did not feature in the classroom or playground, may have also promoted levels of discovery and ideas. These included materials for creative manipulation (item 1, e.g. mud ‘marshmallows’); fixed features such as trees (item 5, e.g. a ‘beanstalk’ or ‘swinging’ branch), rocks (item 6, e.g. ‘balancing’ rock), and water (item 4, e.g. a ‘splashing’ puddle), and routes and paths (item 7) which may have prompted movement which led to novel experiences. Observations suggest a greater emphasis on these other items for the ‘Alien Adventure’ task, which entailed less construction activities than the urban wood tasks.

#### *Biodiversity category*

Animals, or their by-products, are also implicated in experiential novelty on the wild setting tasks (items 1, 2 and 5, e.g. worms, slugs, ‘little birds’, and ‘dinosaur bones’). While these discoveries often seemed incidental to the tasks, they became central to the



conception of at least one wild setting project: ‘Puppet Tour’s’ ‘slug and snail zoo’. Here, Gibson’s comment that living animals are “*the richest and most elaborate affordances of the environment*” because “*they interact with the observer and with another*” (1986, p.134) would seem to apply. Indeed, on the basis of these encounters, animals might reasonably be added to the RI’s affordance category. Lastly, children may have also interpreted the phenomenal depth conferred by biodiversity in the context of novelty, for example, a snail’s ‘sliminess’ or a nettle’s ‘sting’.

### *Relationships between Affordances and Biodiversity categories*

Without a semi-wild versus wild setting comparison, the study cannot establish if affordance richness would have yielded similar results in the absence of biodiversity. In the context of these experiments, the relationship between the two RI categories is complex, rendering it difficult to speculate as to their relative contributions.

For example, it is proposed above that phenomenal depth may have been a factor in perceptions of wild setting novelty. However, Gibson proposes affordances precede and mediate phenomenal understanding, stating that “*objects are not built up of qualities, it is the other way round...the meaning is observed before the substance and surface, the colour and form, are seen as such*” (1986, p.134). This contrasts with the perspective that children’s object knowledge is constructed bottom-up from sense impressions. It also suggests affordances might be viewed as the means by which phenomenal novelty extant in the wild settings was mediated, and thus, the RIs affordance and biodiversity categories seem inseparable in the study context.

The interrelatedness between the two categories is further highlighted by the task measure ‘affordance open-endedness (AOE)’. While AOE returned no significant findings on its own, it confounded early regression and factor analyses. This effect was traced to a mutually-reinforcing correspondence with RI score, where wild setting tasks consistently also scored highest for AOE. However, the high AOE was not due to task design or teaching choice, but to the inherent availability of natural affordances. In the classroom and playground, children could not have fulfilled tasks without the provision of materials, and this lowered their AOE score. However, in the wild setting

biodiversity conferred a ready-made toolkit such that no additional task materials were required.

### *Summary*

Task observations support the idea that children's perceptions of novelty and resourcefulness may have been strengthened by RI items which occurred naturally in the wild setting, but not the classroom and playground. Of the affordance category items, the inherent abundance of loose materials seems most strongly implicated, as these underpinned the majority of activity on the urban wood tasks. The biodiversity category may have also made a contribution via encounters with animals and their by-products, sensory experiences, and by generating a rich diversity of natural materials. It has been argued that the two RI categories cannot reasonably be considered separately in the context of the study's outdoor experiments.

### **7.1.2 Novelty, 'Discovery' and 'Ideas'**

Edward Reed states that “(while) affordances provide opportunities for behaviour and awareness. Whether the animal takes up these opportunities or not is a separate matter” (Reed, 1996, p.108). What then is that separate matter? If there is a meaningful relationship between the RI and 'discovery' and 'ideas' in the wild settings, what could have motivated children to exploit the richer inherent opportunities?

Esther Thelen highlights the centrality of *environmental novelty* to the theories of both Gibson and Piaget, drawing attention to the 'food-for-the-senses' metaphor which permeates both interpretations (Thelen, 1996). For Piaget, a child's primary motivation is to achieve equilibrium with its environment, through exploration and interaction (Piaget & Cook, 1998). Thelen discusses this:

*“One can consider Piaget's structural invariants of assimilation and accommodation, in the service of equilibration, as providing the continuing motor for change. Infants actively seek out aspects of the environment to feed into their existing mental structures,*

*change their structures and then seek out new aspects in the continuing dialectic”*  
(Thelen, 1996, p.313).

While Thelen refers to early development here, the inclination at the preoperational stage towards physical exploration (Bateson & Martin, 2000), and concrete experience as a basis for language and social interaction (Piaget & Cook, 1998) would imply it is still of much relevance to the study age group.

So how do we apply such concepts to the context of a specific curriculum task? One might conceptualise a task goal as initiating a *novel and particular condition of disequilibrium*, by transforming a neutral task setting into affordances of potential pertinence to the specific goal, and where a form of equilibrium is reached upon its fulfilment. To put it more simply, a child may perceive different action possibilities in the same setting depending on whether they are instructed to build a den, explore an alien planet, or hunt for animals. In this sense, experiential novelty is not merely attributable to a setting’s affordances, but also to the layer of meaning they enable for the individual in the context of purposeful activity.

Thus the child is then motivated to seek a dialectic with the affordances of a task setting in service of the specific state of equilibration which that task initiates. In Piagetian Theory, the “*motor of change*” for a task dialectic entails two complementary cognitive processes: *assimilating* new experiences with one’s pre-existing schemas, or if they don’t fit, *accommodating* them within new structures. For Piaget, it is the interplay and unity of both which gives rise to knowledge creation and acquisition in the process of seeking equilibration and novelty (Piaget & Cook, 1998).

In Berlyne’s Model of Aesthetics (MoA) (1971), *novelty* is chief among the four *collative variables*. Arguably, it is also strongly implicated in the other three. *Incongruity* and *surprisingness* imply novel relationships between a setting’s features and context, and *complexity* may also have novel situational aspects, to be discussed shortly. As outlined in Chapter 2, collative variables are theoretical qualities of stimuli which provoke *perceptual conflict* with our experience of other past or present stimuli. Berlyne argued that we have a basic need for perceptual conflict, where optimal levels of cognitive stimulation, termed *arousal*, are rewarded by positive affect, termed *hedonic tone*. Stimulation is gained by seeking out the novelty, and the other collative variables in the environment through *diversive exploration*, and *specific exploration*, to resolve perceptual conflict encountered.

The MoA assumes a direct perceptual relation between collative variables and exploration, which he terms a *mediating response*. Two categories of mediating response fall wholly within the field of meaning: the *imitative* and the *verbal / imaginal*. Within the context of these experiments, therefore, the mediating response allows for features of a task setting to stimulate perceptual conflict and novel experiences *directly* via perception *and* imagination. Examples of this might be a birdsong eliciting an automatic mimicking whistle (imitative), or a gnarled tree instantly invoking a giant's castle (verbal and imaginal).

Novelty is also central to theories of motivation. "*A sense of discovery, exploration, problem solution – in other words, a feeling of novelty and challenge*" was found by Csikszentmihalyi to be a core underlying similarity of a variety of autotelic experiences – rock-climbing, chess-playing, composing, dancing and basket-ball – one which he stressed was "*difficult to overemphasise*" (2000, p.30). Kim's neuroscientific model of motivation (2013), entails a system of three sub-processes in the brain which function to maintain environmental interaction at optimal levels of experiential novelty (Kim, 2013). Although novelty is not formally represented in Cognitive Evaluation Theory (CET), Deci and Ryan propose "*novelty, challenge and aesthetic value*" to be key qualities of intrinsically motivating activities (Ryan & Deci, 2000, p.60). All three theories also imply an association between ideal levels of experiential novelty and positive affect.

Despite their different fields and foci, these theoretical perspectives share notable similarities. All view novelty as a *basic motivational property* of a given environment, and an *enabling factor in an exploratory dialectic* between it and an individual. They also implicate environmental novelty as a *determinant of cognitive change*. This is particularly so in the case of Piaget and Berlyne, i.e. as perceptual conflict, or accommodation and assimilation, respectively. Both Gibson and Berlyne also consider the relationship between novel stimuli and action to be a *direct perceptual relation*, which can be experienced in the fields of both perception and meaning. Lastly, all the theories to a greater or lesser degree *associate individually optimal levels of novel environmental stimulation with positive experience*.

On the basis of these similarities, it would seem reasonable to expect an association between environmental richness (RI Score), and measures of perceived novelty ('discovery') and cognitive activity ('ideas') in the context of a school task. It also

supports the idea implied by ‘the cognitive engine’ that inherent experiential novelty served to motivate and sustain an exploratory dialectic in the wild setting. The importance of novelty is also implied by those rural wood children who considered it the key learning benefit of the wild setting over the classroom, a perception also echoed by children in a Swedish study which compared teaching biology between outdoor and indoor settings (Fägerstam & Blom, 2013).

Furthermore, the association between optimal experiential novelty and positive affect might also offer an explanation for the link with ‘compatibility’ (*where did I like being the most?*), the third member of the ‘creative compatibility’ component, something which will be explored further in the next chapter.

## **7.2 Utilitarian Complexity and Experienced Group Preferences**

If inherent novelty was a significant factor in cognitive activity, why then were the strongest related preferences revealed by the group for whom the task environment was least novel? The experienced children unanimously preferred the outdoor task setting for ‘discovery’. They also significantly preferred it for ‘creative compatibility’, ‘ideas’ and ‘compatibility’ over early years’ in both wild and playground settings. These findings imply that their perception of their wild setting’s capacity to support experiential novelty had not waned as a result of intimate familiarity, but *increased*.

An environmental quality which may be relevant to these findings, is *complexity*. Environmental psychology involves different overlapping concepts of complexity. In its rawest sense, complexity is an objective measurement of a scene’s visual data, which can be algorithmically determined or artificially generated. Artificial complexity is the collative variable (Berlyne, 1971) with the broadest empirical validation (Bell, Greene, Fisher, & Baum, 2006), and shares a similar association with exploration and positive affect described already for novelty.

	<b>COMPLEXITY</b> (information richness)	
<b>COHERENCE</b> (orderliness)	<b>Low</b>	<b>High</b>
<b>Low</b>	Not much there	Visually messy
<b>High</b>	Clear and simple (boring)	Rich and organised

**Table 7.1 ‘Complexity’ and ‘coherence’ (Kaplan & Kaplan, 1989)**

However, due to their underlying pattern regularity, natural settings measure among the least algorithmically complex of all human environments (Bell et al., 2006), which suggests the collative variable may be inapplicable to the present context. It is for this reason that Kaplan and Kaplan deemed algorithmic complexity as unsuitable for assessing human environmental perception. They propose an alternative conception of ‘complexity’, defined as *“the number of different visual elements in a scene; how intricate the scene is; its richness”*, which is one of the four environmental qualities underpinning Preference Theory (Kaplan & Kaplan, 1989). Together with ‘coherence’, or orderliness, complexity is held to constitute our immediate perceptual response to a scene, where an increase in either quality is associated with preference. The relationship between the two qualities is described in Table 7.1 above, where the ideal environment is high in both, and termed *“rich and organised”*.

A third, more granular, conception of ‘complexity’ is put forward by Zamani and Moore to explain aspects of the relationship they observed between pre-school cognitive play and playground affordances (Zamani & Moore, 2013). They defined ‘complexity’ as *“the number of play choices a particular natural element affords, and therefore its capacity to be adapted to play themes”*, and reported this to be a central factor underpinning play preferences. They also observed that materials which were portable and allowed children to shape their environment supported the most cognitive play behaviours, while fixed manufactured elements afforded them the least.

Despite their differences, these three concepts of environmental complexity share two basic similarities. The first is that all imply *a link between complexity and possibilities for thought and action*. As a collative variable, complexity is associated with cognitive motivation and exploration. It can also be experienced via fields of perception and meaning, for example, what is seen in the Rorschach inkblot, or the passing cloud, or

the tree which ‘is’ the giant’s castle. In Preference Theory, the ‘complexity’ of an environment contributes “*content or things to think about*” (1989, p.53-54). Zamani and Moore propose a direct link between complexity and play choices. Indeed, it may be that the perception of action possibilities in natural complexity is facilitated in some way by cognitive preparedness for natural affordances, such as that for naturally-occurring patterns (Olshausen & Field, 2000; Berto et al, 2008).

All three constructs also *entail a positive association between complexity and preference*, albeit only up till the point of optimal stimulation in the MoA (Berlyne, 1971). Interestingly, while natural settings may *measure* low algorithmic complexity, recent neuroscientific research strongly suggests *perception* of natural and artificial complexity are intimately interrelated, and that the former predetermines the latter (e.g. Gauvrit, Soler-Toscano, & Zenil, 2014). It may be, therefore, that our preference for artificial complexity is also predetermined by our evolutionary relationship with the natural environment. Following Kaplan and Kaplan, the premise here would be that the more complex a natural setting, the greater the perception is that it can fulfil needs and goals, and the stronger it is preferred. By contrast, a dis-preference for artificial complexity could occur because it can be manipulated beyond the point where complexity is cognitively useful or productive, something which perhaps is not possible in a coherent natural environment.

On the basis of these commonalities, it is argued that the three constructs may describe the same relationship between cognition and environment, and differences between them relate only to the fact each refers to a different *category* of visual data. This relationship entails a quality of environment or affordances which signifies the immediate potential for personal thought and action, where the ideal setting is complex and organised (i.e. in Preference Theory terms, it combines high levels of ‘complexity’ and ‘coherence’). It is proposed that this quality can be experienced directly via the fields of both sensory perception and meaning, and is positively associated with natural richness and preference.

Considering the active context of the thesis, this environmental variable is henceforward termed ‘utilitarian complexity’, and is defined as the *number of perceived uses a particular setting, or affordance therein, is able to support*, which is an extension of that proposed by Zamani and Moore.

But what relevance might ‘utilitarian complexity’ have to the experienced group’s stronger preferences, particularly, for ‘discovery’ and ‘ideas’? It has been put forward that a task might be viewed as transforming a setting into meaningful affordances relevant to its goal. While this idea allows for a novel goal to enable a new dialectic with a familiar environment, at the same time any interaction is necessarily informed in some way by past experience of the available affordances.

To use an analogy, a craftsman tasked with making something they have never made before, will employ a workshop in new ways. Nevertheless, what courses of action they take will also be influenced by their knowledge of what the toolkit can do. The more a craftsman has used the toolkit, the more courses of action, and combinations thereof, are available to them towards fulfilling a novel goal. While the workshop setting may be more familiar to the experienced craftsman than an apprentice, they also have a greater capacity to perceive its inherent utilitarian complexity and, providing the goals continue to be novel, its experiential novelty also.

Applying the analogy to the current context, therefore, it seems plausible that the experienced children may have a keener perception of their wild settings’ inherent utilitarian complexity, than the apprentice ‘early years’. It would follow, therefore, that this greater capacity to perceive the potential for optimal action and novel stimulation in pursuit of a new goal might be reflected in comparatively stronger preferences for *task-specific* ‘ideas’, ‘discovery’ and ‘creative compatibility’.

In summary, it is argued that different concepts of environmental complexity all share the same underlying cognitive response. This response is associated with preference and notably, the perceived potential for thought and action. In the context of an active task scenario, this perceived potentiality has been termed ‘utilitarian complexity’, or the *number of perceived uses a particular setting, or affordance therein, is able to support*. It is proposed that the experienced group’s greater capacity to perceive and use the utilitarian complexity of their wild setting towards novel goals, underpins their stronger preferences for ‘creative compatibility’, and its member criteria. The discussion thus far would suggest loose materials may play an important role in this perception.



### 7.3 Extent

The final environmental variable which it is proposed may be relevant to task performance is *extent*, so named for being considered largely equivalent to the so-named ART and PRS construct (Kaplan & Kaplan, 1989). ‘Extent’ draws on different support to that put forward for novelty and utilitarian complexity, and which is dealt with more fully and appropriately in the next chapter. Nevertheless, as it is associated with the environmental category, the construct will be described briefly here.

In ART, ‘extent’ relates to the experience of the scale and connectedness of the elements that make up an environment, a perceptual property which is proposed to be built through fascination-motivated exploration (Kaplan & Kaplan, 1989). Thus, not only is ‘extent’ postulated to be contingent upon ‘fascination’, but arguably the relationship between them represents ART’s clearest implication of an active cognitive process, i.e. the construction of *experiential space*.

As will be discussed, there is some empirical support for ‘extent’ being an active element in children’s imaginative task experience outdoors, particularly in the wild settings. By contrast, classroom space seemed more neutral or performatory, that is, a space wherein the children sat or moved through while performing the task.

In short, ‘extent’ might be thought of as an affordance, albeit intangible: a form of constructed or *active space* which children perceived and used while fulfilling the outdoor tasks.

### 7.4 Environment and Affordances: Summary of Main Points

The chapter looked at findings pertaining to the first category of the theoretical framework, *environment*, and the related cognitive factor, the *affordances* of the task settings. Drawing on statistics related to ‘discovery’, ‘ideas’ and ‘creative compatibility’, and supportive qualitative findings, an enabling relationship between natural richness and cognition is proposed.

Three environmental variables were argued to be pertinent to related behaviour and performance: *utilitarian complexity*, *novelty*, and *extent*. All three were couched in terms of the Theory of Affordances (Gibson, 1986), and are proposed to be positively associated with preference and natural richness. In other words, the stronger the affordances of a setting are found to exhibit these perceived qualities, the more the setting is preferred, and the closer it might be considered to come to Gibson's conception of an human ecological niche.

*Utilitarian complexity*, is proposed to be an organised environmental variable, defined as the number of perceived uses a particular setting, or affordance therein, is able to support. It is considered approximate to the combination of complexity (information richness) and coherence (orderliness) that constitutes the immediate environmental response in Preference Theory (Kaplan & Kaplan, 1989). It is also suggested that experience of a rich setting may increase the capacity to perceive and use its utilitarian complexity in novel ways towards novel goals. This is put forward as an explanation for why the experienced group returned stronger preferences for the wild setting for 'discovery', 'ideas' and 'creative compatibility', compared to the early years'.

*Novelty* is the capacity for a task setting to enable experiential novelty –structural, phenomenal or imaginative. This seemed a significant factor underpinning children's wild setting preferences for 'discovery' and 'ideas', and it is put forward that abundant manipulable affordances, and biodiversity, may play an important interrelated role in related findings.

The final variable, *extent* is regarded to be largely equivalent to the ART/PRS construct (Kaplan & Kaplan, 1989). It is conceptualised as an intangible affordance, which enables the active construction of experienced space within the context of the task requirements. How these qualities relate to task performance will be expanded upon in the discussion of attention in the next chapter.

## CHAPTER 8: DISCUSSION OF EXPERIENTIAL FACTORS

### 8.0 Introduction

The second discussion chapter focuses on findings pertaining to the Santiago Theory's concept of a second order unity, or the interaction between the child's experience and the physical environment.

Specifically, it addresses the *observed, or reported, behaviour of individual children which may be associated directly or indirectly with task-related cognition*. With relevance to RHs 1 and 2, it also seeks to build upon the outcomes of prior discussion of environmental variables relevant to performance. While the last chapter explored the enabling aspects of the relationship between environment and cognition, this chapter places greater emphasis on findings suggesting regulatory aspects.

The discussion is structured by discrete sections and summaries of findings relevant to four CFs: motivation, attention, positive affect and physical activity. The fifth factor associated with the child's experience, memory, is dealt with separately in Chapter 10. Wherever relevant, the potential educational significance of findings, and relationships between CFs, are highlighted. The chapter concludes with an attempt to integrate the outcomes of this chapter and the last into a general systems-based summary as viewed through the lens of the theoretical framework.

### 8.1 Motivation

The discussion of motivation is in eight parts. The first part discusses the strong cross-stage empirical support for greater perceived *autonomy* in the outdoor settings, specifically, the 'autonomy' component from the PCA, and the 'empowerment' QV from the interview analyses. These will be discussed in relation to Cognitive Evaluation Theory (CET), which proposes *autonomy* to be the basic need most relevant to intrinsic motivation (Deci & Ryan, 2002), and the theory of behaviour settings (Gump, 1978).

The next four parts are structured by reference to the interactive cycle from Kytta's Bullerby Model (Kytta, 2003). These seek to extend prior discussion of utilitarian complexity and novelty, by exploring specific qualities of natural affordances which could motivate and sustain engagement, namely, responsiveness, self-produced change and the capacity to support graduated challenge. These sections draw on the Theory of Affordances (Reed, 1996), Field Theory (Lewin, 1946), and Flow Theory (Csikszentmihalyi, 2000) and empirical support for children's greater immersive activity and confidence outdoors, particularly in the wild setting. The sixth part then goes on to explore whether outcomes could explain the remarkable outdoor impacts on underachievers reported by the teachers.

In the seventh part there is a brief consideration of why the association between natural richness and autonomy implied by the discussion and qualitative findings, is not statistically supported. The section ends on a general summary of discussion outcomes.

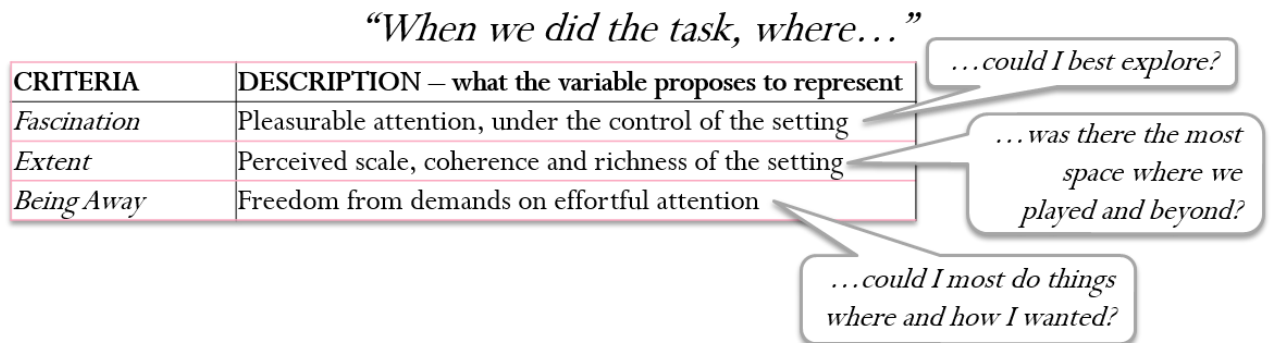
Study findings which imply greater motivation outdoors are broadly consistent with previous studies which have found relationships between green spaces and enthusiasm for activities or learning in young children (Khan, 2014; Blair, 2009; Lovell, 2009; O'Brien, 2009), particularly those which reported more confident participation from underachievers or quieter children (Davis & Waite, 2005; Waite & Davis, 2007; Massey, 2002).

### ***8.1.1 Motivation, Autonomy and Behaviour Setting 'Pressures'***

Greater perceived autonomy outdoors was the study's most consistent cross-task finding. The PCA component 'autonomy' (Figure 8.1 overleaf), statistically defines the outdoor study tasks, in that it has negligible relation to the classroom. While composed of PRS criteria ordinarily associated with restorativeness ('fascination', 'extent' and 'being away'), perceived freedom of range and activity was the more plausible conceptual underpinning of the actual criteria statements.

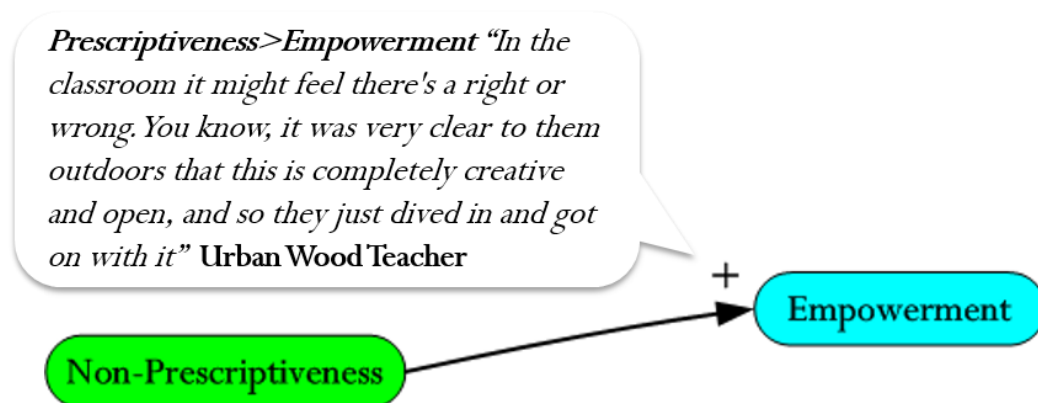
Perceived autonomy outdoors was also a general theme of the interview analysis, embodied in the 'empowerment' QV, defined as *degree of perceived agency when*

fulfilling the task. This aspect of ‘empowerment’ is exemplified by the rural wood teacher’s comment that “they think they’re more free down there”.



**Figure 8.1 The ‘Autonomy’ Component**

In the CLD ‘empowerment’ is proposed to be influenced by environmental ‘non-prescriptiveness’, a relation shown in Figure 8.2 below. In one quote which supports this relationship, the urban wood teacher describes how outdoors “it was very clear to them...this is completely creative and open, and so they just dived in and got on with it,” whereas in the classroom “it might feel there’s a right or wrong”.



**Figure 8.2 ‘Non-Prescriptiveness’ and ‘Empowerment’**

CET defines ‘autonomy’ as the *feeling one is the originator of one’s own actions, and that these are an expression of one’s own self, interests and integrated values* (Deci &

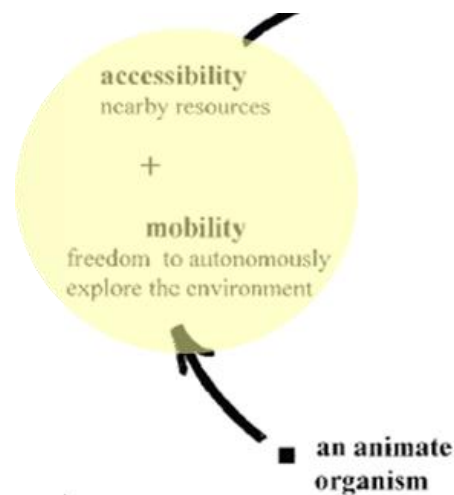
Ryan, 2002). Of the three basic needs CET proposes to be motivation-supportive, research strongly indicates autonomy to be fundamental, in that it predicates the effects of the others (Deci et al., 1991). Deci and Ryan speculate that autonomy may have adaptive significance for all living things. Without autonomy, they argue, the organism forgoes its capacity to regulate environmental relationships towards effective self-integration and self-maintenance, and risks being entrained down maladaptive paths by external factors (Deci & Ryan, 2000).

Marketta Kyttä's Bullerby Model (2003) is based on her research with Finnish and Belarusian communities. It proposes four types of children's environments based on two axes, the *richness of their actualised affordances*, and *the extent to which children had access to them*.

The four environments are shown in Table 8.1. These are the *'cell'*, where mobility is so constrained by physical and social factors, children have little opportunity for affordance interaction; *'glasshouses'* where affordances are visible but inaccessible to them; *'wastelands'* where they are free to move but in an affordance-improverished setting; and the *'bullerby'*, where affordances are rich and the child has free rein to interact with them.

		Affordance Richness	
		Low	High
Autonomy (Accessibility / Mobility)	Low	Cell	Glasshouse
	High	Wasteland	Bullerby

**Table 8.1 The Bullerby Model (Kyttä, 2006)**



**Figure 8.3 Kyttä’s Interactive Cycle i: Accessibility (in Chawla, 2006)**

Kyttä proposes an interactive cycle by which affordances sustain motivation and learning in a ‘bullerby’ environment. The cycle features a child (an animate organism) setting out to explore its environment. It encounters attractive affordances and interaction spurs further exploration and encounters, and so on, while all the time its environmental knowledge and competence grows.

The initial stages of the cycle are accessibility and mobility, shown in Figure 8.3 above. These imply that for affordances to motivate, the child must first be able to interact with them. Could perceived constraints on mobility, and the accessibility of available affordances, have influenced perceived autonomy on the classroom tasks?

One concept which may be relevant to the feeling that there’s a “*right or wrong*” in a classroom context is that of behaviour settings, which integrates the physical environment with predictable patterns of activity and behaviour (Barker, 1969). In the following passage, Paul Gump describes the experience of school starters being inducted into their new classroom behaviour setting:

*“Children entering first grade are exposed to invitations and pressures which, although operative in nursery school, now are more persistent and intense. Formal learning becomes a requirement, not merely an opportunity. Children are asked for a more fundamental orientation...they are to give and get support from peers, they are to reduce their pleasure seeking and find satisfaction in tasks and their completion; they are to become industrious” (Gump, 1967, p.162)*

Albeit purposefully so, all of the invitations and pressures for school starters to conform described above might be considered autonomy-restrictive. They also entail implications for accessibility and mobility, via implicit or explicit rules, or features of the physical design, which discourage or prohibit undesirable behaviours (e.g. moving during lessons, running, climbing).

As implied by the open-endedness measure, the design of a school task itself might be considered to limit mobility and accessibility. This is best exemplified by the pilot ‘Autumn Leaves’. Despite being outdoors, in Kytta’s terms, this task might be classified as a ‘cell’ for the way in which it limited children’s movement and the accessibility of available affordances.

Other interview data might also suggest the implicit influence of the classroom behaviour setting. For example, the rural wood teachers’ comments about ‘Alien Adventure’ that “*imagination went that bit further in the outdoors, despite the class area having a lot more resources to use*”, and “*it feels much more prescriptive (in the classroom) even through I’m asking them to do the same thing*”. Despite being granted full mobility and access to all classroom affordances for this task, there seems an implication here that children, and possibly teachers, deferred to the standing rules and patterns of the behaviour setting, i.e. this is a sit-down task using the usual materials.

Therefore, through Kytta’s lens, the classroom behaviour setting and task design might be argued to have imposed constraints on mobility and accessibility on the study tasks, which were not so prevalent outdoors. This and other ‘invitations and pressures’ associated with the setting may have caused children to perceive some classroom tasks as less autonomy-supportive by comparison, as is statistically implied. If so, then CET would predict this to have had negative consequences on children’s intrinsic motivation.

Nevertheless, for some classroom components – ‘Build a Den’ and, particularly, ‘Puppet Tour’ – children were granted full mobility and accessibility, and appeared to take full advantage of the opportunity. That there are no significant differences between indoor preferences for these tasks, and the indoor tasks with perhaps more limiting designs, would suggest factors other than behaviour setting pressures may also contribute to findings. Moreover, it is also important to note that, impacts on CET’s basic needs are only relevant if a situation is *already* intrinsically-motivating (Ryan & Deci, 2000). Thus, while perceived ‘autonomy’ may have reduced motivation in the classroom, it says little about how either setting enabled it.



## Summary

Empirical support for greater perceived autonomy in the outdoor settings was discussed in relation to CET and Kyttä's interactive cycle. It is proposed that pressures associated with the school behaviour setting or task design may have caused children to perceive indoor tasks as more autonomy-restrictive than the outdoor, and that this could have had consequences for motivation levels.

### 8.1.2 Affordance Motivation

Possibly the strongest overall findings in support of higher levels of motivation outdoors is the children's task self-sufficiency, such as is embodied in the self-sustenance QV and associated with the wild settings.

The last chapter explored the empirical support for an enabling relationship between affordance richness and individual resourcefulness. Three environmental variables were argued to be significant: utilitarian complexity (*the number of perceived uses a particular setting, or affordance therein, is able to support*), extent (*active space as affordance*), and novelty.

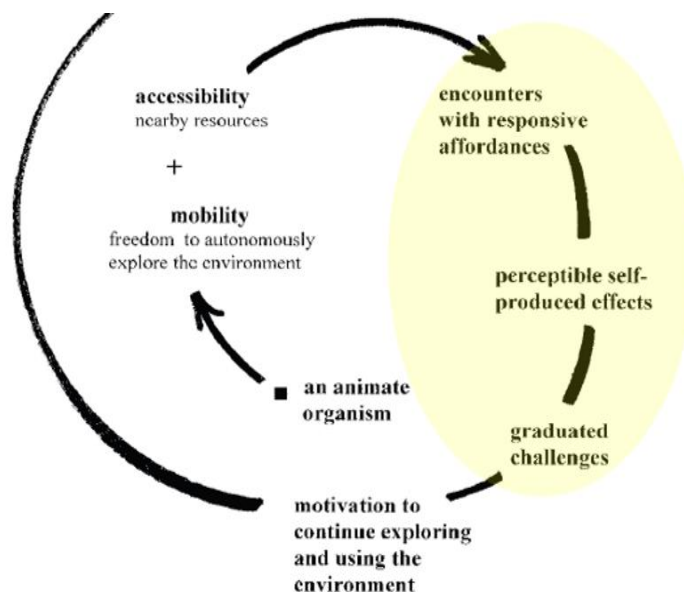


Figure 8.4 Kyttä's Interactive Cycle ii: Responsiveness (in Chawla, 2006)

In the Bullerby Model, environmental motivation relates to the second axis, *affordance richness*. The interactive cycle also implies setting qualities important to sustained motivation. These are associated with its next three steps: *responsive affordances*, *perceptible self-produced effects* and *graduated challenges* (see Figure 8.4 overleaf above). *Responsiveness* might be conceptualised here as the ‘way in’ for cognition to interact with affordances, and *self-produced effects* and *graduated challenges* as the ‘way forward’, that is, qualities which sustain interaction.

### **8.1.3 Responsive Affordances**

*Responsiveness* implies that for an affordance to motivate, or even be perceptible, it must elicit a response in the individual. In the last chapter, it was put forward that such a response could be direct, and involve both perception and meaning (Berlyne, 1971; Gibson, 1986), and that cognitive preparedness for natural affordances might facilitate this in the wild settings.

Edward Reed states that the human tool kit of affordances “*is not just bunch of items; instead, it embodies a set of possible courses of action*” (Reed, 1996, p.123). He describes motivation in the context of affordances as:

*“An effort after meaning and value (which is) both constrained by and made possible by the affordances of the environment, and by the information specifying those affordances”* (Reed, 1996, p.108).

For Reed, affordances are motivating if they are perceived to progress personal ‘efforts’ after meaning and value. The idea of the ‘effort’ emphasises that affordance responsiveness is always in the eye of the beholder, and that an objectively well-resourced task may well be a ‘wasteland’ for those for whom the affordances are not personally-resonant.

The greater diversity of wild setting task activity might be interpreted as an indication of increased responsiveness. In the first 10 minutes of ‘Puppet Tour’, the interactions analysis records dinosaur bones, giants’ castles, beanstalks, fairy cottages, tigers, lightning-struck trees, numbers, drums, swings and snails who had lost their families.

This might be viewed as a spontaneous outburst of personal ‘efforts’ enabled by, and expressed in response to, natural affordances within the task parameters. As proposed in the last chapter, it may be that this responsiveness was facilitated by cognitive preparedness and environmental qualities which facilitate the direct experience of meaning.

It is possible that classroom affordances were less responsive for some children because they were not their preferred modes of personal expression, or their action possibilities in the task context were less perceptible. The latter is perhaps suggested by the rural wood teacher’s comment that “*some of them don’t get a lot of storybooks read to them so they don’t have a great bank of knowledge*”. This implies that some early years’ children may have been unmotivated by the drawing affordances, not because they don’t enjoy drawing, but because their limited experience of storytelling meant they couldn’t perceive how to use them in that specific context.

### *Summary*

Through discussion drawing on ideas from the work of Edward Reed, it is proposed that responsiveness might be conceptualised in terms of the capacity of affordances to enable efforts after meaning and value for the perceiver. It is argued that the greater diversity of immediate responses to the wild settings might be interpreted in terms of an enhanced capacity to enable personal meaning and value. This could be facilitated by cognitive preparedness, and environmental qualities such as those proposed. Conversely, it is proposed that comparative limitations of classroom affordances might be associated with reduced responsiveness, particularly for children at a disadvantage with respect to the task materials or requirements.

### ***8.1.4 Motivation and Self-Produced Effects***

The next step in the interactive cycle is *perceptible self-produced effects*, or the ‘way forward’. This implies that to sustain interaction, responsive affordances must produce ongoing external or internal changes which are perceptible to the child.

Some development theorists propose self-produced change to be functionally significant and a basic precedent for environmental motivation in young children (Lewis, Sullivan, & Michaelson, 1984; Thelen, 1996; Preyer, 2001). Contingent stimulation is argued to provide the basis for a general perception of agency and self-efficacy (Lewis et al., 1984) and through such experiences, for self-awareness itself (Preyer, 2001). It is also linked to positive emotion, which it has been proposed serves to forge associations with environments that facilitate these developmentally-significant processes (Lewis et al., 1984; Thelen, 1996).

A more granular process-oriented view of contingent stimulation may be informed by Lewin's field theory of behaviour and development (1946). Lewin proposes that a child's actions in a given situation are determined by positive or negative *valences*, a theoretical quality of environmental fields and affordances which attracts or repels action. Valences and courses of action always have a specific situational *frame of reference*, which can include personal goal aspirations, past performance and group standards.

Lewin highlights the "*plasticity of the meaning of the object*" to be an important factor in a young child's acceptance of a substitute course of action should their particular way be frustrated. For illustration, he states "*a toy animal has a more fixed meaning than a pebble or a piece of plasticene and is, therefore, less likely to be accepted as a substitute for something else*" (1946, p.823), implying plasticity of meaning can entail both physical (plasticene) and imaginative manipulation (pebble).

However, in the event that a substitute is not forthcoming, Lewin states:

*"It may increase the negative valence of the obstacle until the constellation of forces is changed in such a way that they will withdraw temporarily or finally...(thus it) ceases to be an effective part of the (child's) life space...inaccessibility becomes a 'matter of fact'"* (1946, p.824-825).

Only through spontaneous alternative goals or resignation, Lewin argues, can the child resolve the cognitive and emotional conflict associated with an unattainable goal.

Lewin regarded these fine-grained experiences of success and failure as providing the foundations for persistence and higher aspirations, both within the context of a specific task, and through the transfer of stable or unstable goal structures to others. He found

extrinsic rewards lowered aspirations, and if this was not permitted by the situation, then behaviour often regressed developmentally.

Thus both fine and coarse grained views of developmental processes emphasise the functional significance of affordances which respond to personal ‘efforts’. They also suggest an association between unfrustrated self-expression, and perceived agency, competence, and environmental preference. Particularly, Lewin singles out plasticity of meaning as an environmental quality which can facilitate self-expression.

The predominant role of portable and manipulable affordances in wild setting activities, particularly loose materials, was discussed in the last chapter. Most of these materials have the capacity for physical and imaginative manipulation –e.g. branches, sticks, earth, leaves, stones. Their rich abundance would therefore imply a significantly greater potentiality for plasticity of meaning in the wild setting, than the classroom or playground. Lewin’s theory implies, therefore, that this would have enabled more options and substitutes for personal ‘efforts’ within task parameters.

This idea finds support in data associated with the CLD relation between (environmental) prescriptiveness and (experiential) resourcefulness, such as the urban wood teacher’s comment about how, “*quite a basic a shape (outdoors)*” could be “*a castle, or a car, or whatever*” (see Figure 8.5 overleaf below).

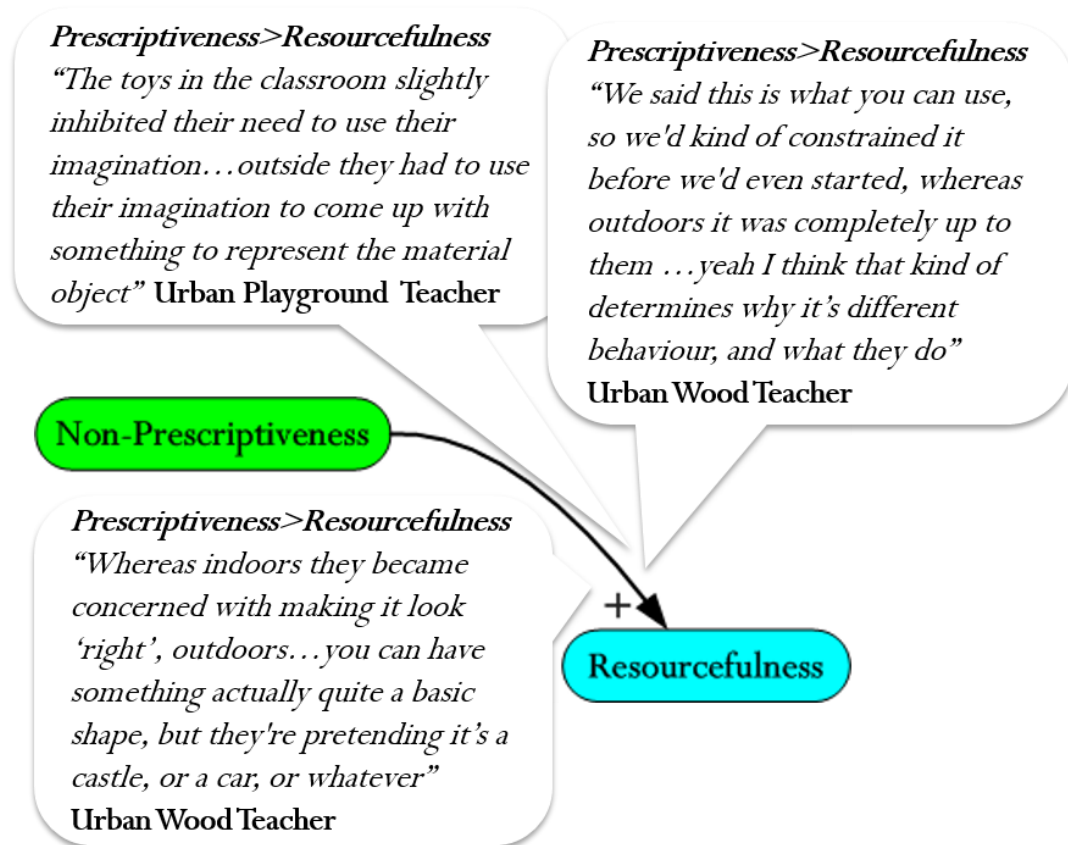
Both urban wood interactions analyses highlighted the diversity of creative interpretation and production enabled by loose materials on the outdoors components, compared to the classroom. These findings also seem consistent with other studies which have reported an association between creative play behaviours and materials which can be used to shape the environment (Zamani & Moore, 2013; Miller, 1984; Nicholson, 1971).

Conversely, other findings imply the non-plasticity of classroom affordances may have constrained meaning. One example is the playground teacher’s comment that “*toys in the classroom slightly inhibited (the children’s) need to use their imagination*”.

Another, is how the physical inflexibility of classroom tables and chairs on this task seemed to determine the close similarity between the indoor den designs, and limit how far the children could take them.

Similarly, the inflexibility of the largest junk in ‘Make a Toy’ may have also limited plasticity of meaning, giving rise to the high incidence of ‘bottle’ rockets, and ‘cereal

packet' buildings and robots. Referring to this task, the urban wood teacher noted how task materials “constrained” or “determined” creativity, and how children became “concerned” with making toys “look right” and needed more help “to take it beyond the simple thing”.



**Figure 8.5 ‘Prescriptiveness’ (plasticity of meaning) and ‘Resourcefulness’**

Perhaps the most overt display of this was an underachiever, Dw, who halfway through one control component threw a sudden tantrum and stormed off. When asked why, Dw said he was unable to find junk large enough to further his giant robot hand – “I need a big robot and there’s none big things” – , at that time only a cereal box (see Figure 8.6). When various options for taking the hand forward were suggested, Dw quickly calmed down.

*\* Approx 15mins into the task, Dw abruptly storms off into a corner, angry and tearful. Teacher is otherwise occupied, so R(earcher) goes over\**

**R(earcher):** *"Is everything alright? What's up?"*

**Dw:** *"I cannae make a robot"*

**R:** *"Why not?"*

**Dw:** *"Because I need a big robot and there's none big things"*

**R:** *"Shall we look and see if we can find? So what bits have you got now?"*

**Dw:** *"This" \*holds up a box\**

**R:** *"And what is that bit for?"*

**Dw:** *"The hand"*

*\*R helps Dw select other body parts which might go with the hand.*

*Dw calms down. Teacher notices and takes over\**

**Figure 8.6 Possible Example of Frustrated Withdrawal**

It may be that, given Dw's past experience, limited affordances offered no ways forward or substitutes for the particular inflexible affordance in which he had invested his 'effort'. In Lewin's terms, this frustrated course of action may have caused this initially responsive affordance to grow in negative valence until Dw's sudden outburst of inner conflict, and withdrawal. Albeit less explicit, other classroom task behaviour might also be interpreted in terms of resignation or alternative goal-seeking, such as the trend towards playing board or computer games during 'Puppet Tour', or finishing early on the second 'Make a Toy' control.

### *Summary*

The developmental significance of self-produced environmental change was discussed, in relation to Field Theory, and the idea of plasticity of meaning (Lewin, 1946). It is proposed that the level of plasticity of meaning –physical and imaginative– of task affordances could act to facilitate or frustrate children's personal task goals. Possible

behavioural evidence was ventured for the enabling plasticity of meaning of outdoor affordances, particularly loose materials in the wild settings, and for comparative constraints on physical and imaginative plasticity in the classroom.

### ***8.1.5 Motivation and Graduated Challenge***

The last of the three step sequence in the interactive cycle is *graduated challenges*. This implies that, for affordances to sustain motivation, interaction must also entail growing environmental mastery. The capacity of natural affordances to adapt to children's differing and growing mental and physical needs across developmental stages is implied by several theories reviewed in Chapter 2 (Bateson & Martin, 2000; Cobb, 1977; Sobel, 2013). Louise Chawla describes a rich natural setting as:

*“A safe world of engaging affordances and graduated challenges that a child can master...the stone that was too heavy to lift yesterday might budge today. This tree branch is still just out of reach, but –success!– today these branches are spaced just right.”* (2006, p.68-69)

Here Chawla highlights how levels of challenge are determined both by the child and the action possibilities inherent in the environment.

Challenge is also an important feature of Csikszentmihalyi's *Flow Theory*, which proposes an optimal 'autotelic' experience, where self and environment merge in action, and demands and feedback are continuous and unambiguous. Csikszentmihalyi terms the most fine-grained conception of the autotelic experience, *micro-flow*. His research found that students deprived of micro-flow activities for short periods experienced significant deterioration in cognitive functioning, including reduced alertness, creativity, reasonability and verbal skills (Csikszentmihalyi, 2000). He concluded the micro-flow state to be an elementary manifestation of patterning experience, which served to regulate stimulation at optimal levels:

*“One may infer that the function of micro-flow experiences is to keep a person alert, relaxed, with a positive feeling about himself, a feeling of being spontaneously creative. To be able to do things that may not appear necessary to a person's survival gives a*



*feeling of effectance, or being in control of one's actions rather than a pawn in the hands of deterministic fate.*

*In addition, this kind of behaviour probably regulates the amount of stimulation available to the organism, by supplying novelty in a barren environment or reducing input when the stimulation is excessive. Obviously, when such behaviour is not available to people, for whatever reason, the attention process is disrupted, the control of stimulus input breaks down, and serious consequences may result”*(Csikszentmihalyi, 2000, p.177).

Csikszentmihalyi acknowledges that the processes by which flow regulates novelty seem consistent with the Model of Aesthetics (MoA) (Berlyne, 1971), such as is represented in the inverted U-shaped curve of arousal and hedonic tone (see Figure 2.4).

Another defining feature of the flow state is the *loss of ego-related concerns*, which Csikszentmihalyi describes as follows:

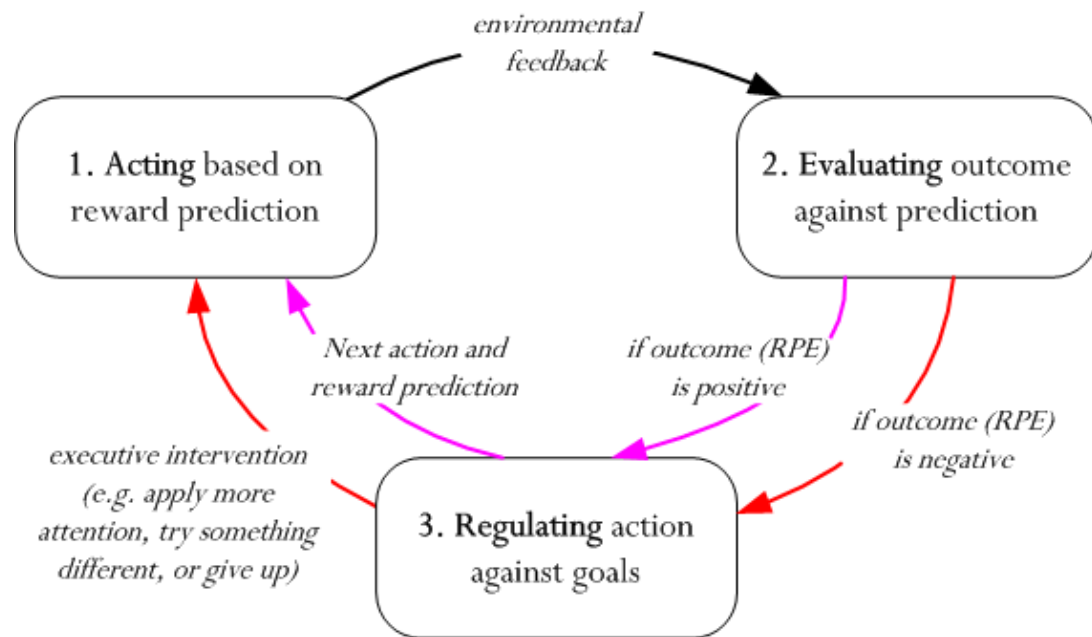
*“When an activity involves the person completely with its demands for action, “self-ish” considerations become irrelevant... what is usually lost in flow is not the awareness of one's body or of one's functions, but only the self-construct, the intermediary which one learns to interpose between stimulus and response.”* (Ibid, 2000, p.42-43).

Central to sustained flow is the idea of graduated personal challenge. On the one hand, Csikszentmihalyi considers autotelic experiences to depend on the feasibility of the task for the individual, which must be *“within one's ability to perform”* (2000, p.39). On the other, however, he argues its most fundamental aspect to be *“a clear set of challenges”* (2000, p.39), of which he regards there to be two categories: *“the challenge of the unknown, which leads to discovery, exploration, problem solution (and) the more concrete challenge of competition”* (p.30). His research found the application of skills, and the associated enjoyment, to be the principal reason people gave for engaging in activities which facilitated autotelic experiences (2000).

Drawing from decades of brain research, Kim's neuroscientific model of motivation also implies a basic role for graduated challenge in environmental motivation (Kim, 2013). His model proposes that at, a neurophysiological level, motivation can be thought of as moment-to-moment actions prompted by positive reward predictions and regulated by environmental feedback. These actions need only to have value on a

sensational or cognitive level, implying activity can be a reward-in-itself. Reward predictions are not absolute values, but particular to each individual.

Kim proposes actions and rewards are governed by a system of three interconnected sub-processes, represented below.



**Figure 8.7 Neuroscientific Model of Motivation (Kim, 2013)**

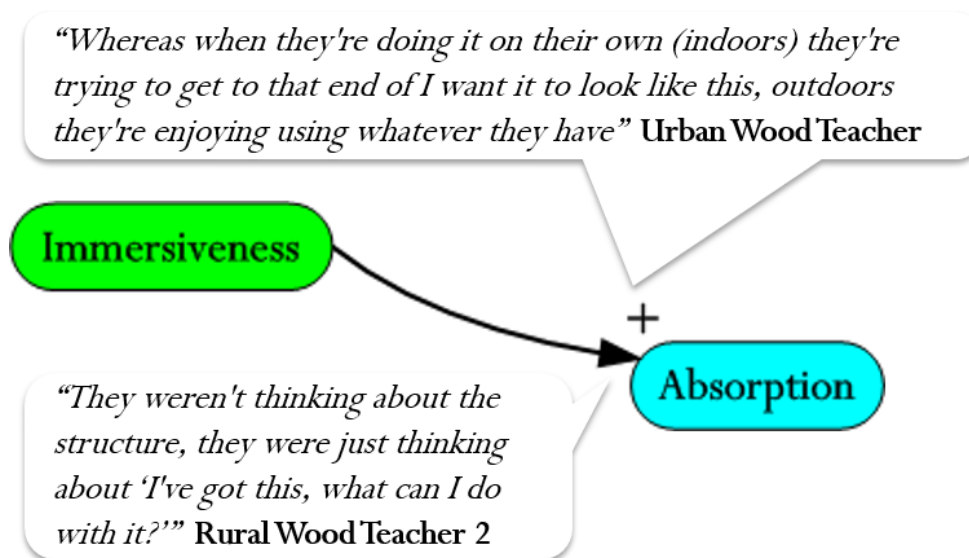
For illustration, let us imagine we are motivated to interact with an responsive task affordance. Upon perceiving the action possibility, our sub-process 1, located in the striatum, predicts our reward and initiates the interaction. Sub-process 2, situated in the striatum and orbitofrontal cortex, then evaluates the environmental consequences of our action to see if the outcome is better or worse than our reward prediction. Sub-process 2 then sends a reward prediction error (RPE) onto executive sub-process 3, located in the prefrontal cortex, which regulates action against higher-order goals, employing cognitive control functions such as attention and goal maintenance.

If the RPE is positive, our motivation and course of action is sustained (the blue arrows). If RPE occurs repeatedly as predicted, it attenuates till the effect becomes negative. If RPE is negative, then executive sub-process 3 initiates regulatory

intervention towards achieving the task goal, such as increasing attentional effort or seeking alternative courses of action (the red arrows).

Both flow and neuroscientific theory share important similarities. Like Reed, both emphasise the personal nature of environmental motivation. As with theories discussed in the last chapter, both also imply an optimal environmental interaction, characterised by autonomous exploration and regulated by levels of positive affect and novel stimulation.

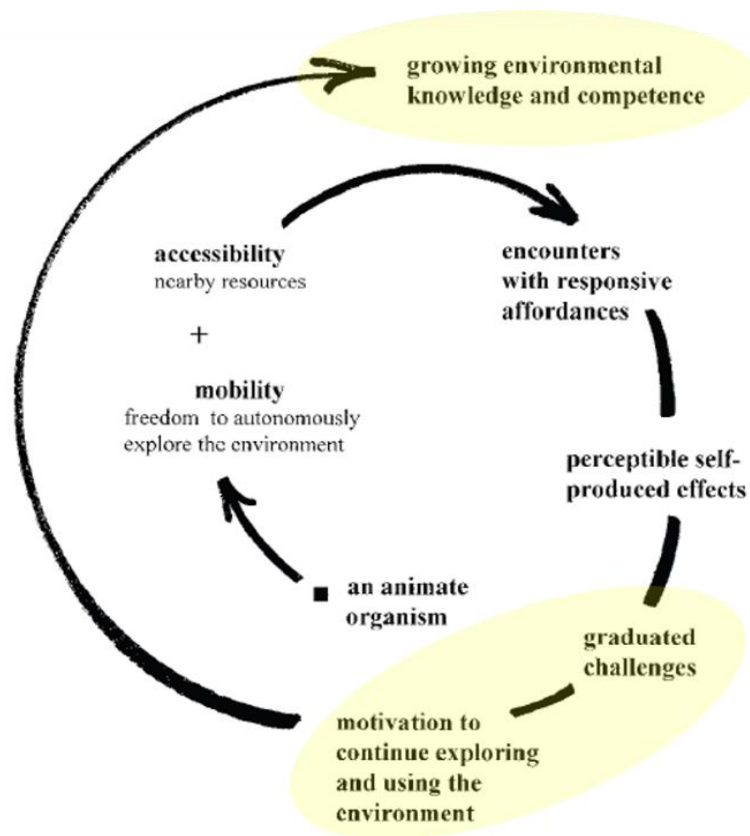
However, they also imply three new aspects. The first is that *optimal interaction is an immersive state*, where each action follows seamlessly from the next, involving minimal executive demands. The second is that *the association between this state and positive affect hinges on granular actions which surpass subjective expectations*. The third is that *for this state to endure, it requires graduated challenge at levels perceived to be personally feasible*.



**Figure 8.8 ‘Immersiveness’ and ‘Absorption’**

Empirical support for a more immersive environmental interaction in the wild setting is exemplified by data associated with the CLD relation between (environmental) immersiveness and (experiential) absorption, shown in Figure 8.8 above. Comments include “(the children) weren’t thinking about the structure (outdoors), they were just

thinking I've got this what can I do with it" and "(indoors, the children were) trying to get to that end of I want it to look like this, (while) outdoors they're enjoying using whatever they have". Both examples imply extrinsic factors – "structure", "that end" – were less a consideration for children outdoors, where interaction was more emergent and moment-to-moment.



**Figure 8.9 Kytta’s Interactive Cycle iii: Graduated Challenges**

While Kim does not mention the emotional qualities associated with this state, in the earlier passages Csikszentmihalyi describes a relaxed feeling of selflessness, effectance and creative control. This echoes CET’s definition of ‘perceived competence’ as *feeling effective in one’s environmental interactions, and able to exercise and express personal talents* (Deci & Ryan, 2002). These might also be the types of emotional qualities associated with growing environmental knowledge and competence, such as Kytta proposes is produced by the interactive cycle (see Figure 8.9 above).

That such an emotion may have been a feature of children's outdoor interactions finds support in findings which will be discussed later in relation to positive affect. Particularly relevant here, however, is those data suggesting enhanced *confidence* outdoors, which together with perceived autonomy, are associated with the 'empowerment' QV.

Subjective experience of challenge was not a study measure. Nevertheless, implicit in the two theories discussed, and the interactive cycle, is the idea that immersive activity is only possible when affordances enable challenge at personally feasible and optimal levels. Thus, it is argued that empirical support for sustained immersive activity, characterised by perceived competence and autonomy, might be considered to indicate the wild settings were generally able to meet these personal requirements.

### *Summary*

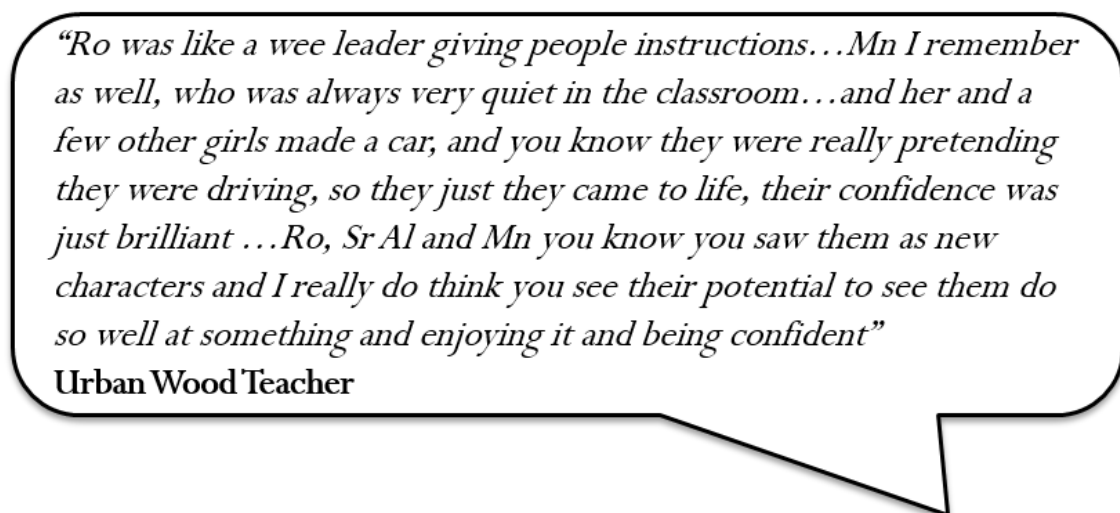
It is proposed that flow (Csikszentmihalyi, 2000) and neuroscientific (Kim, 2013) theories of motivation take a view of optimal environmental interaction broadly consistent with others discussed in the last chapter. Additionally, they suggest optimal environmental interaction may be an immersive state which depends on granular successes at personally-feasible levels of challenge.

It is proposed that empirical support for sustained immersive activity, and perceived competence and autonomy, suggest that outdoor affordances, particularly in the wild setting, better satisfied requirements for personal challenge, than those in the classroom.

Lastly, in overall conclusion to the discussion of affordance motivation, it is proposed the capacity of outdoor affordances to facilitate personal responsiveness, plasticity of meaning and optimal challenge, may have contributed to perception of utilitarian complexity and novelty.

### 8.1.6 Underachiever Motivation

Developing underachiever engagement and motivation has been proposed as key recommendations towards addressing Scotland's performance gap (Audit Scotland, 2014). While findings imply general benefits of the outdoor settings for both, teachers frequently emphasised the impacts on underachievers in related data, particularly the two novices. One example is given in Figure 8.10 below, where the urban wood teacher describes seeing underachievers "*as new characters*" and how "*they just came to life*" in the wild setting. Data like these suggest teachers perceived a more pronounced difference in the behaviour of these children compared to their peers.



**Figure 8.10 Novice Teacher's Observations of Underachiever Confidence.**

Field Theory (already outlined in section 8.1.4) implies perceived competence to be context-specific. Lewin proposes a child's behaviour varies according to their dominant 'frame of reference' for a given task context. This 'frame' entails their past performance and aspirations, as well as group standards and other factors, "*one of which is the tendency to avoid the feeling of failure*" (Lewin, 1946, p.830). Lewin describes how these context-specific failure or success can determine the "*degree of difficulty of task chosen as a goal for the next action (and how) the expression of how quickly (their) goals change when the individual encounters obstacles*" (p.824). Failure is held to cause a lowering of aspiration for that situation, where a "*feeling of success will prevail*

*if a certain level, related to the dominant frame of reference, is reached”* (p.830). In short, Field Theory poses that the challenges a child perceives to be feasible in a given task setting are influenced by their past success or failure in that setting, and related extrinsic goals and social considerations.

CET proposes that one of the two primary cognitive processes by which a task setting influences motivation is its effect on a child’s perceived competence (Deci & Ryan, 2000). The other is whether the locus of perceived causality in interaction is internal or external. The internal locus –perceived autonomy– is held to have particular importance because it enables an *“inherent tendency to work toward inner coherence and integration among regulatory demands and goals”* (2000, p.253). These two cognitive processes are regarded to be basic and functional, biologically hardwired to move the child towards self-organisation by integrating *“in an unfettered manner, personal needs in relation to environmental affordances”* (Deci & Ryan, 2000, p.253).

Through the lenses of Field Theory and CET, a picture emerges of a functional relationship between a child and a specific task environment, one which can either virtuously, or viciously, reinforce levels of motivation and aspiration depending on its capacity to facilitate perceived competence and an internal locus of causality. A strong implication is that qualities of task affordances could be an important enabling or disabling factor.

The positive dynamic –internal locus, perceived competence– seems consistent with outdoor findings and well summarised by the interactive cycle. The negative dynamic – external locus, perceived inability– could be more strongly associated with children who are experientially or dispositionally ill-equipped for a classroom setting. Notably, *withdrawal* is both the ultimate response to repeated failure in Field Theory, and the behaviour most strongly related to primary school underachievement (Perkins, 1965).

In summary, it is proposed both that the outdoor setting enabled the positive dynamic for the study underachievers, and that the negative dynamic may be more characteristic of these children in a classroom setting. This may explain why their motivation and confidence stood out for teachers relative to the classroom and their peers. It is also argued that functional affordance interaction outdoors could underpin the remarkable differences the teachers reported. A final implication is that CET’s basic needs – *perceived competence* and *autonomy*– might be viewed as intrinsic regulatory properties and indicators of functional affordance motivation.

### ***8.1.7 'Autonomy' and Natural Richness***

However, if there is an association between affordance richness and motivation, such as the discussion implies, why was there no significant difference for 'autonomy' statistics between the playground and wild settings?

A possible explanation is that the meaning of the statements for the PRS members of 'autonomy' –i.e. perceived freedom of movement and action– inherently disadvantage a classroom. It may be that children's responses to these statements reflect their general perception of those implicit autonomy-restrictive pressures it is proposed may be specifically associated with classroom behaviour settings. If so, it would follow that they might consider *any* outdoor environment as more autonomy-supportive by comparison to the classroom, irrespective of levels of affordance richness. That a negligible number of participants preferred 'autonomy' for the classroom would appear to support this interpretation.

Consequently, it may be that the association between 'autonomy' and affordance richness implied by the discussion may have been revealed with a larger sample, or comparisons between outdoor settings of varying richness, or statements which were more nuanced or designed to be behaviour setting-neutral (as was the case with the performance criteria).

### ***8.1.8 Motivation: Summary of Main Points***

A discussion of findings suggesting children's greater motivation outdoors was structured by the stages of Kyttä's interactive cycle (see Figure 8.9). It is proposed that behaviour setting 'pressures' may have reduced perceived autonomy on some classroom tasks through constraints on mobility and affordance accessibility, with consequences for children's motivation.

Responsiveness, self-produced effects and graduated challenges were conceptualised in terms of the capacity of task affordances to enable unobstructed efforts after meaning and value, at optimal levels of personal challenge, and within task parameters. It is



postulated that the greater diversity of immediate environmental responses, and behaviours characteristic of sustained ‘micro-flow’ experiences (Csikszentmihalyi, 2000), implies the enhanced capacity of the outdoor affordances, particularly in the wild setting, in comparison to the classroom.

It is argued that related cognitive processes may have functional and developmental significance, and that this could underpin perceptions of utilitarian complexity and novelty, and the remarkable levels of underachiever confidence and motivation reported outdoors. It is put forward that *autonomy* and *perceived competence* might be viewed as emergent regulatory properties and indicators of such processes. Finally, it is postulated that the absence of a statistical association between natural richness and ‘autonomy’ could be due to the fact PRS statements inherently disadvantage the a classroom behaviour setting, in comparison to both the playground and wild settings.

Highly relevant here is the Scottish Government’s aim of developing *confident individuals* (Education Scotland, 2004), one of the four capacities which underpin Curriculum for Excellence. Equally so is the recommendation of Audit Scotland that developing pupil motivation and engagement is essential to closing the ‘performance gap’ between underachievers and achievers (Audit Scotland, 2014). The general impacts on individual confidence and motivation implied by this discussion, particularly with respect to the underachievers, suggest outdoor learning is consonant with Scottish Government’s educational objectives. Notable, is the far-reaching implication that outdoor tasks could help engage those children who may be unready for school, during the critical transition from nursery to primary school.

## **8.2 Attention**

There is a body of research to suggest attentional ability is the foremost predictor of long-term attainment (Duncan et al., 2007; Gutman & Vorhaus, 2012). While the study included no hard tests of attention, ‘fascination’ (“*I could explore*”), which is held to measure *effortless attention under control of the environment* (James, 2012), returned the strongest outdoor statistics of any criterion except the base line measure. Compared with the classroom, outdoor setting preferences and task ratings were at the highest

levels of significance for perceived restorativeness scale (PRS) criteria, which are underpinned by Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989). ‘Absorption’, defined as the *higher level of individual task absorption and persistence outdoors*, is an experiential QV arising from the Stage 3 interview analysis which was strongly associated with the outdoor settings. Lastly, as discussed, increased task engagement and motivation was observed outdoors over the classroom.

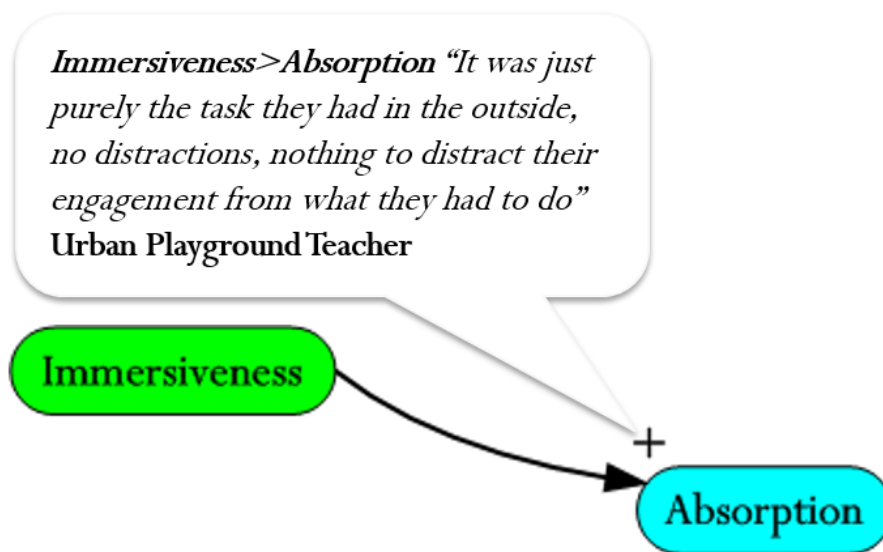
While these findings are broadly consistent with studies which have found positive effects of green spaces on children’s attention (Grahn et al, 1997; Wells, 2000; Dadvand et al., 2015; Schutte et al., 2015; Simone, 2003; Taylor, Kuo, & Sullivan, 2002), previous research has tended to involve post-test evaluations of restorative benefits, rather than in-task examinations of attention. This study may also involve the youngest sample to have taken the PRS (Bagot, 2004; Bagot et al., 2007).

The discussion has six parts. The first assesses the potential impacts of classroom distractions. The second, investigates an implied association between ‘fascination’ and ‘extent’ (Kaplan & Kaplan, 1989), while the third takes the neuroscientific perspective in seeking reconcile ideas of attention restoration with an active task scenario. The fourth explores insights in light of the argument thus far, particularly those related to functional motivation. The fifth looks at findings pertaining to underachievers in the context of school attention deficit in a more general sense and affordance theory (Gibson & Rader, 1979). The section then ends on a summary of main points.

### ***8.2.1 Classroom Distractions***

Contextual factors, such as noise and proximity to others, have been linked to negative attentional impacts in the classroom (Klatte et al., 2013; Evans, 1991; Glass & Singer, 1972). That distractions may have undermined attention in the classroom is implied by data associated with the CLD relation between (environmental) ‘immersiveness’ and (experiential) ‘absorption’. For example, in 8.11 overleaf, the urban playground teacher recalls that “*it was purely the task they had in the outside, no distractions, nothing to distract their engagement from what they had to do*”.

Nevertheless, the idea that distractions were a major factor in findings is unsupported. Only one classroom interruption was observed during the study – a brief announcement during one ‘Build a Den’ task which took place before the activity had begun. The background noise of the video recordings is also substantially quieter in the classroom than outdoors for at least two of the wild setting tasks. Moreover, although indoor space was relatively limited for ‘Build a Den’ and ‘Make a Toy’, for the others, children had a double classroom, or more, to spread out in.



**Figure 8.11 ‘Immersiveness’ and ‘Absorption’ (distraction)**

These observations, and the lack of statistical differences between classroom components, would suggest contextual distractions were not principally responsible for attentional differences between indoor and outdoor settings.

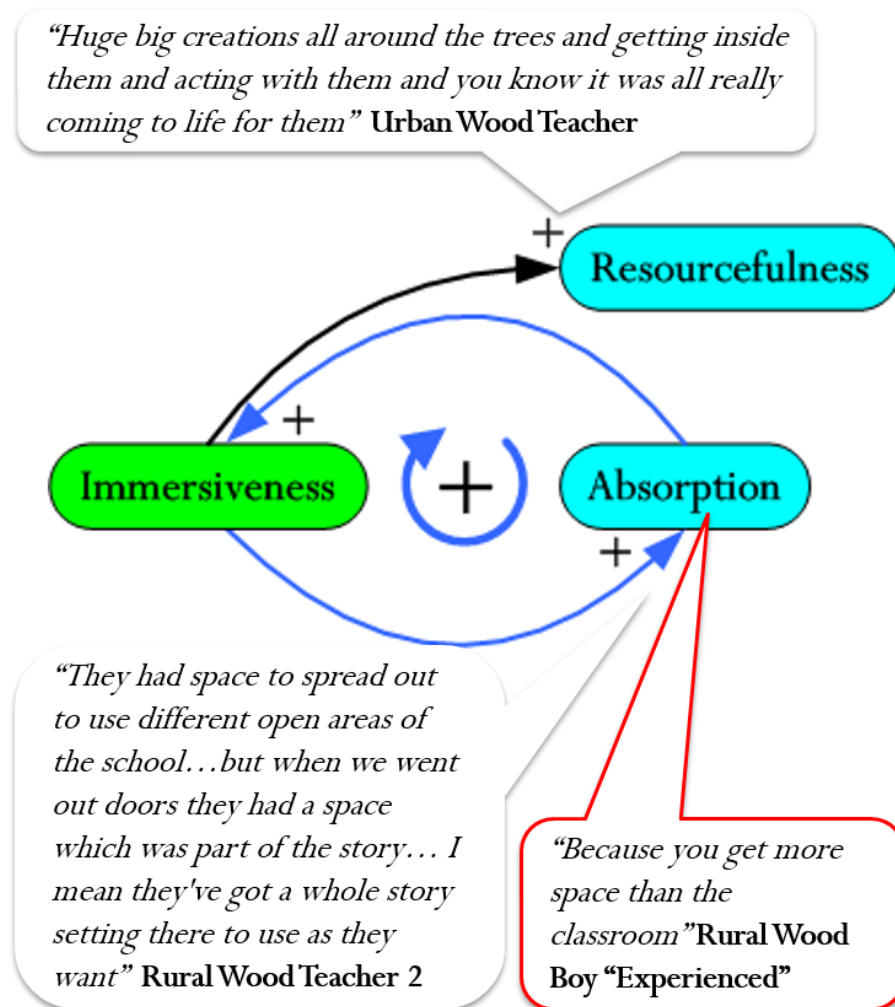
### **8.2.2 Fascination and Extent**

The strongest statistical support for outdoor attentional impacts are the findings for the PRS criterion, ‘fascination’ (“*I could explore*”). *Fascination* is a basic psychological category of attention, proposed to be effortless and governed by environmental stimuli, as opposed to *directed attention*, which is effortful and under executive control (James,

2012). The PRS criterion purports to assess *soft fascination*, which is pleasurable, expansive and associated with natural settings and cognitive restoration.

Analyses also revealed a strong association between ‘fascination’ and ‘extent’. These criteria exhibited a roughly equivalent membership of the ‘autonomy’ component, with marginally weaker preferences for ‘extent’.

The two are intimately linked in ART, which proposes extent to be constructed through fascination-driven exploration involving both perception and the imagination. Kaplan and Kaplan describe ‘extent’ as the sense of the scale and connectedness of elements in an environment, and the experience of it as “*a whole little world’ (...)* captured in a small space” (Ibid 1989, p.191-192).



**Figure 8.12 ‘Immersiveness-Absorption’ (fascination) Closed Loop**

In the environmental discussion, it was put forward that the contingent relationship between ‘fascination’ and ‘extent’ might be thought of as *the construction of experiential space*, an interactive process between cognition and environment. On this basis, it was argued that ‘extent’ might be considered an intangible affordance which children perceived and used in their activities.

The statistical association between ‘fascination’ and ‘extent’ finds support in data linked to the CLD relations between the ‘(environmental) immersiveness’ and experiential QVs, particularly ‘absorption’. Three example quotes are shown in Figure 8.12. In the first, the urban wood teacher describes “*huge big creations all around the trees and getting inside them and acting with them, and you know it was all really coming to life for them*”. In the second, a rural wood teacher talks about how “*outdoors, (children) had a space which was part of the story...I mean they’ve got a whole story setting there to use as they want*”. The concept of a “*whole little world*” seems implicit in these comments, as does the idea that space played an active role in creative processes, infusing and expanding imagination and productions. This sense of active space contrasts with the other settings, where space did not appear integral to activity and seemed used predominantly for performatory locomotion.

Notably, some experienced boys cited space as a principal learning benefit of the wild setting, and the group overall rated the classroom task significantly lower for ‘extent’ than early years’. By the same argument as proposed for utilitarian complexity, it may be that findings like these also indicate these children’s richer appreciation of space-as-affordance as conferred by their experience.

On these bases, it is argued there is a meaningful correspondence between the qualitative findings relating to ‘immersiveness-absorption’ and the statistical support for ‘extent-fascination’. Moreover, assuming the constructive process set out in ART, it is also put forward that this might be conceptualised as a reinforcing closed loop, with performance implications, between attention and the intangible affordance of ‘extent’ (as represented in Figure 8.12). This argument underpins the proposal that ‘extent’ was an environmental variable relevant to task performance on the wild setting tasks.

### ***8.2.3 Fascination and Directed Attention in a Task Scenario***

Nevertheless, it seems paradoxical to propose a role for soft fascination in an active task. On the one hand, fascination is associated with attention restoration, while on the other, a typical school task would seem an exemplar of a context requiring directed attention. Put simply, how can a situation both demand and restore directed attention?

Touched upon in Chapter 2, the Theory of Integrated Competition (Desimone & Duncan, 1995), proposes attention to be “*an emergent property of many neural mechanisms working to resolve competition for visual processing and control of behavior*”. Competition is between environmental stimuli and those arising from executive needs and goals (Desimone & Duncan, 1995, p.194), an external-internal distinction it was suggested parallels that between fascination and directed attention.

Neurophysiological research also suggests these two categories of stimuli involve two functionally-independent, yet interrelated, neural systems: the ventral and the voluntary, respectively (Corbetta & Shulman, 2002). Viewed through a neuroscientific lens, therefore, it might be argued that directed attention and fascination are not either / or states, but those which reflect levels of competition between the two systems.

For example, in a task setting which is not consonant with a child’s needs and goals, there may be greater demands on their voluntary system to resolve competition between exogenous and endogenous stimuli, and higher levels of directed attention. In a setting consonant with needs and goals, however, it follows there would be greater harmony between the two systems, where reduced demands on the voluntary system might also serve to promote fascination or sustain directed attention. That ART proposes attentional benefits to be underpinned by the perception of an environment “*that fosters effective functioning*” (1989, p.68) would seem consistent with this conception.

In summary, from a neuroscientific perspective, the PRS criterion, (soft) ‘fascination’ might be viewed as a property of interaction with environments congruent with needs and goals. Thus, it is argued that the ‘fascination’ statistics for the outdoor tasks, and observations of sustained attention, might be interpreted under an umbrella of functional consonance which might encompass active and restorative situations.

#### **8.2.4 Motivation and Attention**

ToIC (Desimone & Duncan, 1995) also shares two notable similarities with Kim's neuroscientific model of motivation, where attention is associated with sub-system 3 (Kim, 2013). For one, they *both view attention as a regulatory property or cognitive bias of interaction with environment*, as opposed to a localised executive module or capacity (Smith & Kosslyn, 2013). For two, they *both entail the systemic implication that attention is effortful to the extent that environmental stimuli are incompatible with functional needs and goals*. This implies an optimal relationship where the two are in concert, and there is minimal regulatory requirement, or distinction between attention and world. This seems to echo the autotelic experience, where immersive activity involving a limited attentional field are defining features (Csikszentmihalyi, 2000).

Thus, in light of the neuroscience of attention and the prior discussion of motivation, there seems to be a compelling theoretical argument for viewing sustained effortless attention as a *regulatory property* of functional interaction with affordances supportive of personal goals and needs.

#### **8.2.5 Underachievers and Attention**

While the findings suggest general outdoor impacts on children's attention, these are particularly conspicuous for the underachievers. The group returned a higher overall PRS rating for the outdoor task versus their peers, significant for the whole study and the urban wood tasks. In data linked to the 'empowerment' and 'absorption' QVs, teachers frequently use the underachievers for illustration. Moreover, that attention deficit was a characteristic of all study underachievers according to their teachers, but was not apparent in the outdoor settings, is an extraordinary finding. While a previous US study did find children's attentional disorders to be alleviated by exposure to green space, there appears to be nothing in the literature regarding in situ impacts (Taylor, Kuo, & Sullivan, 2001).

The rapid rise in attentional disorders over recent decades has been termed a global pandemic by some. It has become a prevailing factor in underachievement worldwide (Hicks, 2013), and which is noted as contributing to Scotland's performance gap (Scottish Government, 2011a). Both ADHD and ADD involve a broad pattern of deficits distributed across brain regions relevant to embodied interaction, including motivation, directed attention, inhibitory control, and functions related to cognitive energy and rewards. In discussion of the neuroscience of these deficits, Halperin and Healey recommend the remedy of engagement with nature and physical play, particularly in early and middle childhood:

*“Environmental enrichment (and) group-based cognitively and physically challenging activities...may provide an avenue for neural and cognitive growth that would serve to facilitate the diminution of ADHD severity across development.”* (Halperin & Healey, 2011, p.17).

Eleanor Gibson argued rich perceptual and motor interaction with affordances to be fundamental to the development of attentional capacity (Gibson & Rader, 1979). She regarded development as progressing through phases, all characterised by an intrinsic preference for intermodal experiences. In infancy, affordances take the lead, motivating and regulating perceptual and motor exploration, first basic visual and auditory orientation, and later object manipulation. During middle childhood, ambulatory exploration then leads to *“a revelation of attention (to) affordances of places for hiding, escaping, and playing”* (Gibson, 1988, p.8). She also speculates that the ability for a schoolchild to choose between alternative courses of action, may require *“prior maturation of exploratory and motor capacities for search, manipulation and locomotion, and time to try them out”* (Gibson & Rader, 1979, p.18).

E. Gibson's theory has three implications for the discussion, and which seem consistent with the idea of attention as a regulatory property. Together with Halperin and Healey, it suggests that *multimodal embodied interaction with rich environments may be fundamental to the development of attentional capacity*. This accords with the view that the rise of attentional disorders may be attributable in part to increasing screen-based virtual interaction in childhood and school learning (Palmer, 2016). Second, is that *affordances may take the lead in motivating and sustaining these interactions*. Third, is that *without these experiences, or personally-enabling task affordances, a child may find it difficult to apply, or be taught, attentional control and flexibility*.



It is put forward that the underachievers' classroom attention deficit could be attributable in part to their being experientially or developmentally underprepared for typical classroom affordances. If as a result, these children do not perceive such affordances as personally-enabling, then the implication is that sustained attention on related activities may be challenging, or impossible. Conversely, in a context of personally-enabling affordances, such as is proposed for the outdoor settings, it follows that same children may exhibit similar levels of attention as their peers. It is argued that this may explain the standout attentional effects of the outdoor settings implied for the underachievers, relative to the classroom, and that the finding may have developmental and educational significance.

#### ***8.2.6 Attention: Summary of Main Points***

Statistical and qualitative findings suggest attention was more sustained on the outdoors tasks, than the classroom. Classroom distractions are discounted as contributing significantly to the findings. A virtuous interrelationship between attention and 'extent' (space-as-affordance) seems strongly implicated, and may have had implications for creative performance, particularly in the wild settings. It is proposed outdoor attentional effects might be viewed as a property of functional interaction with affordances consonant with personal needs and goals. Noteworthy attentional impacts for underachievers outdoors were explained on the basis of enabling affordances. It was also proposed classroom attention deficit of these children, and in general, could be attributable to experiential disadvantages rendering sustained attention a challenge in the absence of enabling affordances. If so, then the discussion suggests experiential learning in affordance-rich settings could be a potent remedial intervention for addressing Scotland's performance gap in early years'.

### 8.3 Positive Affect

Study findings imply stronger positive emotional impacts of the outdoor settings, compared with the classroom. Enhanced confidence outdoors was a common theme of the interview analyses. The criteria with an emotional emphasis –‘compatibility’ (“*I liked being there*”) and ‘enjoyment’ (“*I had fun*”) revealed significantly stronger outdoor statistics, with no significant difference between the two overall, or within settings or groups across experiments. ‘Compatibility’ is also the strongest member of ‘creative compatibility’, a component associated with natural richness. Compared with the early years’, the experienced group returned stronger preferences for ‘compatibility’, ‘creative compatibility’ and ‘enjoyment’, across all outdoor settings, and in the wild setting only for the first two. Early years’ boys also rated the outdoor task significantly higher for ‘compatibility’ than the girls. On the basis of research suggesting correlation between stated preference and the experience of positive affect (Roe et al., 2013), general outdoor preferences might also be considered to indicate positive emotional association with those settings. Underachievers also rated the outdoor task higher than peers for PRS criteria.

Although these findings pertain to tasks and their settings, they might be considered to complement studies which found a preference for outdoor environments in general (Hart, 1979; Moore, 1986; Wells & Evans, 2003; Ulrich, 1993), notably, Bagot’s PRS school study (Bagot, 2004; Bagot et al., 2007)

There are five parts to this discussion. The first two draw on ART (Kaplan & Kaplan, 1989) to investigate the stronger ‘compatibility’ statistics for experienced versus early years’, and early years’ boys versus girls, respectively. The third ventures an interpretation of the underachievers’ stronger outdoor PRS ratings on the basis of their potential sensitivity to classroom stressors. The fourth explores the concept of eudaimonic wellbeing as an overarching explanation for findings. The section then ends on a general summary.

### 8.3.1 'Compatibility': Experienced vs Early Years' Children

The component 'creative compatibility' is proposed to represent a state of active cognition where a child feels creatively enabled, stimulated and comfortable. While discussion of 'creative compatibility, has thus far focused on 'discovery' and 'ideas', its strongest member was 'compatibility' –the only emotional or PRS criterion to exhibit any link to natural richness. It has been argued that the experienced group's stronger 'creative compatibility' preferences could be attributable to their capacity to perceive and use their wild setting's 'utilitarian complexity' in novel ways towards novel goals. It also seems probable that the group's standout outdoor preference for 'compatibility' reinforced its membership weighting. In short, there is a statistical implication that 'compatibility' could represent the affective dimension of the perception that task affordances are goal-enabling, and that this is enhanced by experience of an affordance-rich task setting.

Under ART 'compatibility' is defined as *the degree to which a setting is perceived to complement the goals and disposition of an occupant*. The perception that a setting supports effective functioning also underpins ART and related restorative benefits (Kaplan & Kaplan, 1989). Preference Theory shares a similar basis, where setting preference is proposed to be a response to an "*assessment of the environment in terms of compatibility with human needs and purposes*" (Kaplan & Kaplan, 1989, p.10). The meaning of 'compatibility' here seems equivalent to the ART construct.

Moreover, while Preference Theory research emphasises a passive response to environment, its constructs all imply active interaction or the anticipation of it. Its fundamental axis entails our basic need for exploration and understanding. It has been argued that both informational factors implicated in the immediate environmental response –'complexity and 'coherence'– are embodied in 'utilitarian complexity'. Of the two remaining inferred factors, 'legibility' "*entails a promise, or prediction, of the capacity to comprehend and to function effectively*" and 'mystery', the factor with the strongest empirical support, "*the promise that one could learn more*" (Kaplan & Kaplan, 1989, p.53-57).

Thus, the extent to which one perceives functional consonance between a setting and personal goals and needs, can reasonably be argued to underpin both theories, and associated affective responses (Kaplan & Kaplan, 1989). Additionally, it is put forward

that the meaning and *feeling* of ART's 'compatibility' construct, might be considered to summarise this basic shared premise. Lastly, as proposed already for attention, while related literature may emphasise the passive response, neither theory seems inconsistent with an active task scenario. Under this interpretation and in the study context, it would seem logical for 'compatibility' to be the PRS measure most strongly associated with natural richness, exposure to a naturally-rich test setting, and general setting preference.

On these bases, therefore, it is argued that the experienced group's stronger outdoor preferences for 'compatibility', and in general, may have the same attribution as 'creative compatibility', i.e. their enhanced capacity for perceiving and using their wild setting's utilitarian complexity. Indeed, 'compatibility' might here be defined as *the positive feeling associated with perceiving and actualising utilitarian complexity*, or those inherent action possibilities of the task setting consonant with needs and goals.

### 8.3.2 'Compatibility': Early Years Boys vs Girls

Another 'compatibility' finding is the higher task ratings for the outdoor setting of the boys over girls. This was the study's sole gender-related finding and seems influenced by the early years' statistics given that the difference remained significant for their analyses, but not for the experienced group alone.

*"In class, if they're to sit down and do something for a length of time, they wander, therefore it causes a bubbling under the surface of their behaviour... (outdoors) I feel that they're less disruptive"*

**Rural Wood Teacher 1**

*"I find with mine – it's mostly been boys that are the lower achievers – that they are much more willing to join in and give it a try than if I ask them to do something similar in class"*

**Rural Wood Teacher 2**

**Figure 8.13 Early Years' Boys: Comments by the Rural Wood Teachers**

Studies show that boys of this age generally exhibit more energetic behaviour and physical play than girls (Lovell, 2009; Moore, 1990). The experienced outdoor teachers also emphasised the difficulties some boys have adapting to sedentary classroom learning, and how these are mitigated by outdoor learning.

In Figure 8.13 above one talks about how “*if they’re to sit down (in the classroom) and do something for a length of time, they wander (which) causes a bubbling under the surface of their behaviour*” whereas outdoors “*they’re less disruptive*”. Her colleague notes how early years’ underachievers have “*mostly been boys*” and that in the wild setting, “*they are much more willing to join in and give it a try than if I ask them to do something similar in class*”.

It is argued, therefore, that the early years’ boys’ ‘compatibility’ ratings could be attributable to the perception that the outdoor task settings were better suited to their energetic disposition, relative to the classroom and to their female classmates. The deeper explanation here is the same as that proposed for the experienced group, only here perceived functional consonance might be viewed in terms of a task tailored to the group, rather than a group tailored to and by the setting.

### ***8.3.3 Underachievers and Classroom Stressors***

The last group finding implying emotional impacts is the underachievers’ higher PRS task ratings for the outdoor settings. Of these, their ‘compatibility’ statistics were the strongest of the PRS criteria and, albeit non-significant, exhibited the biggest difference from peers. It has also been suggested that ‘compatibility’ might be considered to summarise the PRS scale’s underlying premise, implying this finding might also be explained on the basis of perceived functional consonance with the outdoor setting.

A factor touched upon in Chapter 2 which may be relevant is classroom *stress*. Child research highlights many stressors associated with school underperformance, including worrying about failure (Hockey, 1983), social comparison (Evans, 1991), and lack of task or environmental self-mastery (Evans, 1984). Stress has been shown to impact negatively on attention, memory and social interaction (Easterbrook, 1959; Evans,

1984), and cause regression in play (Lewin, 1946). It may be an adaptive response to loss of autonomy, or the perceived threat of it (Evans, 1991). There is also a substantial body of research to suggest stress reduction is an adaptive response to natural environments (Ulrich, 1993; Wells, 2014), with significant effects on children (Roe, 2008; Wells & Evans, 2003).

The idea that classroom stress may have played a role in the underachievers' task perceptions finds some support in other study findings. Most notably, three aspects of child cognition impaired by stress –attention, memory and social interaction– are those CFs where outdoor impacts are most conspicuously linked with the group. Potential classroom impacts on perceived or actual autonomy were also proposed in relation to motivation. Effects were attributed to setting pressures and affordance constraints, and also linked to potential incidences of regressive play. These factors are associated with stress and, as has been implied, seem likely to have had the strongest impacts on the children least experientially prepared for the classroom. For example, most underachievers were early years' boys, and it may be their 'compatibility' ratings weighted this PRS statistic. The related quotes in Figure 8.13 might well be interpreted as indications of stress in an autonomy-restrictive context.

It is argued, therefore, that the underachievers' higher PRS task ratings could reflect the perception and feeling they functioned more freely and effectively outdoors, *relative* to a classroom which they may find more stressful and disempowering than their peers.

#### ***8.3.4 Eudaimonic Wellbeing and Motivation***

Explanations for the stronger positive affect statistics outdoors of the experienced group, the early years' boys and the underachievers have all been ventured on the basis of enhanced perceived functional consonance. It has also been argued that ART and Preference Theory are consistent with a task scenario, and share a basic assumption that the emotional impacts of a setting correspond to the degree which it is perceived to be consonant with personal goals and needs (Kaplan & Kaplan, 1989).

In prior discussion, the link between functional motivation and positive affect was highlighted, and it was proposed this could explain some outdoor findings, notably enhanced *confidence* on those tasks. The association between positive emotion and optimal environmental interaction has been a feature of many theories discussed (Kim, 2013, Berlyne, 1971, Lewin, 1946, Csikszentmihalyi, 2000, Deci & Ryan, 2000). Csikszentmihalyi describes this emotion as a relaxed, positive feeling about oneself, with feelings of effectance and a loss of ego-related concerns. Deci and Ryan portray a similar state associated with intrinsic motivation, termed ‘eudaimonic well-being’, which they define as feeling “*fully functioning*” and aware of one’s own “*vitality, psychological flexibility and deep inner sense of wellness*” (2002, p.22-23).

Some theorists have argued that the evolutionary function of positive emotion in the context of motivation is to forge associations with environments which support effective functioning (e.g. Lewis, Sullivan, & Michaelson, 1984; Thelen, 1996; Preyer, 2001). This is held to have adaptive significance by prompting us to return to settings which promote self-development and perceived self-efficacy (e.g. Lewis et al. 1984; Thelen, 1996; Preyer, 2001). A similar premise underpins Environmental Self-Regulation Theory, where positive affect, determined by integrating or stabilising principles of motivation, is held to mediate associations with places compatible our need for emotional regulation (Korpela, 2002). Deci and Ryan propose self-regulation to be a basic evolutionary requirement, for if the organism cannot manage its environmental relationships towards self-integration and self-maintenance, then it risks being entrained down maladaptive paths by external factors. They argue that this is why autonomy may be fundamental to motivation in all organisms (Deci & Ryan, 2000).

In short, positive affect can be viewed as an emergent property and indicator of a functional relationship with a setting compatible with personal needs and goals, and which serves to mediate positive associations with environments that promote development and self-actualisation.

The implied emotional impacts and experiences of the outdoor task settings have been described in various terms, including feelings of autonomy, self-lessness, enjoyment, relaxed confidence, and environmental compatibility. Although this implies ambivalence, it is put forward that all might be considered facets of the *same* emotional response to environments which support effective human self-regulation. This idea of a single emotional response is perhaps suggested by the urban wood teacher’s observation

that there was “*just one big frantic mood in the woods, (as opposed to) two types of mood in the classroom*”. Finally, it is argued that all these facets seem best captured by the concept of *eudaimonic well-being*, and that the discussion implies ‘compatibility’ to be its most accurate measure in this study.

### ***8.3.5 Implications of Adapting the PRS Scale***

In the methodology chapter, it was suggested that the adaptation of the sense of the PRS statements from passive-abstract to active-concrete may have altered the meaning of the scale. It could be argued that the scale no longer measures what it purports to, and therefore, that it is inappropriate to interpret related findings in the context of ART. That related statistics have been drawn on in discussion of motivation, attention and positive affect may indicate a weakness of the adapted scale.

Nevertheless, it could be non-trivial that the scale’s adaptation for preoperational children shifted its emphasis from restorative response to autonomous exploration, both of which are complementary properties of functional self-regulation. Thus, the adaptation may highlight a deeper underlying relationship between environment and motivation, attention and positive affect which is implicit in ART. This relationship blurs distinctions between endogenous and exogenous stimuli, and encompasses all under a single umbrella of interaction with environments with varying capacities to promote effective functioning. In summary, it is argued this relationship may explain why discussions of different sections in this chapter draw on similar statistical findings, and could expand and enrich an interpretation of ART and the PRS.

### ***8.3.6 Positive Affect: Summary of Main Points***

Findings suggest stronger outdoor impacts on feelings of compatibility, enjoyment and confidence. This has been attributed to a greater perceived functional consonance with



the outdoor settings, a premise which it is proposed underpins both Preference Theory and ART (Kaplan & Kaplan, 1989). The stronger response for the experienced children is explained in terms of the group's enhanced perception of the outdoor task setting's utilitarian complexity; for the early years' boys, to their perceiving it better suited to their disposition; and for underachievers to their perceiving it more empowering and less stressful, relative to the classroom and comparison groups. It is argued the various emotional facets linked to the outdoors might be grouped under a single category of *eudaimonic well-being*, a affective emotional property of autonomous interaction with an environment which supports effective self-regulation. It is suggested that this may account for crossovers in discussions of motivation, attention and positive affect, and that it have been highlighted by the adaptation of the PRS scale for young children.

## **8.4 Physical Activity**

Higher levels of physical activity were observed outdoors over the classroom, and in the wild setting over the playground. Compared to the playground, children's movement in the wild settings seemed more diverse and integrated into creative activities. These observations are consistent with child studies which reported increased physical activity in natural, versus school, settings (Lovell, 2009; Mygind, 2007; Wells & Donofrio, 2011), and its synthesis with play behaviours outdoors (Fjørtoft, 2004). This three-part discussion will first explore relationships between affordances and movement, then look briefly at the implications of movement for cognition, before ending on a summary of main points.

### ***8.4.1 Affordances and Movement***

Setting factors other than affordances which may have constrained physical activity in the classroom have been touched upon already (Gump, 1978). However, these seem unlikely to have influenced differences between the playground and wild settings. For

example, both ‘Build a Den’ and ‘Make a Toy’ featured productions in fixed locations, but the latter still entailed significantly higher levels and diversity of movement. Could affordance richness have played a role in such observations?

Gibson proposes an affordance is what makes environmental interaction possible for the organism (Gibson, 1986), which implies a basic association between affordance richness and the range of options for movement available to it. This idea finds empirical support in the observation that all but one of the RI affordance items scored for each outdoor task setting was actualised in its analogous movement. This would imply a meaningful link between outdoor affordance richness, and diversity of physical activity. This was also a finding of Fjørtoft’s longitudinal study of impacts of naturally-rich and playground settings on the physical activity of 5-7 year olds, which reported a direct correspondence between affordances and levels and diversity of physical activity, motor development and play activities (Fjørtoft, 2004).

#### ***8.4.2 Movement and Cognition in the Wild Settings***

A functional relationship between movement and cognition is a basic assumption of Affordance Theory (Gibson, 1986). For example, Reed proposes affordance motivation to be “*not merely moving to obtain something in the environment – performatory locomotion – but moving as an exploratory process*” (Reed, 1996, p.136). This assumption also seems inherent in Kyttä’s interactive cycle, and underpins many of the theories of environmental motivation already discussed.

Esther Thelen argued perceptually-guided movement, as facilitated by motivating affordances, to be the basic “*engine of cognitive change*” in child development (Thelen, 1996, p.198). Her Dynamic Systems Theory of Development proposes that recurrent sensorimotor patterns formed through embodied interaction constitute the foundations for all higher-order cognitive structures. A basic role for embodied interaction in children’s cognitive development is inherent in E. Gibson’s theory of attention (Gibson, 1988) and those discussed which assume an evolutionary inclination towards physical exploration of natural environments in middle childhood (Bateson & Martin, 2000; Sobel, 1993; Cobb, 1977). In the following passage, Cobb describes the integration of

physical and imaginative activity in such exploration, while emphasising the importance of autonomy:

*“(The child’s) basic need for outer expression of the power to model and mould his environment (which is) achieved through cooperation and mutual relations with his total environment, in which learning, imagination, and the process of evolution will be geared to one another in the child’s personal development” (1977, p.111).*

From an ecological psychological viewpoint, therefore, there seems no useful distinction between a young child’s physical, perceptual and imaginative interactions with affordances. Rather, all are merged into a functional environmental relationship, which theory implies may have fundamental development significance in early and middle childhood.

The integration of physical and creative activity was a key distinction observed between the wild setting and the other study settings, where movement seemed largely performatory by comparison. This is perhaps best illustrated by the ‘Puppet Tour’ interactions analyses, where movement was a viable standalone category in the classroom, but not in the wild setting because it was so interwoven with creative activities. As mentioned, Fjørtoft’s study reported a similar correspondence between affordances and *“a multitude of play activities”* (2004, p37), which was stronger in naturally-rich settings than the playground.

In summary, the integration of creative and physical activity on the wild setting tasks supports the idea of a functional relationship between affordances, movement and cognition, one which enriches that already proposed between cognition and environment. This implies higher levels and diversity of physical activity in the wild setting entailed cognitive impacts which may have been integral to related task performance and findings.

#### ***8.4.3 Physical Activity: Summary of Main Points***

Findings suggest greater levels and diversity of physical activity in the wild settings, compared with the other settings. Links between RI affordance items and observed

activities imply a direct correspondence between richness of affordances and movement, and the interactions analyses highlight its integration with creative pursuits. Cognitive impacts integral to task performance are argued on the basis of theory which implies a functional relationship between affordance-driven movement and cognitive development. As a final point, there is perhaps a tendency to view physical activity in natural settings through a lens of health and wellbeing. However, the discussion would suggest that movement in natural task settings is not only inextricably linked to environmental motivation and cognitive impacts, but might also be considered an indicator and measure of them.

### **8.5 Summary of Relationship between Environment and Experience**

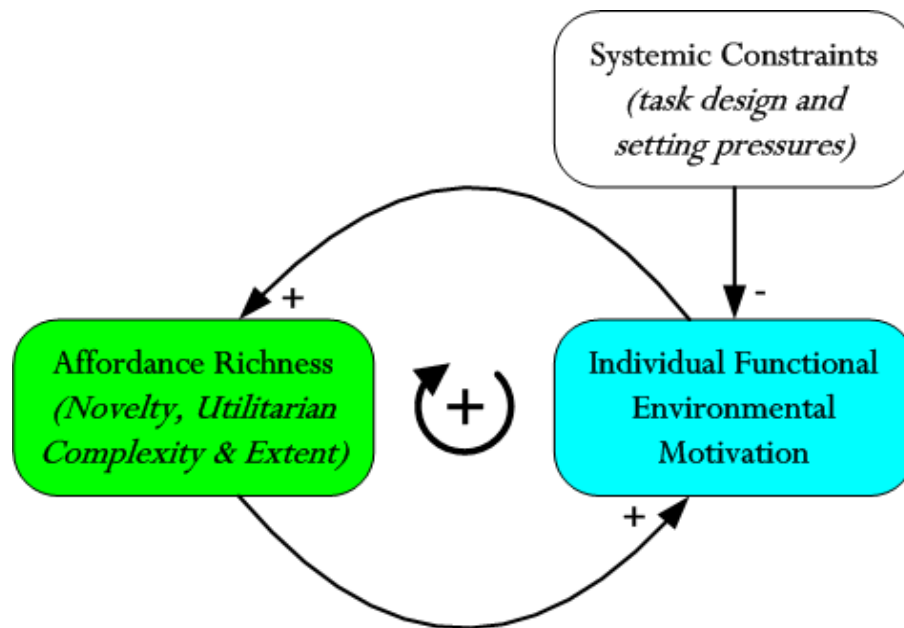
Table 8.2 below sets out the key findings and discussion outcomes for the 5 CFs discussed in this and the previous chapter. There is empirical support for a stronger link between all and the outdoor task settings, compared to the classroom. Furthermore, while a relationship with natural richness seems more explicit for some than others, arguably, qualitative findings suggest all are more strongly associated with the wild settings than the playground.

The discussion also implies meaningful interrelationships between the cognitive factors, which imply a common underlying psychological factor with implications for their attainment. This section seeks to start to articulate this factor and address the thesis's fourth objective by integrating discussion outcomes thus far into a general picture of the relationship between environment and individual cognition. It will do so by assessing the contents of Table 7.3 through the lens of the theoretical framework.

It is put forward that the relationship between environment and individual cognition is best summarised by the reinforcing loop shown in Figure 8.14 below. This loop represents the second-order unity, or the coupling of individual children and their task setting. It is argued that this is best conceptualised *as a functional motivational relationship between cognition and environment*, one which has developmental and educational significance in the age group.

<b>AFFORDANCES</b>		
<ul style="list-style-type: none"> <li>• Statistics for 'discovery', 'ideas' and 'creative compatibility', with qualitative support, suggest an enabling relationship between natural richness and task-related cognition, with the role of biodiversity and multiple affordance categories implied, particularly loose materials. Three qualities, or constructs, are implied: utilitarian complexity, novelty and extent.</li> <li>• Utilitarian complexity, is defined as the number of perceived uses a particular task setting, or affordance therein, is able to support. It is argued familiarity with an affordance set could enhance perception of the quality, and that this may explain the stronger preferences of the experienced group versus the early years'.</li> </ul>	<ul style="list-style-type: none"> <li>• Novelty is the capacity for a task setting to enable experiential novelty, in the fields of perception and meaning.</li> <li>• Extent is an intangible affordance which enables the construction of 'active' space, and regarded to be largely equivalent to the ART/FRS construct (Kaplan &amp; Kaplan, 1989).</li> </ul>	<ul style="list-style-type: none"> <li>• Statistics for 'autonomy', and interview data suggesting autonomy and self-confidence outdoors, imply a regulating relationship between the outdoors and task-related cognition, as well as limiting factors in the classroom.</li> <li>• Increased diversity of immediate responses, self-confidence and behaviour characteristic of sustained 'micro-flow' experiences (Csikszentmihalyi, 2000) in the wild setting could imply a capacity for affordances to enable unobstructed efforts after meaning and value, at optimal levels of personal challenge.</li> <li>• Processes may have functional, developmental and educational significance (the latter for notable impacts on underachiever motivation and engagement), where perceived autonomy and competence are emergent properties and indicators (Deed &amp; Ryan, 2000).</li> </ul>
<b>ATTENTION</b>		
<ul style="list-style-type: none"> <li>• Statistical and qualitative findings suggest more sustained attention on the outdoor tasks than the classroom. Indoor distractions are discounted as a major factor.</li> <li>• Virtuous interrelationship between 'fascination' and 'extent' seems strongly implicated, promoting outdoor imagination, while inherently disadvantaging classroom settings.</li> <li>• Notable impacts on underachievers were attributed to motivation by an enabling environment, compared to a classroom settings they may find more disabling than peers due to experiential disadvantage. The functional and educational significance of this was emphasised.</li> <li>• Attention perhaps better conceptualised as a property and indicator of functional environmental motivation, where affordances help regulate endogenous and exogenous stimuli in accordance with personal needs and goals and at levels optimal for individual and situation (Desmone &amp; Duncan, 1995).</li> </ul>	<ul style="list-style-type: none"> <li>• Cross-method empirical support for generally enhanced compatibility, enjoyment and confidence in the outdoor task settings, compared with the classroom.</li> <li>• It is proposed that the emotional effects of the outdoors might be grouped under eudaimonic well-being, or a regulatory property of an autonomous functional environmental motivation with an environment supportive of personal needs and goals.</li> <li>• Stronger outdoor positive affect statistics for some groups are explained on the basis of increased perceived functional consonance with the environment: for the experienced group due to a deeper appreciation of utilitarian complexity; for early years' boys, for it being more suitable to their energetic disposition; and for underachievers, due to it being less stressful and disempowering than the classroom.</li> </ul>	<ul style="list-style-type: none"> <li>• Greater physical activity observed, with a direct correspondence between affordance richness and diversity of movement implied.</li> <li>• Movement in the wild setting seemed integral to performance, whereas it was more performative in the other settings. On the basis of theory which implies a functional relationship between movement and cognition, impacts are argued.</li> <li>• It is argued that movement in the wild settings should be viewed as an indicator of task cognition and motivation, and not limited to the context of health and wellbeing.</li> </ul>
<b>POSITIVE AFFECT</b>		
<b>PHYSICAL ACTIVITY</b>		

**Table 8.2 Main Findings and Outcomes for Environment and Child's Experience**



**Figure 8.14 Closed Loop: Affordance Richness and Functional Motivation**

In this relationship, the cognition of each child is viewed as seeking congruence with a task context determined by two variables. The first is the capacity of task affordances to meet a child’s personal and dispositional needs and goals, in the context of their task-relevant experience. This capacity is termed *affordance richness*, and is proposed to be underpinned by actual and perceived richness of three environmental variables: utilitarian complexity, novelty and extent. The second variable is extrinsic *systemic constraints* such as the specific task design, or implicit setting pressures and related experiences, which could impact on perceived autonomy and competence, and processes of functional motivation.

It is argued that this relationship has interrelated enabling and regulating aspects. The *enabling aspects* relate to the capacity of task affordances to facilitate personal efforts after meaning and value, at optimal levels of novelty and challenge. Related properties were the main focus of the discussions of affordances and motivation, and include individual task resourcefulness and motivation.

The *regulatory aspects* pertain to emergent properties of the enabling relationship. It is proposed these serve to sustain motivation in the moment through self-immersion and self-confidence, and in the future, by forging a positive self-image and association with environments that support self-actualisation. These properties have been the main

theme of this chapter and include sustained attention, exploratory movement and eudaimonic wellbeing. Taken together, it is argued that the properties associated with the closed loop can be considered indicators of a successful task environment, or one which supports effective functioning.

### ***8.5.1 Two Perspectives on the Relationship***

The discussion suggests that in the specific thesis context, the relationship between natural affordances and the second-order unity might be interpreted from two perspectives.

The first is of *a human child coupled to an ecological niche*, where behaviour is viewed in terms of adaptive processes which motivate and regulate interaction consonant with functional needs and goals. Edward Reed argues that all human thought and concept emerge from experiences with basic affordances, which enable “*ordinary and specialized processes of exploration and information pickup (and) patterns of thought that go well beyond perception*” (1996, p.124). Esther Thelen proposes children are born with epigenetically acquired biases, where “*certain internal states and external stimuli are endowed with a particular hedonic tone (which) constitutes the infant’s value of motivational primitives*”. For Thelen, these biases are “*essential and critical elements at the core of the development of the mind*” (Thelen, 1996, p.316) and the perceptually-guided experience of affordances they motivate *is* development itself.

Many of the theories central to the discussion so far assume an innate bias towards understanding and exploring the natural environment (e.g. Kyttä, 2003; Gibson, 1986; Reed, 1996; Kaplan & Kaplan, 1989; Bateson & Martin, 2000; Cobb, 1959; Sobel, 2013). Another theme has been the importance of rich concrete interaction for wholesome development. In these respects, it would seem unsurprising that there should be a bias towards what Edward O Wilson terms “*the most information rich part of the known universe*” (Wilson, 2007, p.39) as a motivational basis for action and development. Particularly, that some of the urban wood children had never visited a wood before and yet appeared instantly in their element, seemed to emphasise the possibility of an innate bias.

The second perspective is of *a child operating in a specific task context, towards curricular ends*. Child researchers have noted the special quality of natural environments to motivate childhood learning. For example, Moore notes “*the particular knowledge and developmental supports that can be acquired through playful interaction with natural materials and phenomena*” (1986, p.9); and Davis and Waite, its “*myriad experiential learning opportunities*” (2005).

For Thelen, the functional and educational perspectives cannot reasonably be considered separately in child development:

*“Language, logic, consciousness, imagination, and symbolic reasoning are not “above” the processes of motivated perception, categorization, and action...rather they are part and parcel of these processes, seamless in time and mechanism. Above all, we maintain, higher cognition is developmentally situated. It grows from and carries with the history of its origins. In particular, cognition is embodied and socially constructed“* (1996, p.321).

From Thelen’s viewpoint, therefore, the wild settings might be considered developmentally-situated task environments, one which promote performance by motivating basic, integral processes of perception, categorisation and action within task parameters.

For me, the capacity of the wild settings to be turned to diverse task goals and productions by the children, recalled the “Room of Requirement”: a sentient room from the Harry Potter books which “*transforms itself into whatever the witch or wizard needs it to be at that moment in time*” (Harry Potter Wiki, 2015). As an adult schooled in the modern world it is perhaps difficult to see the wood for the trees, as it were, and appreciate the rich toolkit that children perceive in natural settings. However, as Harry Heft argues, the primacy of natural affordances “*may be especially apparent in children for whom intellectualization of environmental experience is likely to be less pervasive as compared to adults*” (Heft, 1988, p.31), and the discussion in this chapter would tend to support this view.



### ***8.5.2 Conclusion***

There is theoretical and empirical support for the argument that the outdoors, particularly the wild settings, better facilitated a general enabling environmental relationship within task parameters. It is proposed this could have been underpinned by the richness of natural affordances, and a cognitive predisposition for them, with significant implications for task performance. Conversely, there is also the implication, and some empirical support, for the idea that affordance limitations and setting factors had negative consequences for some children's classroom performance. A main discussion theme has been the implied capacity of natural affordances to motivate and enable the task performance of children who are underachieving in a classroom setting. Another has been the implication that children's ability to perceive and utilise the affordances of a naturally-rich school task setting may improve with exposure.

## CHAPTER 9: DISCUSSION OF SOCIO-LINGUISTIC FACTORS

### 9.0 Introduction

This chapter will address findings pertaining to the Santiago theory's concept of a third order unity, that is, a purposeful social system interacting with its environment. Particularly, it explores findings and performance impacts relating to the children's Socio-Linguistic Domain, or *observed or reported behaviour associated with task-related cognition, that is, which can be described in social or semantic terms*. It investigates two cognitive factors relevant to the Socio-Linguistic Domain –*social interaction* and *positive teacher feedback*– the latter which necessarily investigates the framework category, the *teacher experience*. The discussion is relevant to RHs 1 and 2, and seeks to build on the outcomes, and functional motivation hypothesis, summarised at the close of the last chapter.

### 9.1 Social Interaction

Children's more effective cooperation outdoors was a general observation. This finds support in the urban wood interactions analyses, where a trend was also noted towards collaborative projects in the wild setting, but towards social fragmentation in the classroom. For 'Build a Den', children made positive references to playground teamwork in response to evaluatory questions, but not the classroom. For 'Alien Adventure' improved creative collaboration is implied by wild setting stories and presentations which were more integrated than the classroom. Common themes and QVs arising from the teacher interviews included more confident, creatively-generative and self-sustaining cooperation outdoors.

Statistical preferences for 'social interaction' (*we worked well as a team*) were stronger outdoors than the classroom, and in wild settings over the playground, though not significantly so for the latter. Nevertheless, differences between indoor and outdoor

statistics were the weakest of all criteria, and ‘social interaction’ was excluded from PCA and regression analyses due to its slight, yet confounding, effects.

These findings are consistent with research which has reported impacts of natural settings on children’s social interaction, both in general (Wells, 2014), and in a context of outdoor learning (AIR, 2005; Mygind, 2009; Lieberman & Hoody, 1998; Fägerstam & Blom, 2013; Malone & Tranter, 2003). Particularly relevant, are those outdoor learning studies which have reported greater language use (Davis & Waite, 2005; Massey, 2002; Waite, Evans, & Rogers, 2013), self-sufficiency (Blair, 2009; Davis & Waite, 2005; Lieberman & Hoody, 1998; Moore, 1989), underachiever participation (Davis & Waite, 2005; Kaarby, 2004; Massey, 2002) or different patterns of peer relationship to other settings (Davis & Waite, 2005; Mygind, 2009).

There are six parts to this discussion. The first looks at the potential social constraints of school behaviour settings. The second investigates the idea of mutual affordances, as facilitated by joint attentional processes. The third expands on this idea, exploring its experiential dimension through discussion of parallels between concepts of play and the autotelic experience. These two parts also take a broader developmental perspective, with relevance to early years’ education and motivation. The fourth part assesses the potential performance impacts by reference to concepts of positive interdependence and process gain. The fifth looks at statistical inconsistencies regarding the ‘social interaction’ criterion. The section then ends on a general summary of main points.

### ***9.1.1 Behaviour Settings***

That the classroom behaviour setting may have limited children’s movement and perceived autonomy on some tasks has been discussed (Gump, 1967, 1978). There may also be some support for implicit constraints on children’s social interaction. Notably, when asked why she thought children had not worked together on ‘Make a Toy’ indoors, as they had in the wild setting, the urban wood teacher answered:

*“I think it's just the way you've got your own space, you've got your own seat, you've got your own glue pot, you get your own bits and pieces, you know, it kind of leads them to*

*doing it on their own more I think. Whereas I guess you just naturally helped each other and enjoyed making things together outside.”*

There is perhaps the implication here that a typical behaviour-milieu synomorphy – “*your own space / seat / glue pot / bits and pieces*” – caused children to assume the task was a solitary endeavour, and proceed accordingly.

Nevertheless, while ‘Make a Toy’ indoors entailed no collaborative production, associative behaviours and conversation featured throughout. Furthermore, other classroom components, notably ‘Puppet Tour’, involved significant levels of cooperation, which suggests implicit setting constraints on social interaction for these experiments were weak or task-specific.

### ***9.1.2 Mutual Affordances and Social Development***

The last chapter concluded that between-setting variations in individual behaviour might be explained in terms of the capacity of affordances to enable functional motivation within task parameters. It was further argued that sustained attention might be considered an emergent regulatory property of such interaction (Gibson & Rader, 1979).

Costantini and Sinigaglia’s research programme on joint attention, or *the ability to attend to an object together with another person* (Seeman, 2012), suggests that affordance interaction may also be a collective cognitive process. They have found strong support for an innate capacity to perceive the affordance relations of others as our own, through the non-conscious mapping of their interactions onto our own motor repertoire. They argue,

*“The affordance relation is not a private business of a single individual but relies on a mirror mechanism that allows one to share the space of his or her own action with others...reshaping the nature and the range of the relation itself...the investigation of affordances (therefore) mandatorily involves dealing with cognitive processes underlying basic social cognition”* (Costantini & Sinigaglia, 2011, p.451-452).

The literature on joint attention in children paints a picture of a developmental process which begins in early infancy and proceeds through stages characterised by an increasing capacity for social interaction (Tomasello, 1995). Some argue that joint attention plays a vital role in the development of core facets of social cognition including perspective taking, imitative learning, language comprehension and production, and environmental understanding (Seeman, 2012).

Another perspective on mutual affordances is implied by Mildred Parten's theory of *play stages* (Parten, 1932). Based on extensive observations of preschool children, Parten proposed play to progress through stages characterised by increasing social sophistication. This begins with watching others play (*onlooking*); moves onto playing alone (*solitary play*); then playing separately alongside others doing the same thing (*parallel play*). At around 4 years old, play begins to incorporate social rules such as sharing and taking turns (*associative play*); with truly cooperative play emerging towards the end of nursery.

The theories of play stages and joint attention both imply a programme of social development built upon shared experiences of affordances, and characterised by growing competency with the rules and content of collaboration. This seems to evolve from mirroring what and how others do, into how they feel, think about and articulate doing, and integrating their behaviours, motives and worldview with our own. This viewpoint seems consistent with research that suggests the majority of preoperational peer interaction is facilitated by concrete experience (Piaget & Cook, 1998), and occurs in a context of play (Hughes, 2009). Additionally, it highlights the inherent social drive of early years' children, and also the challenges they could experience negotiating meaning face-to-face in the manner of adult conversation, without mediating affordances.

There seem to be two implications here for task collaboration. The first is *that interaction may centre, and depend on, mutually responsive and enabling affordances*. This idea might account for two otherwise puzzling wild setting findings, namely, the trend from individual activity towards collaborative projects on the urban wood tasks, and the teacher's observation that children "*all worked with people they don't normally tend to work with in the class, naturally*", also a finding of other forest learning studies (Davis & Waite, 2005; Mygind, 2009). For if early years' collaboration is underpinned by mutually-compelling affordances, it seems unsurprising for a class to exhibit an

unusual pattern of peer interaction in rich task setting or for it to self-organise into project-based pursuits. Indeed, the project browsing which characterised the earlier stages of urban wood's wild setting tasks might be viewed as children trialling shared experiences before settling on the one most personally meaningful for them.

Equally, in a setting where affordances are insufficient to enable and sustain collaboration, one might expect a disintegrative pattern of social interaction, such as was observed on both classroom components of 'Puppet Tour'. This trend could be interpreted as regression from cooperative play, into increasingly associative, parallel and solitary behaviours (Parten, 1932). Notably, feeling incapable of social participation is associated with regressive behaviour in young children (Lewin, 1946).

The second implication is *that children who are disadvantaged developmentally may have greater need for mutual affordances to enable collaboration*. Research reveals a strong correlation between levels of social competence and play in primary schoolchildren (Uren & Stagnitti, 2009), and also between social withdrawal and primary school underachievement (Perkins, 1965). The implication here is that these findings may be attributable, in part, to the absence of affordances sufficient to enable some children to collaborate effectively with peers, who may be more advanced in social development or classroom-relevant experiences.

One classroom finding which might be interpreted in this context is that underachievers rarely created toys similar to their neighbours during 'Make a Toy', while their peers did. The underachievers' isolated, often ambiguous, concepts could be indicative of the difficulties these children experience interacting or integrating ideas in a social situation without mutual affordances. That the only standalone toy concept not associated with an underachiever was made by a shy girl with very poor spoken English appears consistent with this interpretation. By comparison, the apparent capacity for natural affordances to enable the same underachievers to collaborate effectively seems remarkable. A standout example was Ro's 'ship-helicopter', where an underachiever led the most popular of all wild setting 'Make a Toy' projects.

In summary, the potential significance of mutual affordances in early years' social interaction and development was discussed. It is proposed that mutually responsive and enabling affordances may have served as an organisational principle for wild setting collaboration, underpinning atypical peer relationships, the trend towards collaborative projects, and underachiever participation on the urban wood tasks. Conversely, a lack

of socially enabling and sustaining affordances in the classroom could explain urban wood observations such as the disintegrative pattern of social behaviour on ‘Puppet Tour’, and the conceptual isolation of underachievers on ‘Make a Toy’.

### ***9.1.3 Social Motivation, Play and Implicit Rules***

This section discusses the potential relevance to social interaction findings of two factors proposed to be emergent properties of functional motivation: *eudaimonic wellbeing* and *implicit rules*.

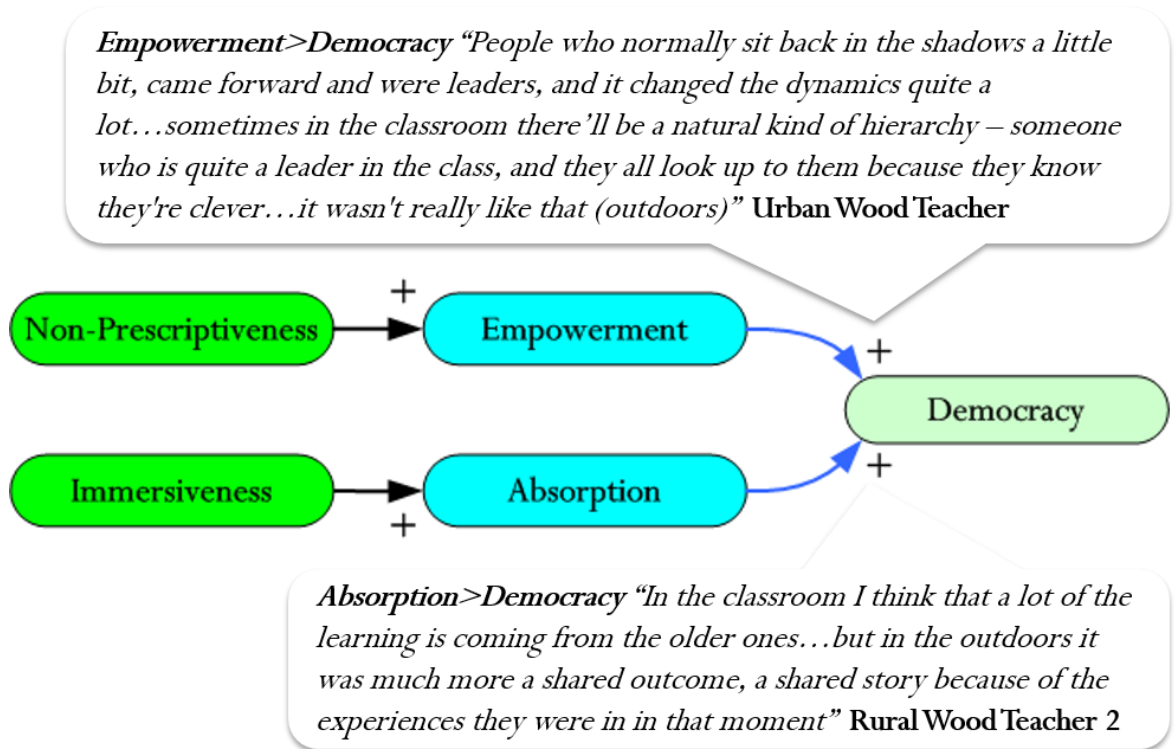
#### *Eudaimonic wellbeing*

It has been suggested in section 8.3.4 that eudaimonic wellbeing may encompass various emotional qualities, including confidence and self-lessness. The potential impacts of these factors on outdoor collaboration are implied by the proposed influence on ‘democracy’ by ‘empowerment’ and ‘absorption’ in the CLD.

Data associated with this relation includes the urban wood teachers’ observation that children “*who normally sit back in the shadows a little, came forward and were leaders*”, and how this gave rise to a more non-hierarchical social dynamic than the classroom (see Figure 9.1). That self-less absorption in activity may have been a factor in the less hierarchical collaboration reported outdoors is perhaps also implied by the rural wood teacher’s remark that “*it was much more a shared outcome, a shared story, because of the experiences they were in in at that moment*”, whereas the experienced children tended to lead their buddy group in the classroom component.

In section 8.3.4 it was also put forward that the decreased capacity of classroom affordances to absorb children in activity, may have caused the surfacing of self-conscious preoccupations (Csikszentmihalyi, 2000) and feelings of stress. Self-conscious preoccupations negatively associated with social interaction in a classroom setting include social comparison (Johnson & Johnson, 1989; Kim, 2013), group standards (Lewin, 1946), fear of failure (Hockey, 1983), extrinsic rewards, and reduced

autonomy or competence (Deci et al., 1991). These factors have already been linked to underachievers and the classroom over the course of the discussion, and may therefore have constituted a barrier to collaboration for some, with consequences for social dynamics overall.



**Figure 9.1 ‘Democracy’**

‘Relatedness’, the last CET’s basic needs, is defined as *a sense of belongingness and secure connection with one’s peers* (Deci & Ryan, 2002). The implication here is that levels of ‘relatedness’ may be associated in part with the capacity of affordances to enable and absorb children in activity. Where affordances do have this capacity, relatedness might be considered an emergent, virtuously-reinforcing property of interaction, as has been proposed already for perceived autonomy and competence. However, where affordances do not promote self-absorption, it may be that self-conscious concerns can surface which could impact on perceived relatedness, and therefore on levels of motivation also.

In summary, it is put forward that the eudaimonic wellbeing associated with functional interaction may have facilitated collaboration outdoors, particularly in the wild settings,



by promoting self-lessness, confidence and a sense of relatedness. It is further proposed that the weaker capacity of classroom affordances to enable functional interaction may have caused the surfacing of self-ish concerns for some children with negative consequences for levels of participation and overall task collaboration.

### *Imaginary Situations and Implicit rules*

In the last chapter, it was suggested that outdoor activity had characteristics of flow, particularly in the wild settings, and that this might be taken to indicate the environment was supporting optimal functional motivation. Csikszentmihalyi also regards flow to be a social phenomenon, providing there is individual adherence to rules:

*“As long as all the participants follow the same rules, there is no need to negotiate roles. The participants need no self to bargain with about what should or should not be done. As long as the rules are respected, a flow situation is a social system with no deviance”* (Csikszentmihalyi, 2000, p.43).

Csikszentmihalyi also argues *play* to be the “*the flow experience par excellence*” (2000, p.13), noting that “*practically every writer who has dealt with play has remarked on the autotelic nature of this activity.*” (2000, p.47).

The concept of rule-based play is a central component in Vygotskian theory. He proposed play is comprised of two key components: an *imaginary situation* – its defining feature– and the *implicit rules* that govern it. He also considered play to be “*a serious game*” (Vygotsky, 1978a, p.104), one which radically alters the child’s basic psychological structure and relationship with reality. He describes this as follows:

*“(In play) the child learns to act in a cognitive, rather than an externally visible realm, relying on internal tendencies and motives, and not on incentives supplied by external things...(in play) things lose their motivating force. The child sees one thing but acts differently in relation to what he sees. Thus a situation is reached in which the child begins to act independently of what he sees...(in play) thought is separate from objects, and action arises from ideas rather than from things”* (Vygotsky, 1967, p.11-12)...*(in play, the child) adopts the line of least resistance, i.e. he does what he feels like most because play is connected with pleasure. At the same time he learns to follow the line*

*of greatest resistance, for by subordinating themselves to rules children renounce what they want since subjection to rule and renunciation of spontaneous impulsive action constitute the path to maximum pleasure in play” (p.13).*

What Vygotsky is saying here is that, in an imaginary situation, the pivot of the child’s experience is no longer the *actual* object or action, but the *meaning* the child imagines for them, for example pretending a stick is wand or waving it in a wizardly manner, respectively. He termed this the first paradox of play, in that *“the child operates with an alienated meaning in a real situation”* (p.13). Additionally, he highlights how the child subordinates the gratification of their immediate impulses to the rules of the imaginary situation in order to gain the greater pleasure of sustained social play. The balance between effortless activity and effortful self-control in an imaginary situation, he called the second paradox of play.

Vygotsky regarded imaginary situations to have fundamental developmental and educational significance. He argued that imagination as a conscious function is unavailable to young children, for whom behaviour is contingent on situational demands and where every perception stimulates some form of activity. He cites the example of 2 year olds unable to repeat the sentence *“Tanya is standing up”* when Tanya is sitting in front of them, and change it to *“Tanya is sitting down”* (Vygotsky, 1967, p.11). Over the course of childhood, however, the imaginary situation is held to facilitate separation of the child’s fields of meaning and perception. At first an unconscious and spontaneous response, this develops into a capacity to exercise thought, language and will, internally, and independently of situational demands. A further implication is that the content of imaginary situations is more introspectible and transferable for children than concrete experience because it is already conceptual and detached from the physical context.

Vygotsky argued that the child *“moves forward essentially through play activity”* (p16), and considered the imaginary situation to be the highest level of preschool development, and to remain implicit in all schoolwork and beyond:

*“At school age play does not die away but permeates the attitude to reality, it has its own inner continuation in school instruction and work (compulsory activity based on rules) (Vygotsky, 1967, p.17) ...the old adage that child's play is imagination in action can be reversed: we can say that imagination in adolescents and schoolchildren is play without action”* (Vygotsky, 2011, p.8).

Vygotsky's viewpoint stands in contrast to conventional ideas of play as a distinct type of process, or frivolous recreational activity (Oxford English Dictionary, 2015). While Piaget does not grant play the same developmental significance, he shared Vygotsky's view of it as a cognitive *relationship* with the social and physical context, which entails the growing separation of meaning and perception in young children, and remains present in many activities thereafter to a greater or lesser degree (Nicolopoulou, 1993). Both Piaget, and Parten, also noted the developmental pattern in play characterised by increasing intersubjectivity, capacity to operate free of situational demands, and preoccupation with shared rules (Parten, 1932; Piaget, 1962; Piaget & Cook, 1998).

Developmental psychologist, Ageliki Nicolopoulou, puts forward a case for the academic value of systems of shared rules associated with imaginary situations:

*“It is precisely through the understanding and acceptance of a system of shared rules that children are allowed and encouraged to take an active role in their own education. This is true whether the practice is a game, or active collaboration, or making use of the conceptual system of mathematics in order to solve a problem”* (Nicolopoulou, 1993; p.14).

While she notes that these rules *“may be inherent in the structure of the activity itself”* (1993, p.14), she also emphasises how they may also be stricter for the children than the ordinances of authority:

*“Autonomy is not the same thing as arbitrariness. It requires a capacity for self-discipline and self-determination. To be able to think and act autonomously requires moving from dependence on the authority of particular superiors to operating within the framework of a shared and voluntarily accepted system of impersonal rules”* (Nicolopoulou, 1993, p.14).

Nicolopoulou illustrates the educational potential of imaginary situations by reference to her research on “Fifth Dimension”, a software programme designed to enable classes to determine their own learning goals and pathways within a curricular framework. She found that Fifth Dimension supported rapid advancement, sustained academic achievement and social cohesion, but only in so far as groups engaged with the play-world and collaborated within it (Nicolopoulou, 1993).

It is strongly argued here that collaboration on the study tasks might be interpreted largely as forms of imaginary situation. The play ‘relationship’ is the typical mode of

peer interaction in the age group (Hughes, 2009), and is also considered by Vygotsky to be implicit to some degree in any school task (Vygotsky, 1967).

It is further proposed that there are two parallels between the concepts of an imaginary situation and an autotelic experience in contexts involving young children. The first is *a close dialogue between meaning and environment*, which developmental theory predicts is likely to be more intimately coupled for the study sample. The reimagined wild setting affordances which characterised the ‘Alien Adventure’ outdoor stories (trees, leaves, a woodpile etc.), but which were not evident in the classroom stories, might be viewed as empirical support for such a dialogue. So too those shared natural affordances which provided pivot and context for urban wood projects, in contrast to the non-plastic affordances it is proposed may have constrained social and imaginative interaction in the classroom.

The second parallel is the *paradoxical mix of autonomous activity and adherence to rules*. In the discussion context, Vygotsky’s ‘lines of least resistance’ perhaps approximate with the seamless autonomous ‘efforts’ it is suggested may be enabled by an affordance-rich setting. His ‘lines of greatest resistance’ might then be viewed as those implicit rules of task-framed imaginary situations which can emerge from interaction (Nicolopoulou, 1993), and serve to motivate and regulate self-disciplined collaboration (Vygotsky, 2011).

Some findings suggest the stronger influence of implicit rules outdoors. For example, greater task self-sufficiency, as embodied in the ‘self-sustenance’ QV, implies the rules maintaining outdoor projects were coming from the children and their collaboration, not from the teacher. Implicit rules might also be considered a self-organising principle underlying the opposite patterns of cooperation between urban wood settings, one which complements mutual affordances. The regulatory influence of rules on meaning might also account for the greater thematic coherence, and integration of individual contributions, on the outdoor ‘Alien Adventure’ stories. Notably, self-sufficient activity has been a main finding of previous UK forest school studies of nursery and primary schoolchildren (Waite & Davis, 2007; Waite, 2007), which have also reported more significant and sustained language use on child-led activities (Davis & Waite, 2005).

To summarise, it is postulated that task collaboration might be conceptualised as a form of imaginary situation, which in an optimal state parallels the autotelic experience. Vygotskian theory proposes imaginary situations have motivational properties and are

integral in the development of will, social skills and operational thinking. It is argued that a greater capacity for natural affordances to enable and sustain imaginary situations, particularly in the wild settings, is supported by findings implying the stronger influence of implicit rules and a closer dialogue between affordances and meaning.

#### ***9.1.4 Affordances, Positive Interdependence and Process Gain***

This section will explore how affordance-enabled social interaction may have promoted overall task productivity.

Gibson proposes other people to be the richest of all human affordances:

*“(Because) when touched they touch back, when struck they strike back, in short, they interact with the observer and with one another. Behavior affords behavior, and the whole subject matter of psychology and of the social sciences can be thought of as an elaboration of this basic fact”* (Gibson, 1986, p.135).

Reed viewed the relationship between cognition and environmental affordances in social situations as a *“concrete and collective process in which individuals participate to varying degrees”* (Reed, 1996, p.141). He describes this process as:

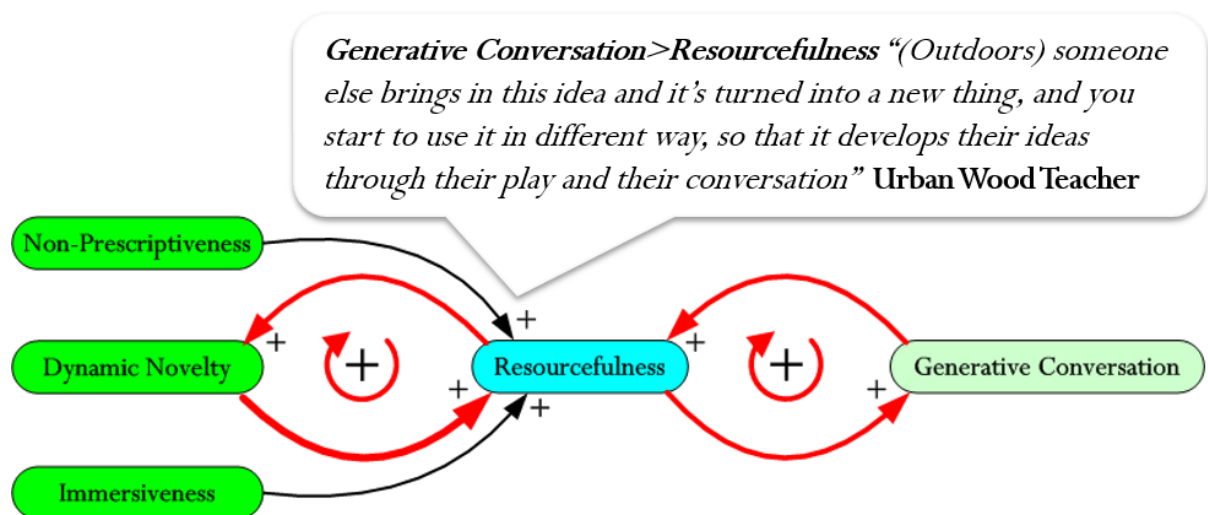
*“A collective effort after meaning and value (which doesn’t) mean that every individual in a group does the same thing, or that each individual has internalized the same motivational ideal or mechanism; on the contrary, each individually may do something that is unique in order that the group as a whole achieves its needs”* (Reed, 1996, p.11).

Johnson and Johnson argue that the awareness of the value of one’s own unique contribution in group situations to be a driving force in *positive interdependence* (Johnson & Johnson, 1989). Positive interdependence is held to occur when individuals perceive that achieving their personal task goals depends on promoting and incorporating the goals of collaborators (Johnson et al., 2007). The related synthesis of ideas is termed ‘controversy’ and is associated with enhanced retention, attention, problem-solving, creativity and task persistence in children (Johnson & Johnson, 1989).

Johnson and Johnson propose that the stronger performance impacts of positive interdependence, compared with individualistic task situations, could be because they require children to articulate and discuss their perspective and rationale. They suggest this may cause them to experience higher levels of thinking, critical analysis, conceptual conflict and situational curiosity, and enable them to internalise the verbal reasoning of others (Johnson & Johnson, 1989).

‘Process gain’ is proposed to be a key performance indicator of positive interdependence, which is defined as *when new ideas, solutions, or efforts are generated through group interaction that are not generated when persons work individually*” (Johnson & Johnson, 1989, p.49). Research suggests process gain occurs in two ways: through the transfer of ideas or solutions from the group to individual, and via the creation of new insights and higher-level reasoning strategies that individual members might not discover alone.

Thus, both Johnson and Johnson, and Reed, allude to a unity-in-diversity social scenario, where collaboration towards a shared goal is enriched through the integration of unique individual sub-goals and contributions. For Reed, these processes are enabled and expressed through the affordances of the setting, including other participants. For Johnson and Johnson, an indicator and measure of successful cooperation is process gain.



**Figure 9.2 Closed Loop: ‘Resourcefulness’ and ‘Generative Conversation’**

There may be empirical support for greater process gain outdoors, particularly in the wild setting, and also for the promotive influence of natural affordances. This idea is implicit in ‘The Cognitive Engine’, particularly the loop proposed between ‘(experiential) resourcefulness’ and ‘(SLD) generative conversation’ which is defined as *the degree to which task-related conversation and co-creation generated new ideas outdoors, compared with the classroom*. Associated data is exemplified by the urban wood teacher’s comment that in the wild setting, “*someone else brings in this ideas and it’s turned into a new thing, and you start to use it in a different way, so that it develop their ideas through their play and their conversation*” (see Figure 9.2 above).

Outdoor process gain is perhaps also implied by those responses to the Thinking Hat questions (De Bono, 2009) which suggest explicit higher-reasoning strategies in the playground. It is interesting that these responses were most strongly associated with the ‘windy’ task. As postulated by Johnson and Johnson, they may reflect the internalisation of intense verbal problem-solving and negotiation this task demanded, rather than genuine metacognition. Nevertheless, it remains a strong indication of positive interdependence and process gain (Johnson et al., 2007)

Finally, support for process gain and its two drivers is also suggested by the map of inherited ideas arising from the ‘Make a Toy’ interactions analyses (Figure 4.13) and the examples given for illustration. The transfer of ideas from the group to the individual seems extant in the integration of Al’s earlier project experiences into his ‘Big House’. The generation of new insights and reasoning that neither Im nor MI may have discovered working alone is perhaps also implied by their sophisticated ‘2 Driver Car’. Notably, Im and Al produced isolated concepts in the corresponding classroom component, which in Al’s case, was primitive in comparison to his classmates. Examples of process gain such as these might be interpreted in the context of another Vygotskyian concept, the *zone of proximal development (ZPD)* (Vygotsky, 1978), which he defines as:

*“The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers”* (Vygotsky, 1978, p.86).

Vygotsky argued school learning “*introduces something fundamentally new into the child’s development*” (1978, p.85) for its capacity to promote ZPDs which accelerate

the evolution of higher cognitive functions. However, while Vygotsky viewed the ZPD as a purely sociocultural phenomena, an implication of this discussion is that the task affordances may also play a crucial role in enabling the type of collaboration which underpins the ZPD. Through the lens of the ZPD, the apparent capacity for natural affordances to enable the effective participation of underachievers like Al can be considered to have much educational and developmental significance.

To summarise, parallels are proposed between Reed's account of affordance motivation in a group context and the concept of *positive interdependence*. Empirical support was put forward which implies greater affordance-driven process gain and positive interdependence in the outdoor settings over the classroom. Lastly, it is postulated that these findings imply an enabling role for affordances in Vygotsky's concept of the ZPD, which has significant implications for performance, particularly of underachievers.

#### ***9.1.5 Statistical Inconsistencies***

Although there seems a strong qualitative argument for the impacts of outdoor affordances on positive interdependence, the quantitative support appears more indecisive and ambiguous. When teachers were asked for their opinion on why the children's statistics for 'social interaction' did not reflect their observations, they suggested preferences could have been confused by an early years' association between the the criterion wording, "*working as a team*", and the classroom. Apparently, there is a strong emphasis on teamwork during transition, or as one said, "*you have children coming from different nursery backgrounds, so you're always encouraging them to 'work together as a team'*". It may also be that evaluating personal participation, or the social context, require cognitive capacities which are not fully developed in early years' children. This may have rendered clear assessment of social interaction a challenge for them, particularly when it involved immersive activity and after an extended period.

However, these factors seem less likely to have influenced the experienced group, and yet their statistics for 'social interaction' were marginally *lower* than early years for the wild setting—a statistic which confounded earlier PCA and regression analyses. This finding also seems inconsistent with the argument proposed that their stronger



preferences were underpinned by a keener appreciation of the functional benefits of their setting. One possible explanation is that responsibility for a younger ‘buddy’ felt more socially-constraining relative to the group’s typical levels of outdoor autonomy, and the ‘social interaction’ statistics reflect this perception.

In summary, it is suggested that the weaker statistical support for outdoor impacts on positive interdependence may be attributable to an early years’ association between the term ‘teamwork’ and the classroom, their developmental-related difficulties assessing the social context, or to collaborative constraints imposed on the experienced group.

### ***9.1.6 Social Interaction: Summary of Main Points***

Study findings are consistent with research which suggests positive outdoor impacts on children’s social interaction. These were discussed in the context of developmental theory and the functional motivation hypothesis proposed in the last chapter.

Support for the impacts of implicit setting factors on classroom collaboration seems weak or task-specific. It is put forward that motivating mutual affordances, underpinned by joint attentional processes, might better explain variations between the settings. For urban wood, this included different collaborative trends, patterns of peer interaction, and levels of underachiever participation. Eudaimonic wellbeing may have also promoted outdoor collaboration through enhanced confidence, relatedness, and the negation of self-ish concerns which might impede classroom participation for some.

The greater capacity of natural affordances to enable and sustain imaginary situations, is suggested by stronger empirical support for implicit rules in outdoor collaboration, and for a closer dialogue between environment and meaning. Findings also suggest these situations entailed increased levels of process gain, positive interdependence and higher cognitive functioning versus the classroom. It is strongly argued these factors have substantial implications for school performance, particularly of underachievers (Vygotsky, 1978b; 2011). Lastly, it is speculated that the weaker and ambiguous statistical support for these qualitative findings could be attributable to task-specific or developmental factors.

One theme of particular relevance to the thesis' overarching aim is the implied developmental and educational significance of the play relationship. Csikszentmihalyi argues the autotelic experience to be a basic manifestation of patterning experience of the environment (2000). An implication of the discussion is that the optimal imaginary situation may entail the same environmental relationship, albeit with emphasis on imaginative collaboration and the negotiation of personal meaning (Vygotsky, 2011). As Nicolopoulou argues:

*“Play is almost never studied on its own terms as a vehicle of the expressive imagination of children... because researchers are interested in translating play into more established psychological functions” (1993, p.13)”*.

It may be that such efforts to shoehorn ‘play’ into cognitive structure, or its recreational associations, or laboratory-based research, distract us from seeing it as a more basic and ubiquitous mode of interaction between personal meaning and environment.

Certainly, Vygotsky proposes the imaginary situation to be implicit in all school tasks and to underpin academic success. The work of Reed, and Johnson and Johnson, imply that the productivity of an imaginary situation is related to the diversity of individual contributions and its capacity to sustain positive interdependence. The discussion suggests that affordances may play a vital role in enabling and regulating sustained imaginary situations within a curricular framework, particularly for children who might benefit from them the most. Indeed, one might argue that the wild task settings could be viewed as a successful *actual* version of the generally engaging and sustaining play world envisaged by the developers of “Fifth Dimension”.

This discussion also seems highly pertinent to the promotion of another two of Curriculum for Excellence’s four capacities, *effective contribution* and *successful learning* (Education Scotland, 2004). Moreover, given the developmental stage of the early years’ children, and the proposed association between affordance richness, and imaginary situations, positive interdependence and the ZPD, could be the most important research finding from a curricular perspective. Particularly, utilising rich affordances to enable the effective participation of socially or experientially disadvantaged children in school tasks, could have the potential to provide significant support for transition and for reducing Scotland’s performance gap.

## 9.2 Positive Teacher Feedback

Findings suggest two effects of the outdoor settings on teachers which may have promoted children's task performance. The first is enhanced *positive affect*, implied by the 'enjoyment' QV, stronger preferences for 'enjoyment', 'compatibility' and overall, and lower classroom PRS ratings than the children. Moreover, teachers perceived their mood to have influenced performance, and 'Puppet Tour' transcripts suggest interactions were more sustained, child-centred and participatory in the wild setting. The second effect was a reduced management burden outdoors, something highlighted by all the teachers. These findings broadly concur with studies reporting beneficial impacts of outdoor settings on teacher mood and approach (Szczepanski et al., 2007; Evergreen, 2000; Lieberman & Hoody, 1998; Davis & Waite, 2005; Mygind, 2005; Ernst & Monroe, 2004). This section will discuss the two factors in turn, and potential causal factors and performance consequences.

### 9.2.1 Teacher Enjoyment and Child Performance

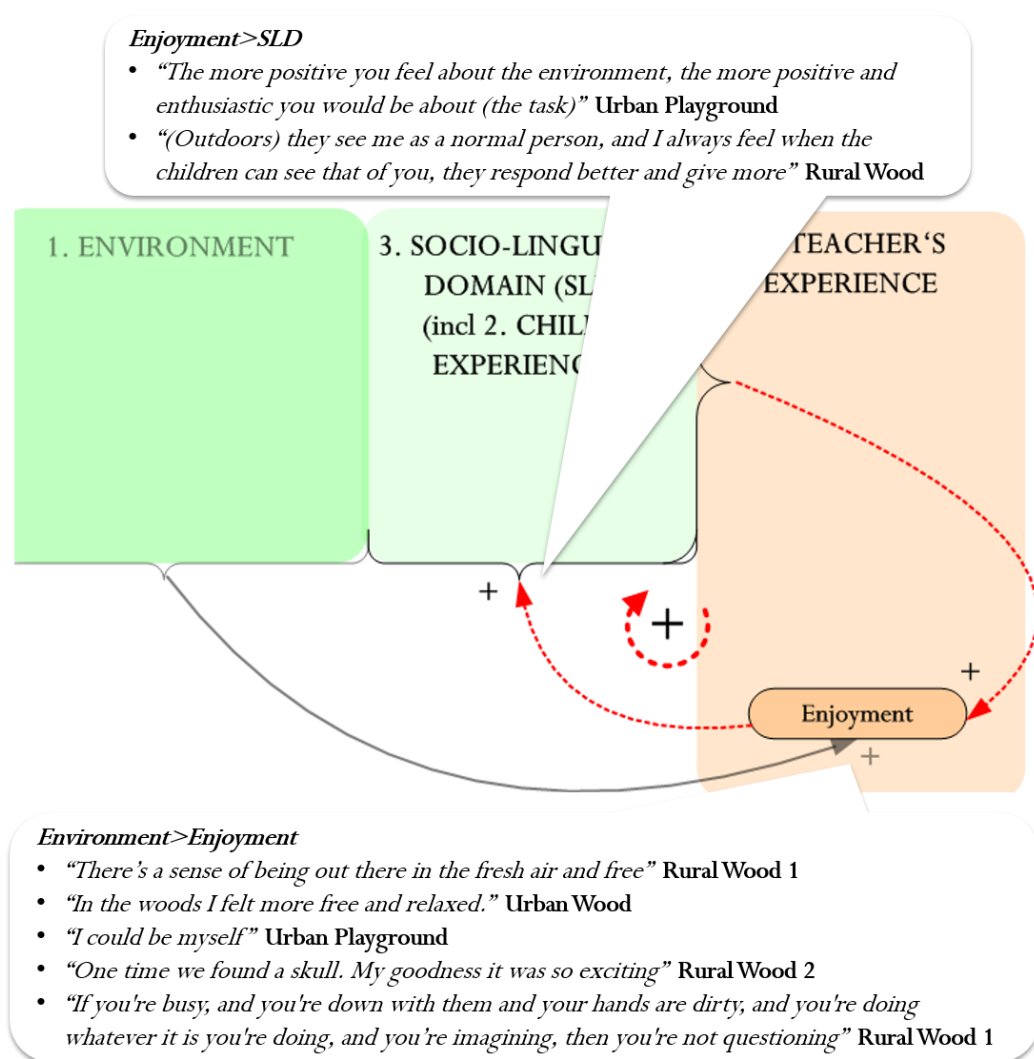
It has been argued that the emotional impacts of the outdoor settings on children might be viewed as eudaimonic wellbeing associated with functional motivation. It has also been proposed that eudaimonic wellbeing may have helped regulate a more participatory, non-hierarchical pattern of positive interdependence.

Previous outdoor learning studies have reported positive impacts of natural settings on teachers' motivation (Evergreen, 2000; Lieberman & Hoody, 1998) and mood (Szczepanski et al, 2007). Others have observed better working relationships with pupils, compared to the classroom (Davis & Waite, 2005; Evergreen, 2000; Mygind, 2005), and at least one noted less hierarchical teacher-child interactions (Ernst & Monroe, 2004).

Interview data associated with the 'enjoyment' QV might be interpreted in the context of previous arguments regarding functional motivation and eudaimonic wellbeing, such as those shown in Figure 9.3 overleaf. Quotes like "*being out there in the fresh air and*

*free*”, “*more free and relaxed*” and “*I could be myself*” imply perceived autonomy. The rural wood teacher’s account of the skull discovery suggests experiential novelty. Her colleague’s comment that “*if you’re busy, and you’re down with them and your hands are dirty, you’re doing whatever it is you’re doing, and you’re imagining, then you’re not questioning*” has characteristics of flow. It also implies a more child-centred and non-hierarchical approach than the classroom, such as is also suggested by the ‘Puppet Tour’ transcripts.

That these factors may have promoted task performance are exemplified by the comment by the playground teacher that “*the more positive you feel about the environment, the more positive and enthusiastic you would be about the task*”, and by the rural wood teacher, that outdoors children see her as “*a normal person*” which causes them to “*respond better and give more*”.



**Figure 9.3 Teachers: Environment, Positive Affect and Child Interactions**

One might infer something of the nature of the teachers' classroom experiences by their preferences, and how they viewed the classrooms as different by comparison to the outdoors, i.e. less participatory, free, relaxed or myself. Reduced autonomy and increased workload are both linked to stress (Evans, 1984) and it may be the teachers' PRS task ratings share a similar explanation as proposed for the underachievers, namely, that they perceived the classroom as a more stressful setting relative to the outdoors, and the children. Data also suggests they perceived interaction to be more teacher-led in the classroom –for example, being “*more controlling*” or “*interrupting (more, as is the) natural teacher thing to do*” – a finding which was noted in Chapter 2 to be generally pervasive in classroom research literature (Gump, 1967; Wells, 2009).

In summary, the implied emotional impacts of the outdoor settings on the teachers, and its positive consequences for their social interaction, seem consistent with the functional motivation hypothesis put forward for the children. On the basis of the teachers' own perceptions, and studies which reveal a strong association between positive teacher-pupil interaction and attainment (e.g. Klem & Connell, 2004; Deci et al., 1991; Ryan & Grolnick, 1986; Sanders, Wright, & Horn, 1997), it is argued that this may have promoted children's task performance.

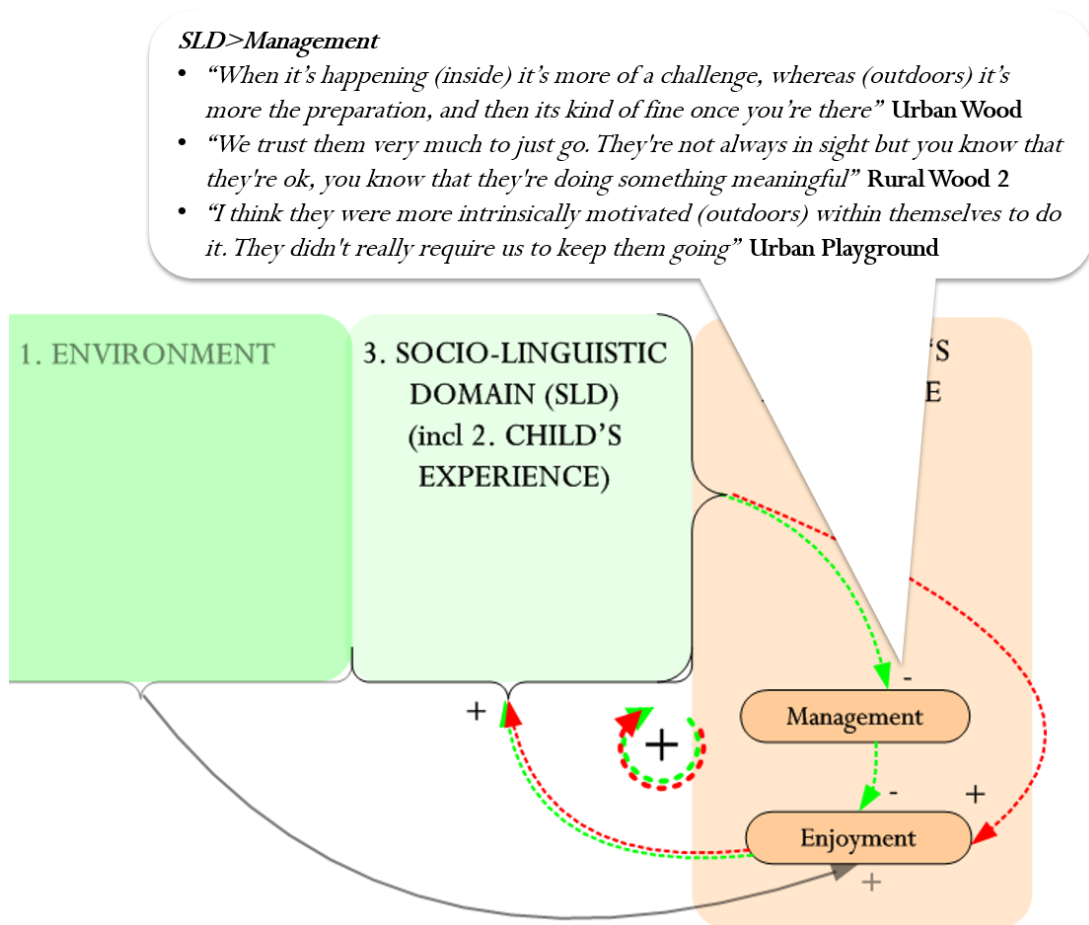
### ***9.2.2 Management Burden and Teacher Participation***

The other environmental effect associated with the teachers was their reduced management burden outdoors, compared to the classroom.

This may have been attributable to factors other than affordances, for example, the perceived burden of inducting early years children into a classroom behaviour setting (Gump, 1967, p.162). While associated pressures would seem implicit in any school task, the perception of an alleviated workload could still be related more to being away from the formal classroom setting, than to phenomena grounded in the outdoor setting.

Nevertheless, a body of research suggests the majority of a primary schoolteacher's classroom time is spent on behaviour and activity management (Jackson, 1990; Gump,

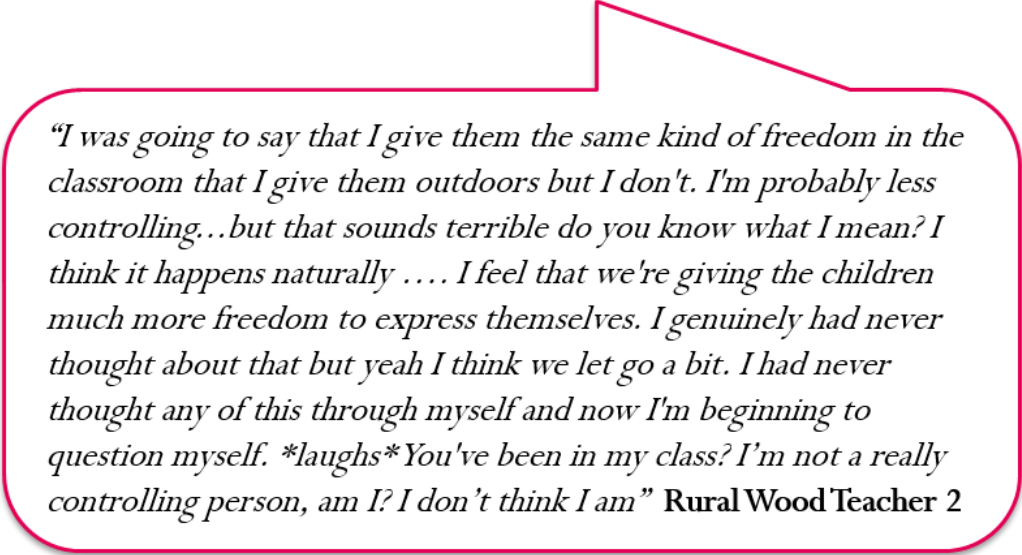
1978; Biddle & Adams, 1967). The study teachers also gave specific examples of management requirements they face in the classroom but did, or do, not outdoors. Many entail factors which have been discussed in the context of functional motivation, including space constraints, shy or over-energetic dispositions, emotional frustration, and lack of attention, ideas or task-relevant experience. Summarising the difference between the classroom and wild setting, the urban wood teacher said, “(indoors) when it's happening it's more of a challenge, whereas (outdoors)...it's kind of fine once you're there” (see Figure 9.4 below).



**Figure 9.4 Teachers: Environmental Impacts on Management Burden**

Furthermore, as outlined above, some UK studies involving nursery and primary schoolchildren suggest self-sufficient activity may be a general feature of forest schooling (Waite & Davis, 2007; Waite, 2007). It was also an observation during this thesis's exploratory fieldwork. Interview data also support the idea that the teachers' hands-off approach outdoors was attributable to this self-sufficiency, and not to any

intentional strategy. Examples include the playground teacher's comment that "*(the children) were more intrinsically-motivated (outdoors, and) didn't really require us to keep them going*", or the rural wood teacher's that "*we trust them very much to just go, they're not always in sight...but you know that they're doing something meaningful*".



*"I was going to say that I give them the same kind of freedom in the classroom that I give them outdoors but I don't. I'm probably less controlling...but that sounds terrible do you know what I mean? I think it happens naturally .... I feel that we're giving the children much more freedom to express themselves. I genuinely had never thought about that but yeah I think we let go a bit. I had never thought any of this through myself and now I'm beginning to question myself. \*laughs\* You've been in my class? I'm not a really controlling person, am I? I don't think I am"* **Rural Wood Teacher 2**

**Figure 9.5 The Rural Wood Teacher's 'Dilemma'**

On these bases, it is argued that affordance-enabled self-sufficiency seems a more likely contributor to the reduced outdoor management burden, than the setting perceptions or intentional approach of the teachers themselves. The increased classroom management burden might then be viewed as the teachers compensating for a reduction in generally enabling and regulating affordances. This interpretation could resolve the rural teacher's dilemma as to why, relative to the wild setting, she should be a "*controlling person*" in the classroom (see Figure 9.5 above), a revelatory reflection which evidently conflicted with her beliefs about herself and her teaching approach. Stated simply, it could be that an environment which cannot regulate children's behaviour and activity adequately, demands that she take greater control.

This hypothesis has two implications for children's performance. Firstly, it follows that teachers had more time outdoors to interact with whom and in ways they choose, as is perhaps implied by the 'Puppet Tour' transcripts. School studies have linked longer teacher-child interactions with performance impacts, particularly for disadvantaged pupils (Baker, 2006; Blatchford & Mortimore, 1994). The second implication,

assuming longer teacher-child interactions *and* children's general self-sufficiency, is that teachers' impact on outdoor performance may have been negligible compared to affordance and peer interaction. This stands in contrast to research which reports the teacher to be a pivotal factor in classroom performance (Sanders, Wright, & Horn, 1997; Klem & Connell, 2004; Deci et al., 1991; Ryan & Grolnick, 1986).

Might then the reduced role and impact of the teacher be considered a weakness of the outdoor tasks? John Dewey proposed the educative significance and value of a school task depended on its capacity to enable social interaction and continuity with pupils' prior experience. He argued that "*the immediate and direct concern of an educator*" is to promote objective conditions which regulate "*the total social-set-up*" towards these ends (Dewey, 1997, p.44-45). From Dewey's viewpoint, therefore, a reduced role for the teacher might be considered to indicate they have been successful in their design of the task's total social-set-up. Indeed, one might reasonably argue that a class motivated to direct their own learning within task parameters, with a teacher free to target support and instruction where needed, is an ideal classroom scenario.

In summary, it is proposed that variations in management burden between classroom and outdoor settings are primarily attributable to levels of affordance-motivation. It is further put forward that the extended teacher-child interactions this may have enabled outdoors, could have had positive performance impacts, albeit negligible compared with those associated with affordance and peer interaction.

### ***9.2.3 Teachers' Affinity with Natural Settings***

Something which may undermine these arguments is the teachers' personal affinity with natural settings, a factor which the study did not assess. If the participating teachers had a pre-existing inclination towards natural settings, then findings could be specific to the group, rather than a general effect as the discussion implies. For example, teachers less comfortable with the outdoor settings may have perceived greater risk and management requirement on these tasks, with negative emotional consequences.



Nevertheless, there is a growing body of research to suggest preference, stress reduction and emotional regulation may be a general human response to natural environments (Ulrich, 1993). Moreover, prior to their experiments, both novices expressed their nervousness, and the playground teacher requested expert support on this basis. Later, both also expressed genuine surprise at the ease of the outdoor tasks and agreed on the children's self-sufficiency. These factors perhaps give support to the idea that eudaimonic wellbeing and reduced management burden could be attributable to general environmental effects, rather than the perception of the teachers.

#### ***9.2.4 Positive Teacher Feedback: Summary of Main Points***

In summary, it is argued that findings suggesting teachers' improved positive affect and social interaction outdoors are consistent with the functional motivation hypothesis proposed for the children. It is also proposed that variations in their management burden between classroom and outdoor settings were primarily attributable to children's affordance-underpinned self-sufficiency. Lastly, it is suggested that these factors enabled extended participatory interactions with some children which may have contributed to their performance.

### **9.3 Summary of Relationships involving the Socio-Linguistic Domain**

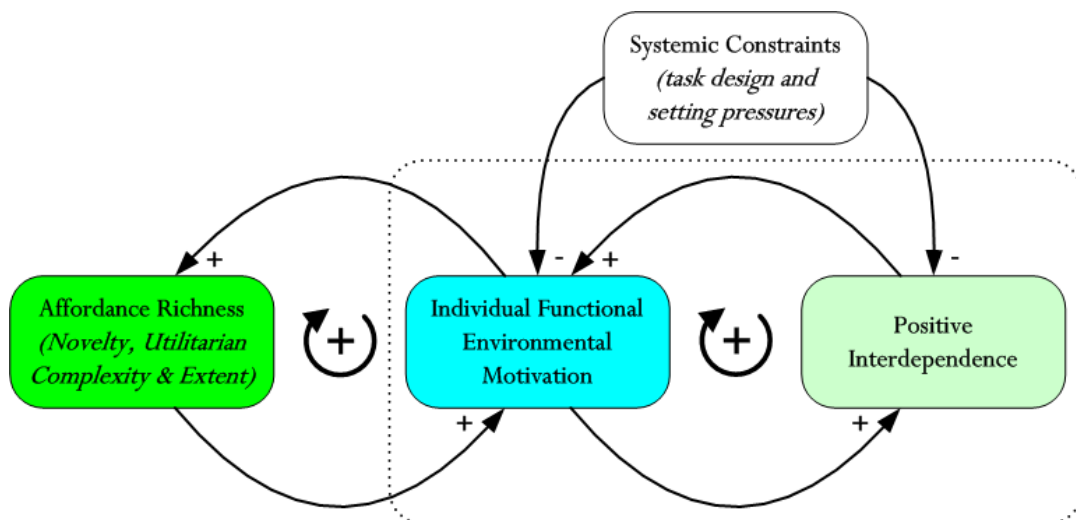
The key findings and outcomes of the discussion of the Socio-Linguistic Domain are shown in Table 9.1 overleaf. Compared with the classroom, greater positive impacts of the outdoors, particularly the wild settings, are implied for both social interaction and positive teacher feedback with significant implications for task performance.

Discussion has sought to interpret these findings in the context of the functional motivation hypothesis put forward in the conclusion to last chapter, and this section aims to build upon the model proposed there.

SOCIAL INTERACTION	TEACHER FEEDBACK
<ul style="list-style-type: none"> <li>• Higher general levels of non-hierarchical positive interdependence, particularly on open-ended wild setting tasks, with empirical support for greater process gain.</li> <li>• Mutual affordances and joint attention, and eudaimonic wellbeing may have promoted cooperative 'play', while setting pressures and reduced support from affordances in the classroom may have rendered collaboration challenging for some.</li> <li>• Sustained 'imaginary situations' (Vygotsky, 1967) may have been enabled and regulated by affordance qualities outdoors, while in turn may have reinforced task motivation and organised creative behaviour through commitment to their implicit rules.</li> </ul>	<ul style="list-style-type: none"> <li>• Higher levels of teacher enjoyment, with positive consequences for children's mood and performance implied.</li> <li>• Reduced task management suggested higher levels of general class motivation and self-sufficiency, and promoted less controlling, and more personal, interaction with pupils.</li> </ul>

**Table 9.1 Main Findings and Outcomes for Socio-Linguistic Domain**

It is put forward that the third-order unity –i.e. the social coupling of sub-groups or the whole class with their task setting– can be conceptualised similarly to the second-order unity, that is, as a functional relationship between cognition and environment enabled and regulated by affordances.



**Figure 9.6 Closed Loop: Richness, Motivation and Positive Interdependence**

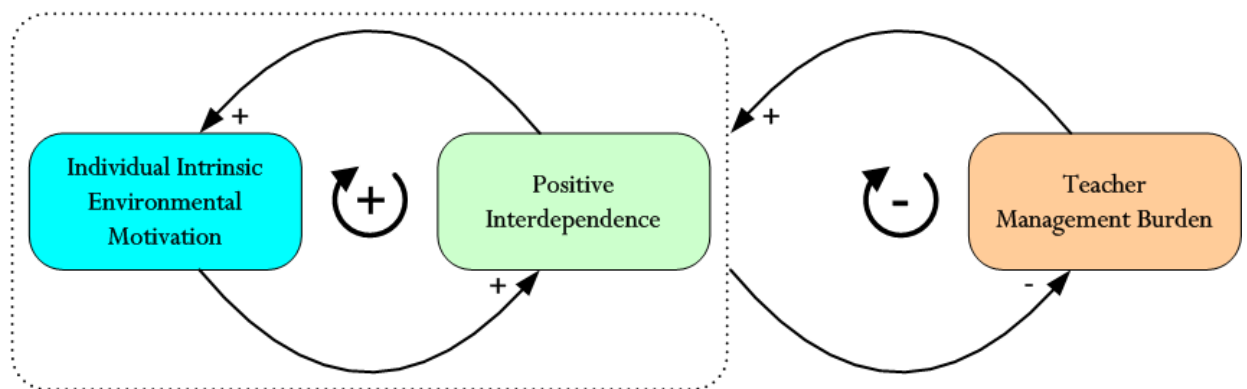
The reinforcing dynamics of this relationship are represented in the CLD in Figure 9.6 above, where it is proposed that functional environmental motivation at the second-order level gives rise to an emergent pattern of group motivation, or *positive interdependence*, at the third-order level. As mentioned in section 3.2, in the context of the experimental tasks the theoretical assumption is that both second-order (individual) and third-order (group) unities are essentially the same cognitive system coupled to a setting, only viewed at different levels. The dotted boundary in Figure 9.6 represents the totality of this cognitive system.

This chapter's discussion has suggested two features of affordance interaction at the second-order level which could enable and reinforce the third-order pattern. The first is the confidence, perceived autonomy and negation of self-ish concerns associated with *eudaimonic wellbeing*, which may override personal barriers to participation. The second is *mutual affordances*, underpinned by processes of joint attention, which could motivate and enable shared efforts after meaning and value. It is proposed that these dynamics applied equally to the participating teachers, as it did the children.

At the third-order level, it is argued that this gives rise to 'imaginary situations' characterised by *positive interdependence*. It is proposed these situations maintain their integrity through the capacity of their content and rules to sustain engagement. In an open-ended task, it is proposed they may self-organise around affordance-related activity each participant finds most meaningful. Vygotskyian Theory holds these situations to be intrinsically-motivating, and have developmental and educational significance for promoting conceptual flexibility, self-discipline and social skills.

Concepts of the ZPD (Vygotsky, 1978b) and process gain (Johnson & Johnson, 1989) also imply that the cognitive impact of these situations is related to the novelty and diversity of individual contributions negotiated therein, where the least experientially-equipped advances the furthest (Vygotsky, 1967). In their optimal state, where individual imaginative contribution is rendered effortless by generally enabling affordances, these situations might be viewed to approximate to ecological concepts of group motivation such as is described by Csikszentmihalyi and Reed (Csikszentmihalyi, 2000; Reed, 1996).

In short, it is argued positive interdependence may be reinforced by the capacity of task affordances to enable and regulate collaboration and shared meaning. Equally, a reduction in this capacity may have consequences for the integrity, self-sufficiency and productivity of collaboration, by surfacing personal barriers to participation at the second-order level. These include affordances which are insufficient for enabling and sustaining social interaction, and the emergence of extrinsic concerns and negative affect. Additionally, the influence of extrinsic systemic constraints associated with the task and setting described in the last chapter are considered equally relevant here.



**Figure 9.7 Balancing Loop: Management Burden**

Despite their qualitatively different role, it is argued the teacher can also be viewed as a part of this system and subject to its properties and effects, and where the positive effects on their mood and teaching approach may further promote performance. A negative association is also proposed between the teacher’s management burden and the capacity of affordances to enable and regulate positive interdependence (see Figure 9.7 above). From the systemic perspective, an increased management burden might be viewed as the teacher having to compensate for the reduced input from task affordances, for example, by supporting individual ideas and self-image, or managing overall behaviour and activity. An implication is that stressors associated with this burden may have negative consequences for the teacher’s mood and interactions with children. As such, reduced management burden might be considered as a systemic property and indicator of an optimal task environment.

## CHAPTER 10: DISCUSSION OF MEMORY

### 10.0 Introduction

This chapter deals with the last of the cognitive factors (CF): memory. The findings on children's recollections are probably the research's clearest demonstration of cognitive impacts, and memory could well be the factor most relevant to attainment. The discussion emphasises the possible association between natural richness and children's performance (RH2) over general performance impacts of the outdoors versus the indoor task settings (RH1).

Memory is the most fundamental of all CFs to long-term attainment (Alloway & Alloway, 2010; Engel de Abreu et al., 2014; Swanson, 1994) and, arguably, the thesis's only hard cognitive measure. However, it comes last because many, if not all, of the previous CFs are positively associated with memory. Thus the impacts which have been proposed in prior discussion might be considered to contribute to present findings.

The most significant memory finding is that 5-7 months post-test, outdoor tasks were remembered more readily, and in more detail, than the classroom by children and teachers. That children also recalled more about the wild settings than the playground, implies an association with natural richness. Additionally, underachievers recalled more than their peers, significantly so for the wild settings, and returned the longest recollections recorded for both outdoor settings. In their interviews, both experienced outdoor teachers cited a general association between wild setting tasks and stronger memories, and examples of how they use this to support classroom learning for underachievers.

These findings broadly complement previous studies which have reported impacts of green space on children's memory (Hart, 1979), particularly in an outdoor learning context (Fägerstam, 2012; Rickinson et al., 2004), and involving nursery or primary schoolchildren (Dadvand et al., 2015; Waite, 2007; Waite & Davis, 2007). The four part discussion will first assess memory impacts by reference to prior discussion and the Levels of Processing Theory of memory ( Craik & Lockhart, 1972). The second part will then venture an interpretation of the stronger memory impacts for underachievers

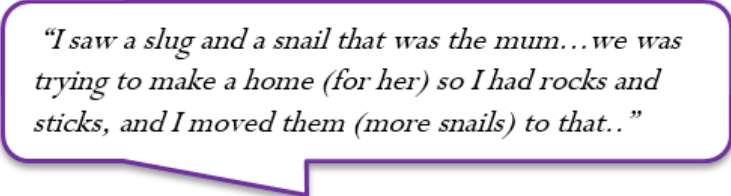
through the lens of the theoretical framework (Maturana & Varela, 1992) and Piagetian Theory (Piaget & Cook, 1998). The third, will assess the educational implications of findings from the viewpoint of the Experiential Learning Cycle (Kolb, 1983), with the section ending on a summary of main points.

### ***10.1.1 Environmental Compatibility***

The Levels of Processing Theory proposes trace strength to be influenced by five variables ( Craik & Lockhart, 1972), and which therefore provide a useful framework for assessing how task settings may have influenced memory findings.

#### *Personal meaning for the individual*

An argument for the greater personal responsiveness, and plasticity of meaning, of natural affordances was put forward in the section on motivation. Some recollections do support the idea that individual efforts after meaning and value were operating within task parameters. One example is the quote below, where the urban wood underachiever, Iz, refers to making a “home” for a “mum” snail and her family.



*“I saw a slug and a snail that was the mum...we was trying to make a home (for her) so I had rocks and sticks, and I moved them (more snails) to that..”*

**Figure 10.1 Excerpt from Iz’s ‘Puppet Tour’ recollections outdoors**

#### *Compatibility of stimuli with analysing structures*

Greater functional compatibility with the outdoor settings has been a main discussion theme. Previous points relevant to this variable include a proposed cognitive preparedness for natural affordances, and inclination towards them, and the enhanced

perception of utilitarian complexity it has been proposed is conferred by rich usage of a naturally-rich setting.

Compatibility with analysing structures might possibly be inferred from the temporal event structure which characterises the longer outdoor recollections, on the basis that this may relate to the flow of the underlying environmental experiential model (Csikszentmihalyi, 2000). Events also featured in the urban wood teacher's recollections of the wild setting tasks, but not the classroom, also a finding of a previous UK study which compared teachers' memories of indoor and outdoor learning (Waite, 2007).

### *Attention*

The empirical support for greater sustained attention in the outdoor settings was discussed in the related section. It was proposed attention in the context of rich affordances might, in part, be considered a property of functionally-motivated interaction. Studies have also revealed a statistical association between intrinsic motivation (Roebbers et al., 2001) and stronger memory effects.

### *Multi-sensory input*

Several child studies have noted the sensory detail of outdoor memories, compared to those of other settings (Fägerstam, 2012; Hart, 1979; Waite, 2007; Waite & Davis, 2007). Waite attributed the prevalence of “*vivid and enduring*” woodland recollections in her research, to inherent multi-sensory richness, which she proposed promotes “*rich contextualisation*” in the form of complex cross-channel neural links (2007, p.344).

This was not a finding of the present study, where children's recollections from both settings entailed a similar emphasis on action. This might be attributable in part to the method, in that the recollections question focused specifically on the task, and participants were not prompted for description. However, sensory detail did distinguish some teachers' outdoor recollections from their indoor. This is consistent with prior research and suggests the lack of sensory detail in the children's data wasn't entirely on account of the approach.

A more likely explanation is the age of the children. They were the only preoperational group to have been memory tested in this context, and markedly younger than any participants in the research cited. Developmental factors such as lack of a knowledge framework or verbal skills sufficient to categorise or articulate sensory detail (Kail, 1979), or a stronger orientation towards action (Piaget & Cook, 1998), might also explain an absence of sensory description in this group, compared to older children.

Thus, it is argued that absence of evidence is not necessarily evidence of absence. While sensory detail may not have been apparent in children's utterances, it seems likely that rich multimodal contextualisation involved in natural affordance interaction played an important *implicit* role in reinforcing children's outdoor memories, (McGilchrist, 2012; Stolpe & Björklund, 2013).

#### *Processing time*

Processing time is largely discounted as a contributory factor on the basis that some tasks entailed outdoor components which were appreciably shorter than the indoor, and yet still returned stronger outdoor recollections.

#### *Summary*

With the exception of processing time, it is proposed that variables associated with depth of memory processing ( Craik & Lockhart, 1972) are likely to have been more prevalent outdoors, and stronger in the wild settings. Drawing from the discussion and main argument thus far, it is argued these variables might all be promoted by functional compatibility between cognition and rich, motivating affordances.

#### ***10.1.2 Cognitive Change and Underachievers***

One memory finding not so easily accounted for by general environmental compatibility is the more detailed outdoor recollections of the underachievers. It is not inconceivable that this group found the outdoor tasks more personally meaningful or absorbing than



their peers. However, their levels of engagement on the outdoor tasks were notable for being indistinguishable from their classmates, not for being higher.

Classroom stress has been proposed to be a potential factor in the underachievers' experience, and is linked with negative memory impacts (Evans, 1991). However, while it might be argued that stress weakened underachievers' indoor recollections, it explains why they remembered more about the outdoor task than their peers.

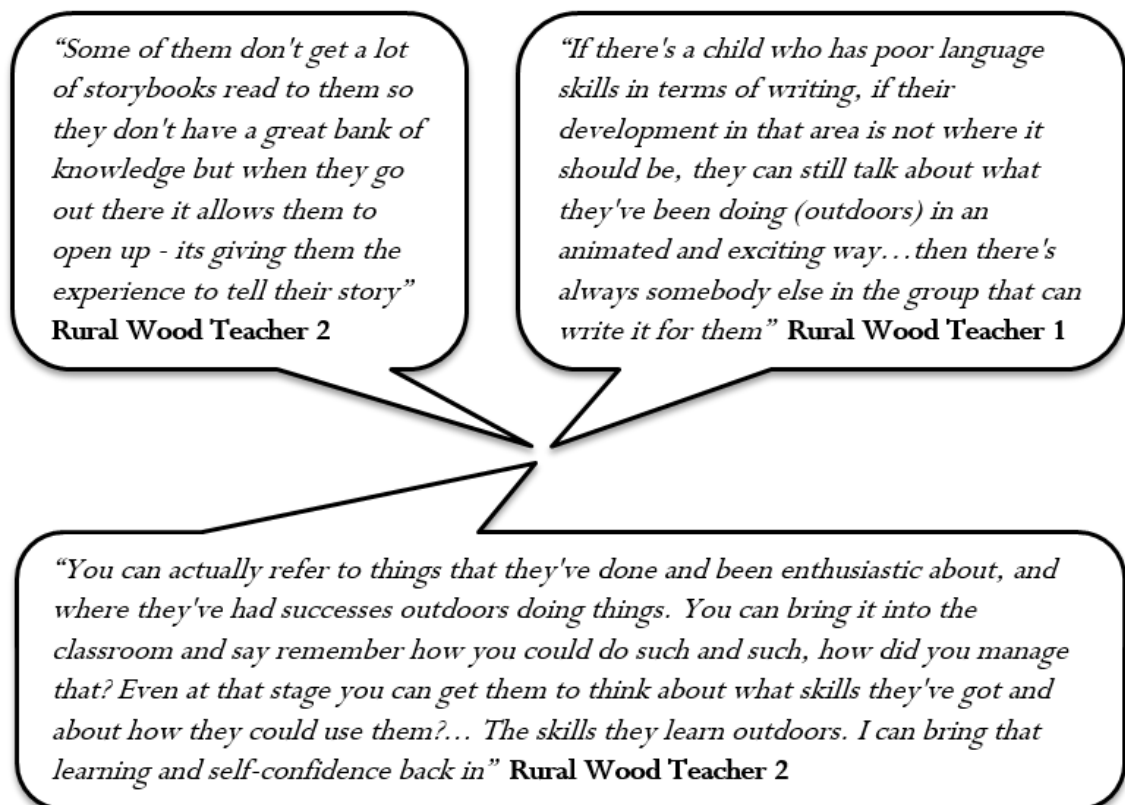
Another explanation is that underachievers sustained comparatively more *task-related* cognitive change outdoors. In the theoretical framework, task 'knowledge' is proposed to be a measure of history of environmental interactions, or 'structural coupling', which a child undergoes in pursuit of congruence with the *specific* task milieu (Maturana & Varela, 1992). The idea that there would be a relationship between degree of task-related structural coupling and the richness of the task setting underpins the rationale for the 'total recollections' measure, RH2, and the 'Make a Toy' interactions analyses (see Figure 4.11 and 4.12). The Santiago Theory also predicts that the extent of task-related structural coupling each child undergoes is inversely related to how much 'knowledge' relevant to the task they have already gained from past experience. Stated simply, a child for whom the task experience is entirely novel will learn more than the one who has performed something similar in the past

There are parallels here with the Piagetian view of cognitive change as the process of assimilating and accommodating new experience we undergo when seeking equilibrium with our environment (Piaget & Cook, 1998). It has been proposed that a task could initiate a novel and particular condition of disequilibrium with its setting, where a form of equilibrium is reached upon fulfilling the goal. By transforming the task setting into those affordances relevant to fulfilment, it was suggested that experiential novelty could be a function of the field of meaning enabled by the goal and its context, as well as the perceptual field. In this sense, it was argued that a perceptually familiar task setting might continue to support high levels of assimilation and accommodation for users in the realm of meaning, providing task requirements remain novel.

In the last chapter, it was also put forward that processes of joint attention could enable affordance relationships to operate at a group level as 'imaginary situations' (Vygotsky, 1967). It was suggested that the process gain generated by these situations could be

underpinned by the affordance-enabled novelty and diversity of individual contributions negotiated within them, where the least experientially-equipped advances the furthest. Notably, controversy in situations of positive interdependence is strongly associated with memory impacts (Johnson & Johnson, 1989), which in this instance is argued to have been fuelled by affordance richness, particularly in the wild setting.

Thus, when applied to a specific task context, the theories of Maturana and Varela, Vygotsky, and Piaget, share two essential similarities. For one, *both regard the extent of cognitive change to be a measure of the distance a child travels, cognitively-speaking, to reach equilibrium with the task milieu.* For two, *both imply that the distance travelled is inversely related to a child's level of task-relevant experience.*



**Figure 10.2 Teachers' Comments about Underachiever Recollections**

The idea that underachievement may be associated with experiential or developmental disadvantage has already been put forward, notably, in the discussion of attention. Interview quotes, such as those in Figure 10.2 from the rural wood teachers, may also

provide empirical support for this in the context of outdoor recollections. The first cites how children cannot invent a story if they have never been read one, because they have no “*bank of knowledge*” of how character and narrative work, but how the outdoor task environment gives “*them the experience to tell their story*”. The other two talk about how wild setting experiences can motivate classroom participation, by enabling underachievers with “*poor language skills (to) still talk about what they’ve been doing in an animated and excited way*”, or to recall “*successes (and) think what skills they’ve got and how they could use them*”, thereby bringing “*that learning and self-confidence back in*”.

Here the teachers not only give support to the link proposed between experiential or developmental disadvantage and underachievement, but also give examples of how they have leveraged the rich cognitive and affective content of outdoor task memories for related remedial interventions in a classroom setting.

Another finding suggestive of *implicit* memory impacts for underachievers is the second den comparison from the playground task (see Figure 4.2). Built by a workgroup where two of the three were underachievers, including the leader, this was the only den featuring a similar design in both settings, and the only free-standing one in any classroom component. That they reconstructed their outdoor den unaided in a different setting after a three month period is consistent with the idea that outdoor experiences had stronger impacts for disadvantaged children. It is perhaps also the clearest indication of implicit memory and transference in the study experiments.

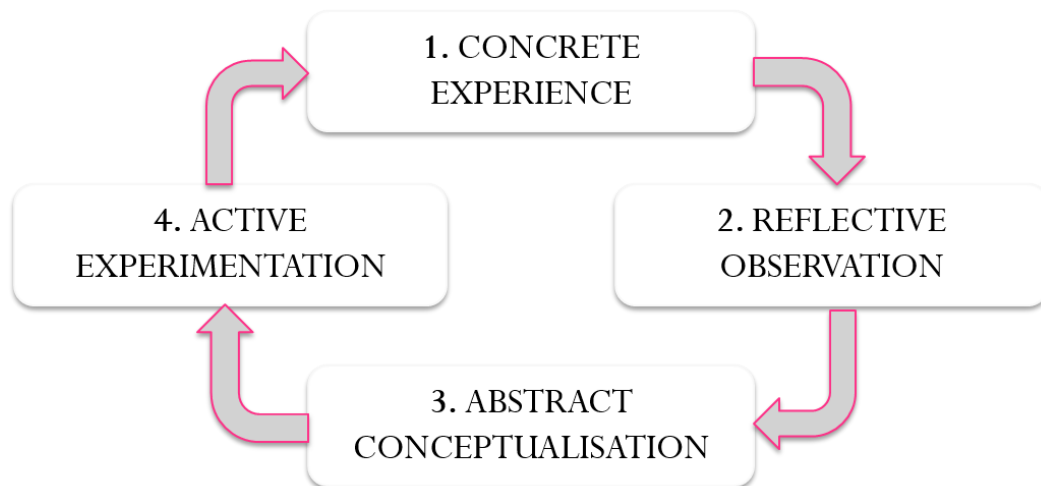
### *Summary*

On these bases, it is argued that the underachievers’ disadvantages regarding the task situation may explain their stronger outdoor recollections. In short, the ‘total recollections’ statistic can be regarded as reflecting the greater extent of cognitive change they sustained on a generally-motivating task, comparative to peers with more task-relevant experience.

### 10.1.3 General Impacts and Cognitive Change

It is worth reflecting on the relevance of the memory findings and discussion above to formal learning. One theory that may be useful for assessing experiential memory in an education context is Kolb's Experiential Cycle, outlined in Chapter 2 and appearing in Figure 10.3 below.

The Cycle, exemplifies a common argument running through the thesis, namely, that rich embodied experiences may underpin academic attainment for young children, through their influence on factors including higher cognitive functioning, declarative memory, positive interdependence and self-actualisation.



**Figure 10.3 Kolb's Experiential Learning Cycle (Kolb, 1983)**

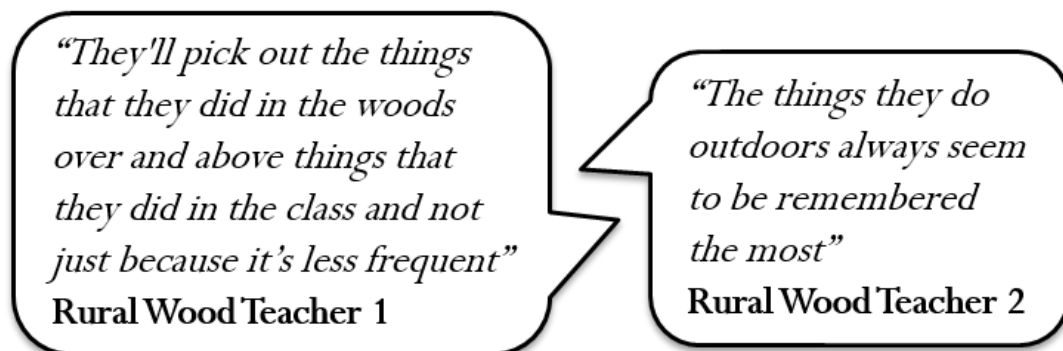
Arguably, task recollections can be considered a rough measure of the first two stages of the Cycle, *concrete experience* and *reflective observation*. While these recollections do not entail purposeful or critical reflection, as Kolb assumes, they do indicate a greater capacity to introspectively observe, and call forth, experiences of the outdoor task, compared with the classroom.

In terms of the Cycle, therefore, this meets the requirement stage 3, or *abstract conceptualisation*. Although the study finds weaker support for this stage (which is to be expected given the participants' developmental stage), it is perhaps implied in the Thinking Hat responses which suggest metacognition on the playground task, and in the

presentation of the wild setting ‘Alien Adventure’ stories. Both might be argued as examples of the abstract conceptualisation of children’s own task experience, as mediated by reflective recollection.

The proposed capacity of the wild settings to enable and regulate ‘imaginary situations’ might also be viewed in the context of abstract conceptualisation. Although the position has been that these situations arise spontaneously in young children, rather than through reflective observation, Vygotskian Theory does imply their conceptual nature contributes to their introspectability and transferability to other contexts (Vygotsky, 2011). Thus, the interpretation of Vygotsky in this thesis’s context, and Kolb’s Cycle, imply that *the educational value of a task experience is determined by its conceptual stability, introspectability and transferability*, which in turn is underpinned by rich and concrete environmental experiences.

The Cycle’s fourth stage, *active experimentation*, is largely beyond the scope of these experiments. However, it is argued on the basis of support for the previous stages, that the outdoor experiences offer greater potential than the indoor to facilitate the full cycle. Indeed, this potential might be considered inferrable from the experienced teacher quotes in Figure 10.2 and the free-standing den (see Figure 4.2).



**Figure 10.4 Teachers’ Comments about Strength of Outdoor Memories**

Other data from the experienced teachers gives weight to the idea that impacts of natural affordances on conceptual stability, introspectability and transferability may be a general phenomena. For example, in the quotes in 10.4 above, they state “*the things they do outdoors seems to remembered the most*” and “*it’s not just because (the outdoor*

*lessons are) less frequent*". These observations and findings also find some support in previous outdoor learning studies. Notably, in Sue Waite's research on outdoor learning memories, the prevalence of woodland recollections caused her to conclude these settings have "*special qualities, which make them an effective learning environment*" (2007, p.338).

### *Summary*

It is argued that the educational significance of a task experience for young schoolchildren is determined by its conceptual stability, introspectability and transferability to new learning contexts. In turn, it is proposed these factors are underpinned by the richness of the underlying concrete environmental interactions. It is put forward that findings which imply an association between natural richness and recollections from this, and other, studies, give support to these assumptions, and highlight the potential value of outdoor experiences as a resource for formal learning in situ and the classroom.

#### ***10.1.4 Memory: Summary of Main Points***

The hypothesis that readiness and richness of recall would be positively related to natural richness is supported. Drawing from prior discussion, it is proposed that there is support for an association between setting richness and all variables which promote depth of memory processing, except processing time ( Craik & Lockhart, 1972). The underachievers' more detailed outdoor recollections are explained in terms of the greater extent of cognitive change they underwent relative to their peers, due to experiential or developmental disadvantages. It is argued that the findings suggest the outdoors, particularly the wild settings, may have promoted *conceptual stability*, *introspectibility* and *transferability*, and that this has considerable educational significance. Particularly, there is the implication that rich concrete experiences may be important, indeed *necessary*, for enabling those children most relevant to Scotland's performance gap to engage fully in formal learning.

# CHAPTER 11: DISCUSSION OF EDUCATIONAL IMPLICATIONS

## 11.0 Introduction

This, the final, discussion chapter sets out to explore matters related to the thesis's sixth objective, that is, *to draw conclusions and recommendations regarding the value of outdoor learning to primary school educational and policy objectives*. There are three sections. The first summarises the main outcomes of the discussion so far, drawing out those aspects most relevant to attainment and Curriculum for Excellence (CfE). The second completes the general model of environment and cognition which has been constructed over the course of chapters 7-9, through the integration of chapter 10 outcomes. The chapter then ends on a discussion of some implications of the model and findings for the Scottish curricular framework and early years educators. The summary of this chapter and related recommendations will be set out in thesis's concluding chapter in sections 12.1.5 and 12.3, respectively.

## 11.1 Summary of Discussion Outcomes and their Curricular Relevance

The last four chapters have entailed a systematic discussion of research findings by categories of the theoretical framework and cognitive factors related to each, in turn. Chapter 7 dealt with *environment*, and concluded three variables –*utilitarian complexity, novelty* and *extent*– to be relevant to natural richness and an assessment of cognitive impacts in the context of a school task. Chapter 8 addressed the *child's experience*. It proposed an enabling and regulating relationship between the environmental variables and the levels of general *functional environmental motivation* of individual pupils in the outdoors, particularly in the wild settings (which, Chapter 9 argued also applied to teachers). Investigating the *socio-linguistic domain*, Chapter 9 concluded the virtuous relationship, in turn, includes and promotes levels of *positive interdependence*, reinforcing individual motivation and reducing the teachers' *task management burden*. It also put forward that extrinsic *systemic constraints* associated

with the task design or behaviour setting could limit levels of individual and group motivation.

Some outcomes of this virtuous relationship were proposed to have specific and significant relevance to formal educational and Scottish curricular objectives. Chapter 8 highlighted *individual confidence* –one of the four capacities underpinning CfE (Education Scotland, 2004)– and sustained, general engagement and resourcefulness, notably, from children with classroom attention and behaviour issues. Chapter 9 noted the advancement of two further CfE capacities –*effective contribution* and *successful learning*– and general, self-sufficient positive interdependence within task parameters. The consequent reduction in management burden could also free up teachers to allocate time more effectively and by promoting higher-quality child-led interactions. Findings linked to the experienced group and teachers also imply rich natural environments could sustain and improve these curricular impacts throughout primary school.

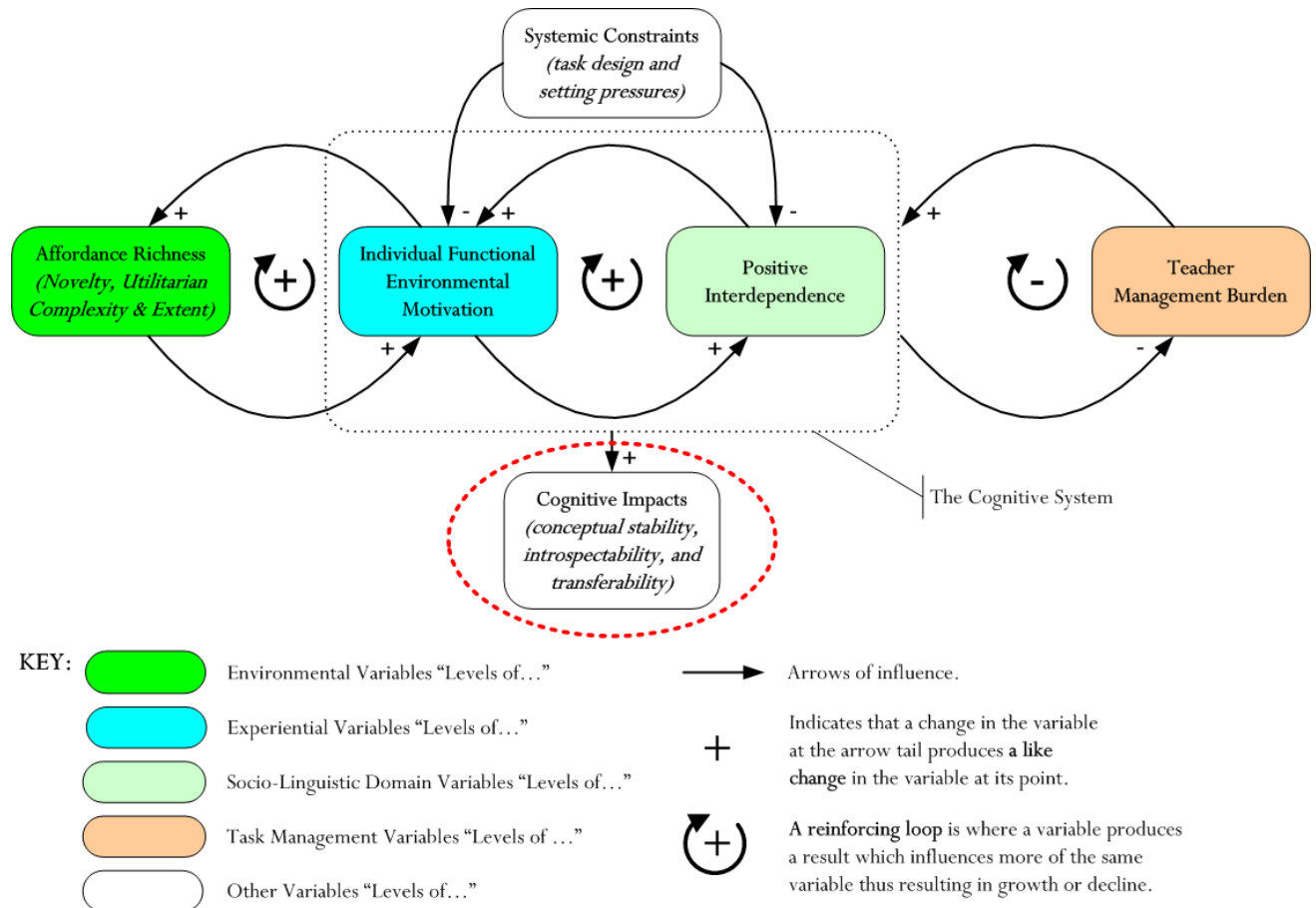
Chapter 10 focused specifically on memory. It concluded that *conceptual stability*, *introspectability* and *transferability* could be the outcomes of the virtuous relationship most relevant to academic attainment. The clearest indications of this were stronger outdoor recollections, the utilisation of these in a classroom context by the rural wood teachers, and evidence of reflective observation on the playground tasks. It is proposed that the outdoor settings promoted more flexible task schemas by facilitating sustained engagement, grounded multi-modal experiences, and collaborative situations with context-independent rules and content. It is also argued that rich concrete experiences may be important, indeed *necessary*, to enable some pupils to engage fully in formal learning.

A common thread running the chapters has been the disproportionate impacts of the virtuous relationship implied for children at a disadvantage regarding classroom learning: socially, experientially, dispositionally or developmentally. Facilitating the successful engagement of these children in early primary school activities is a key objective of the Scottish Government’s early intervention policy (Scottish Government, 2008) towards achieving national attainment targets. This study demonstrates the potential of rich enabling environments to satisfy this objective and narrow Scotland’s performance gap by enabling the participation of underachievers in early school tasks, and supporting the transition into formal schooling for all children.



## 11.1 General Model of Task Environment and Cognition

Over the course of Chapters 7-9, a systems dynamics model has been constructed to reflect the outcomes described above. Figure 11.1 below completes this model through the addition of the cognitive impacts proposed in Chapter 10 (in the dotted red circle).



**Figure 11.1 General Model of Task Environment and Cognition**

The general model is proposed to represent the relationship between environment and cognition across all the experimental tasks. This is best summarised as a *virtuous systemic interrelationship between affordance richness, functional motivation, and positive interdependence, with significant implications for task performance*. The model might be viewed as a living representation of the theoretical framework in the context of this study, informed by and integrating all main findings.

It is strongly argued that the capacity of available affordances to enable and regulate the relationship within task parameters is the most plausible explanation for those differences between the settings related to performance and the cognitive factors. It is further proposed that this capacity is related to the Richness Index measurements.

Moreover, although in the context of these experiments the virtuous dynamics seem associated with the natural richness –which may be linked to cognitive preparedness for natural affordances– the model itself is intended to be setting-neutral, and equally applicable to any school task milieu.

### **11.3 Curriculum Environments, Experiences and Outcomes**

While educational ‘experiences and outcomes’ constitute the heart of Curriculum for Excellence (CfE) (Education Scotland, 2004), there seems a strong argument here that early years educators should be equally as preoccupied with environment. Indeed, a pithy discussion summary might be that young children’s outcomes depend on their experiences, which depend on their environment. In short, outcomes depend on environment.

The conversation it is hoped may be provoked by the general model, is not whether the outdoors is superior to the classroom in supporting early years’ outcomes. Rather, it should be about which environments, or combinations thereof, are best equipped to motivate and engage the majority of school starters in curricular learning and reduce the performance gap, i.e. the two recommendations arising from Audit Scotland’s review of Scottish education which are within the remit of schools and teachers (Audit Scotland, 2014). A key implication of the discussion is that poor environmental quality –both in terms of a child’s past and immediate experience– may constitute a barrier to these recommendations which cannot be overcome by classroom instruction alone. Stated another way, a teacher may not be able to teach a pupil attention, motivation, inhibitory control, persistence or social competence, if their environment hasn’t done this already, or it features task affordances which engage, enable and support their personal efforts after meaning and value.

One of the thesis's most remarkable findings is that those behaviours for which early years' pupils had been classified as underachieving by their teachers, were not evident in the natural settings. Children with attention deficit (almost all the underachievers) showed engagement and persistence, the shy and withdrawing exhibited proactive teamwork and leadership, and problem types behaved well and respectfully to others. Indeed, so many behavioural aspects that formerly I would have interpreted as a problem with the child or their background, I now ask if it could be a problem with their immediate physical environment.

Thus, perhaps there is a gauntlet laid down here for educators in Scotland, and elsewhere in the world, who assume schooling is something which "*takes place indoors*" (Higgins & Nicol, 2013), to achieve the *same* levels of general motivation and engagement on similar open-ended tasks in a classroom? The intention of this challenge is not to spark an indoor versus outdoors argument. Rather, it is to promote critical reflection and necessary debate on which environmental qualities deliver the best primary school performance, and how these can enhance task design and teaching approaches.

Towards these goals, the present study highlights the importance of rooting performance in holistic and ecologically-valid comparisons of task situations across different settings. It also strongly implies how fundamental the physical environment, or rather an environmental *ecology*, could be to critical national policy objectives, and also that vision of experiences and outcomes upon which CfE's enduring success depends.

## CHAPTER 12: CONCLUSION

### 12.0 Introduction

The overarching aim of this thesis was to evaluate the impacts of outdoor and classroom settings on the curricular task performance of primary schoolchildren, with a focus on children beginning school. Six objectives were formulated to fulfil this aim:

1. To review theory and empirical research relevant to the development and performance of young children, with a focus on cognitive factors linked to both academic achievement and exposure to natural settings.
2. To develop a theoretical framework, and toolkit for assessing task situations, suitable for comparing and analysing the general cognitive impacts of different outdoor and classroom task settings on young children with limited or variable competencies.
3. To gather a rich ecologically-valid dataset consistent with the theoretical framework, on the task performance of primary schoolchildren in outdoor and classroom learning settings, including data relevant to the transition from nursery, underachievement, exposure to outdoor learning, and the perspective and experience of teachers.
4. To analyse behavioural differences between outdoor and classroom groups and task settings, and their relationship to environmental factors.
5. To discuss findings and their relationship to cognitive factors and the theoretical framework.
6. To draw conclusions and recommendations regarding the value of outdoor learning to primary school educational and policy objectives.

The objectives are addressed in the preceding chapters. Chapter 2 reviewed theory and empirical research relevant to the cognitive development and performance of young children, focusing particularly on eight cognitive factors (CFs) associated with both natural settings and academic performance (objective 1). On the basis of the empirical support for a cognitive predisposition for natural affordances discussed in Chapter 2, two main research hypotheses (RHs) were put forward:

- **RH1.** The performance of primary schoolchildren on a curriculum task will be better in a natural setting than a classroom
- **RH2.** There will be an association between the natural richness of the task setting and performance

Chapter 3 then described the theoretical framework and methodology developed to gather a rich ecologically-valid dataset relevant to the hypotheses, research aim, design and situation (objectives 2 and 3). The theoretical framework is based on the Santiago Theory (Maturana & Varela, 1992), which views a curriculum task as a discrete system and assumes a general holistic view of cognition. Structured by this framework, a dynamic, exploratory and pragmatic methodology was adopted, informed by principles of grounded theory. Specifically, this entailed four diverse field experiments, all of them curriculum tasks chosen by teachers from their upcoming teaching plans. Children from 3 distinctive Scottish primary schools were allocated to matched groups, and performed the task once in their classroom and once in outdoors –either a playground or a wood– or vice versa. Settings were categorised for natural richness using a Richness Index –a checklist of affordances and biodiversity.

Data on the tasks were gathered and analysed in three stages using mixed methods. Stage 1 entailed qualitative task observations and outcomes. Stage 2 was a quantitative follow-up questionnaire which recorded task recollections and preferences. Stage 3 involved focused interviews with the participating teachers, where data was subject to thematic and systems analyses. Each stage was informed by prior learnings, but also assumed a unique task perspective. The goal was to provide a rich integrative context for findings and discussion, and a strong basis for analytical generalisation across the experiments. Seventy one pupils completed indoor and outdoor components of one task, and the follow-up questionnaire. Predominantly, these were children in their first or second year of primary school, but involved an older group with extensive outdoor learning experience, as well as thirteen underachievers. The study also included 4 teachers: two novices and two with outdoor experience.

Respectively, Chapters 4-6 set out the procedures for the three stages and their findings as to behavioural differences between experimental settings and their relationship to environmental factors (objective 4). Chapters 7-9 discussed findings by the categories of the theoretical framework and the cognitive factors related to each, in turn, with

chapter 10 taking a specific focus on memory (objective 5). Chapter 11 then drew conclusions regarding the value of outdoor learning to primary school educational and policy objectives (objective 6). This included proposing a final model, based on the theoretical framework, of relationships between environment and cognition across the experimental tasks, which had been constructed over the course of the discussion chapters .

The purpose of this concluding chapter is to summarise the thesis's key findings and conclusions. Based on these, it will put forward recommendations for educators in Scotland and further afield, in line with objective 6. Additionally, it includes a reflexive discussion of the research approach, reflecting on strengths and limitations of the study, its contribution to the field and its implications for future research.

It ends on some concluding comments about how the thesis journey has altered my perspective on how humans perceive environment, and the broader implications of this for education and sustainability.

## **12.1 Key Findings and Conclusions**

### ***12.1.1 Research Hypotheses***

*RH1: The performance of primary schoolchildren on a curriculum task will be better in a natural setting than a classroom*

The hypothesis that the outdoor settings would enhance children's performance, compared with the classroom, was empirically supported. Outdoor tasks and settings were recalled more readily and in more detail. They were also significantly preferred for nine measurements relevant to cognition, with responses strongest for children with extensive outdoor learning experience. All teachers perceived a higher quality performance from the children on the outdoor tasks over the classroom.

General observations included the greater diversity of task outcomes and interpretations in the outdoors. Another was more sustained creative collaboration, which on open-

ended tasks evolved from individual activity into stable projects but exhibited the opposite trend in the classroom. Lastly, the outdoors featured higher levels of physical activity.

Stronger outdoor impacts are implied for all cognitive factors discussed.

Correspondences between (qualitative) systems and (quantitative) components analyses suggested greater perceived autonomy to be a characteristic of the outdoor experience for all children and teachers, which the discussion linked to higher levels of motivation, attention and positive affect. It was argued that all might be viewed as regulatory properties and indicators of a relationship of functional consonance with the task setting, which the interview analysis associated with perceived environmental immersiveness and non-prescriptiveness. It was also proposed that the relationship's positive emotional aspects might be classified as eudaimonic wellbeing, which serves an adaptive function of forging associations with environments which support autonomous self-development.

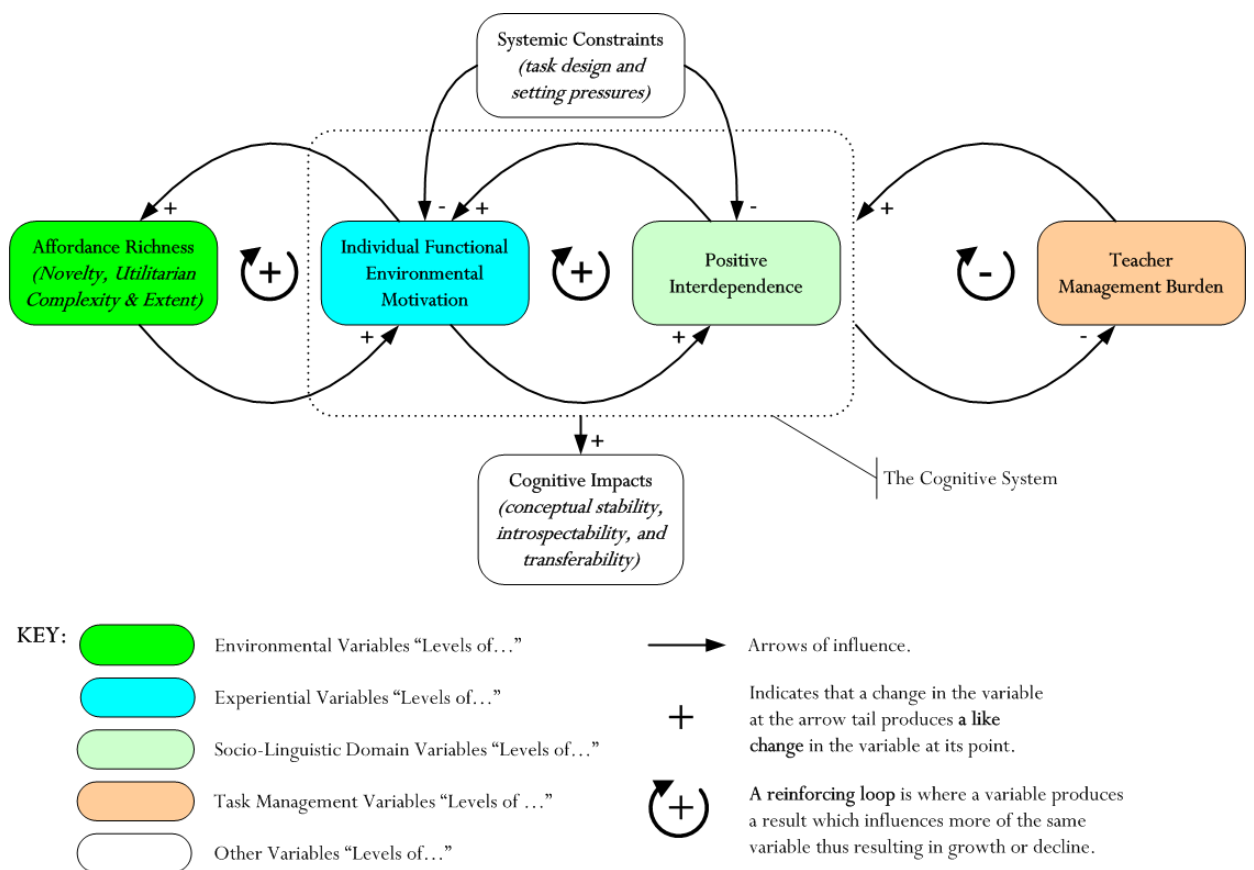
*RH2: There will be an association between the natural richness of the task setting and performance*

There was also empirical support for the second research hypothesis. Compared with the playground, more was recalled about the wild settings and preference means were significantly higher for discovery, and performance criteria overall. Greater diversity of movement was observed and it was intimately integrated with task activities, whereas in the playground it was largely performative locomotion. The group with woodland learning experience returned significantly stronger preferences for the wild setting and task, over those for whom it was completely or relatively novel.

A statistical factor linked to enabling aspects of task experience – particularly perceived levels of discovery and ideas – revealed a graduated relationship between setting preferences and Richness Index categories. This included a significant difference for the wild setting over the playground for both early years and experienced groups. The finding was complemented by a closed loop arising from the interview analyses which

suggested an enabling relationship between wild setting affordances and children’s task resourcefulness and self-sufficiency.

In discussion, it was argued three environmental variables –*utilitarian complexity*, *novelty* and *extent*– could underpin this relationship. The variables were viewed to functionally motivate children by facilitating courses of action within task parameters which were personally meaningful, novel and challenging. It was postulated the enabling relationship could be mediated at a group level through processes of joint attention. The stronger preferences for the experienced group were explained in terms of their enhanced capacity to perceive these variables through exposure to their wild setting. The discussion also suggested the stronger impacts of the wild setting on most, if not all, cognitive factors, and it was concluded that the findings associated with RH1 might be considered regulatory properties of functional motivation and the relationship outlined here.



**Figure 12.1 General Model of Task Environment and Cognition**



A general model (shown in Figure 12.1) was put forward as representing the enabling and regulating relationship between environment and cognition across all experimental tasks. This is summarised as a *virtuous systemic interrelationship between affordance richness, functional motivation, and positive interdependence, with significant implications for task performance*. Wild setting performance might be viewed as the optimal functioning of a purposeful group within its ecological niche, and underpinned by affordance-driven processes consistent with Kytta's interactive cycle (in Chawla, 2006). The comparatively reduced performance impacts implied for playground and classroom settings are attributed principally to more limiting task affordances, and to a lesser degree, by the constraints of classroom behaviour settings and task design.

### ***12.1.2 Underachievers***

The underachieving group recalled more about the outdoor and wild setting tasks than their peers, and rated them higher for perceived restorativeness scale criteria. Observations and interview data highlighted their uncharacteristically high levels of sustained attention, confidence and collaboration outdoors, with novice teachers noting hitherto unrecognised qualities, competencies and learning potential. These profound outdoor impacts were explained in terms of the children's stronger response to the enabling and regulating affordances, compared to their peers and the classroom. It was argued this may be attributable to their relative disadvantage with regards to classroom learning, which may render adaptation challenging and stressful. The experienced teachers also gave examples of how they utilise outdoor experiences to enable and support classroom learning for underachieving children.

### ***12.1.3 Experience of Outdoor Learning***

Compared to the early years' group, the task ratings and setting preferences of children with 4-5 years regular experience of woodland learning were significantly stronger

outdoors and weaker indoors. An explanation was proposed on the basis of the group's enhanced capacity to perceive and use the affordances of their wild setting towards school task goals. The implication is that the educational benefits of naturally-rich settings may endure and improve with exposure.

#### ***12.1.4 Teachers***

Teachers recalled and preferred the outdoor tasks and settings over the classroom, and were unanimous that they had delivered the best outcomes. Their perceived restorative scale ratings were lower for the indoor task than children, and it was suggested this might be attributable to classroom workload and stress. Common interview themes included their reduced management burden outdoors, and greater enjoyment, and both were argued to have further benefits for children's performance. In discussion it was argued the functional environmental relationship proposed for the children, was equally applicable to the teachers. It was also postulated that the greater requirement for classroom management, and the teachers' managerial approach, might be explained in terms of the systemic consequences of less sustaining affordances.

#### ***12.1.5 Educational Implications***

The outstanding educational implication is the greater task motivation, engagement and contribution of underachieving children on the outdoor tasks. This gives strong support to those critical policy objectives and recommendations related to narrowing Scotland's national 'performance gap' and achieving national attainment targets.

It was strongly argued that the formal learning significance of task-related knowledge for early years' children is determined by its conceptual stability, flexibility and transferability, and that findings (particularly, stronger recollections) suggested the greater capacity for outdoor experiential learning to promote this.

Other impacts associated with the outdoor tasks were held to have far-reaching educational significance. Findings suggested they better promoted three of the four capacities underpinning Curriculum for Excellence: *individual confidence*, *effective contribution* and *successful learning*. Children appeared to exhibit generally higher levels of task motivation, resourcefulness, collaboration and self-sufficiency, including those with classroom attention or behaviour issues. Some data suggested the outdoors promoted better quality interaction between teachers and children. Findings associated with the experienced group and teachers also imply rich natural settings have the capacity to sustain and improve these curricular benefits throughout primary school.

## **12.2 Limitations**

The study has several significant limitations. First is sample size, which has implications for reliability and transferability. The research entails a modest number of Scottish schools and children overall, and some arguments hinge on small sub-groups, e.g. the teachers, underachievers and experienced group. In the case of recollections, this was further exacerbated by data loss. The experiments also lack true statistical controls. Rural wood does not feature any control condition, and yet underpins the argument for the long-term benefits of outdoor learning.

Regarding research design, arguments for an association between natural richness and performance are weakened by there being only one playground condition, and no semi-wild settings. This leaves open the possibility that factors other than setting may have influenced findings. The delay between the tasks and the retrospective stages 2 and 3 interventions may have influenced findings, particularly, in light of the literature on early years' memory and self-assessment. Similar interventions conducted close to or concurrent with the experiments may have yielded a different or more accurate response.

The diversity of schools and tasks might also be considered by some to undermine the external validity of task comparison. Nevertheless, as touched upon in Chapter 3, the consistency of cross-task findings in spite of this diversity might also be viewed to

strengthen conclusions. In relation to the case study methodology, Yin proposes that “*if two or more cases are shown to support the same theory, replication may be claimed*” (2013, p.31). Comparison between extreme cases, or those selected for theoretical reasons, are held by some to yield more information than a random or representative sample (Flyvbjerg, 2006, Pettigrew, 1990), notably, in educational settings (Johannsson, 2003). Similar principles seem extant in the present approach to schools and tasks, and thus it is argued that this reinforces the case for analytical generalisation.

There are limitations with respect to the thesis measures, particularly, that they include no hard assessments of attainment. Only one task (‘Alien Adventure’) entailed a typical formal outcome, and this was suitable only for qualitative analysis. The performance criteria are unvalidated, theoretical self-assessments. Recollections are the only measure which might be considered truly objective, and these have no apparent precedent as a test of basic cognitive impact. It has been speculated that the adaptation of the PRS scale to the research situation may mean it measures something other than what was originally intended. The modified statements for each criterion all entail some departure from previously validated measures for Attention Restoration Theory (Kaplan & Kaplan, 1989), most notably so in relation to ‘extent’.

The data analysis might also be considered to have limitations. The discussion is founded on analyses of retrospective data which, in turn, involve additional layers of interpretation. Nevertheless, it is argued that the more complex analyses of questionnaire and interview data were still systematic and rigorous, and the remarkable correspondences between their outcomes was a both a surprise and a watershed moment for the thesis. This led to formerly peripheral cognitive factors –particularly motivation– becoming central to the argument and conclusions.

The final limitation, and the one underpinning all the above, is the combination of an exploratory experimental approach with a broad ecologically-valid canvas. The theoretical and methodological framework has meant information which may have yielded more nuanced or different interpretations has been excluded from the analysis (e.g. factors outside the task ‘boundary’). It also gave rise to the numerous design inconsistencies in stage 1, and a literature review which was heavily influenced by post-test circumstances and played a minimal role in the development of the methodology. The conflict between the ecological (theoretical framework) and mechanistic (research)

perspectives on cognition is also responsible for the disjointed structure from which the thesis frequently suffers.

In short, it has not been able to make an iron-clad case for long-term impacts relevant to Scottish primary school performance and attainment (i.e. literacy, numeracy and science). Statistical models are based on the inference from a random representative sample to a population, but that assumption should here be viewed in light of the study limitations, notably, the small group and sample sizes, non-random allocation, diverse cases and experiments, and the ‘real world’ context. Nevertheless, it should be noted that the statistical tests employed here have also been used to argue differences in much smaller groups and samples than these (Field, 2005). It is also argued that the validity of main findings – which have significant practical implications for the early years’ curriculum – are reinforced by their generalisability across diverse schools and experiments, and a strong resonance between higher-order quantitative and qualitative outcomes.

Furthermore, it is also important to stress that outcome measures by which attainment-relevant benefits or active cognition can be clearly measured at this age are problematic or precluded. There is a wide variation in children’s competency with attainment measures (presenting, reflecting, reading, writing etc.), where underachievers are typically those least able to produce analysable outcomes. Thus, to employ such measures runs the risk of returning findings which say little about those children whose performance seems most relevant to improving national attainment. Equally, if researchers wait until later primary school, when general outcome measures may become viable, the golden opportunity for intervention may have been lost. Studies of older groups exposed to early years outdoor programmes (e.g. the experience group), cannot easily attribute attainment impacts to environment, or ascertain if and how these may have facilitated the transition of disadvantaged children into formal learning. In short, while some cognitive measures could be viable in an ecologically-valid situation (see section 12.4.1 below), it is argued that educators may have to explore, develop, and learn to trust experiential learning theory and findings such as feature in this study if they are to deliver truly effective early intervention towards long-term attainment goals.

### 12.3 Recommendations

Informed by empirical support for outdoor learning's relevance to Scottish primary school policy objectives, three specific recommendations are proposed:

1. *Use outdoor learning programmes to provide support for underachievers and transition from nursery.* Findings strongly suggest the capacity of natural task settings and affordances to motivate and engage children who are disadvantaged regarding classroom learning, while providing them with developmentally and educationally significant experiences. Enabling the effective participation and contribution of these children in curriculum tasks, particularly during transition, could serve to reduce the performance gap at the level of individual classes and schools. The literature also predicts that setting in motion a cycle of successes at this stage, rather than failures, could have far-reaching implications for overall academic attainment.

The research also suggests the generally-motivating properties of natural task settings may be beneficial for experientially-driven formal learning for all children at this developmental stage, and for freeing teachers up to devote more time for needy pupils. The findings from the experienced group and teachers also imply these benefits may remain or improve throughout primary school.

Given that transition, early intervention and reducing the performance gap are critical policy priorities for the Scottish Government, this study might be considered to add significantly to the evidence base for formal inclusion of outdoor learning in Her Majesty's Inspectorate of Education inspection schedules for transition and early primary schooling in Scotland. For instance, an embedded outdoor learning programme could be a key quality indicator upon which an 'excellent' evaluation is contingent (HMIE, 2011).

2. *Employ outdoor learning to promote 'confident individuals', 'effective contributors' and 'successful learners', particularly in relation to open-ended tasks.* The study gives strong empirical support for the general positive impacts

of natural settings on children's self-sufficiency, self-confidence and positive interdependence, across a variety of open-ended curriculum tasks. In this respect, it is argued that, aside from the significant academic implications of these factors, the outdoor tasks also contributed more than the classroom to building these three capacities underpinning Curriculum for Excellence. Furthermore, findings also suggest the potential for rich natural settings to be used as a general workshop for early formal learning and creative collaboration, as opposed to considering them only appropriate, for example, for physical education or subjects with a specific 'nature' theme.

3. *Use the Richness Index, or similar environmental measures, as tools for assessing the quality of early years' school settings and affordances.* The study strongly suggest that implicit qualities of natural affordances may deliver superior performance benefits to the artificial or prescriptive affordances of a typical school playground or classroom. It has been argued that these qualities enabled personal meaning and resourcefulness within task parameters for most, if not all, participants, with virtuous consequences for collaboration, health and wellbeing. On the basis of findings which strongly imply an association between performance and Richness Index scorings, it is proposed such measures could be used to assess the capacity of indoor and outdoor task settings to promote virtuous learning dynamics. The findings may indicate value in 'rewilding' areas of school grounds.

## **12.4 Suggestions for Future Research**

### ***12.4.1 Performance***

It is hoped future studies will provide clarification or validation of the study's methodology or findings. The repeat measures, field experiment approach where performance or behaviour is compared between settings assessed for richness (or other environmental factors), could have extensive application. Specific improvements to this

study might include larger matched sub-groups and overall sample, as well as statistical control groups and greater task standardisation between cases.

Towards strengthening the two research hypotheses, studies might seek comparisons involving only outdoor environments, or indoor and outdoor settings where biodiversity and affordance levels vary (as was the intention for the 'semi-wild' RI category). Positive associations between settings / affordances and motivation, attention, positive interdependence or memory would seem critical research areas from an educational perspective, particularly in relation to underachievers. Exploring the effects of affordances within the context of CET / SDT would also seem a potentially fruitful avenue of inquiry (Deci & Ryan, 2002).

The study's setting and task assessment tools might be further tested or developed. In light of the discussion, the Richness Index's affordance category might be improved through the introduction of living animals and their remains, or a more fine-grained treatment of manipulable affordances on the basis of their plasticity and responsiveness. Its design might also benefit from incorporating the Bullerby Model's axis of accessibility and autonomy (Kytä, 2003), and / or a consideration of other implicit setting rules and pressures (Barker, 1990; Gump, 1978). Furthermore, while the general open-endedness of the final four field experiments meant the assessment tool revealed little of interest, I still believe strongly that task design is potentially confounding in any assessment of environmental richness. For this reason, the concept of a task open-endedness tool may have practical utility for similar studies, and one learning is that it could benefit from the inclusion of design constraints on social interaction.

The findings validate the questionnaire approach for use with the age group and thus this may also future research application. Both free recall and the preference measures yielded meaningful data, and an intervention immediately post-test may have returned more interesting results. The performance criteria also seem validated as setting-neutral impact measures, with findings suggesting that the 'compatibility' criterion might usefully be incorporated. Furthermore, while adaptations to the remaining PRS criteria may call into question its effectiveness at assessing the restorativeness of settings, it may have application as a measure of their autonomy-supportiveness, which it has been argued may still be a factor relevant to ART (Kaplan & Kaplan, 1989). Finally, although task / component differences meant a consistent approach to the Stage 1



interactions analyses was not possible, they did prove effective at visualising and quantifying complex socioenvironmental behaviour. In this respect, they may have further developmental potential as a method for comparing performance impacts between settings.

Future research in the area might also seek tighter or harder measures of cognition. While recollections are perhaps validated here as a rough measure of a setting's cognitive impact in the age group, there are likely to be methods for more accurate assessment of the other cognitive factors. For example, sustained attention might conceivably be measured during the task using eye-tracking technology (Berto et al., 2008) or by cognitive tests immediately post-test. Physiological measures (e.g. cortisol levels), or responses to an emotional preference scale, captured during the task, or promptly after, might provide empirical support for impacts on positive affect. Relationships between physical activity and affordance richness might reasonably be tested using accelerometers (Lovell, 2009) or behavioural categories (Fjørtoft, 2001). Although motivation may be more problematic in terms of objective measures, a self-assessment scale might reasonably be developed and administered in situ, or post-test. Lastly, with slightly older age groups, formal academic outcomes could serve as a viable test measure of all of the above.

#### ***12.4.2 Outdoor Teaching Expertise and Practice***

Another potentially rich vein of inquiry research relates to outdoor learning practitioners. Data from the rural wood teachers, particularly their use of outdoor recollections to support formal learning, imply a valuable untapped resource of practical educational knowledge. Arguably, their approaches manifest those experiential learning processes implied by developmental theory (Kolb, 1983; Piaget & Cook, 1998; Vygotsky, 1978a), and may prove a powerful tool for early intervention and transition.

Another area of interest is the impact of settings and affordances on teachers' well-being, instructional style and pupil relationships, and the potential consequences for class performance. Of all the cognitive factors, positive teacher feedback in natural settings is perhaps the most difficult of the thesis impacts to measure. However,

insights might be provided by comparing the behaviour and performance impacts of teachers with varying environmental preferences in the same task / setting milieu.

## **12.5 Original Contribution**

The thesis is the first study to compare relationships between different learning environments and general cognition in an active task context, and to propose a statistical association between levels of natural richness and child performance. It puts forward an overarching systems-based theory of basic motivation, which may offer a way of conceptualising a range of theories and impacts associated with natural environments under a single umbrella, including those related to health and wellbeing, social interaction, as well as attention, memory and other aspects of cognition.

As such, it also offers an ecologically-valid and integrative context for theories of environmental perception and child development, many of which have been informed largely by laboratory-based studies to date, while providing further empirical support for a special human relationship with nature. As mentioned, the study validates new approaches –including the use of field experiments to measure environmental impacts on task performance, interactions analyses, a setting-unbiased performance scale, and the first early years application of the PRS scale. All of these might be used and improved to further educational research involving young children. It also proposes tools for assessing setting richness and task open-endedness which could have utility for comparing the performance impacts of different learning environments. The insights on affordances and approaches have practical pedagogical implications for early years education, and suggest problem behaviour may be a problem of environment, not of child, where natural settings could play a significant mediating role.

Despite the small scale of the study, the consistency of some themes and findings across diverse tasks and contexts, and methods, increases its external validity, generalisability and transferrability. It is hoped conclusions give empirical support for the anecdotal evidence base for outdoor educational benefits, while also being of value to Scottish policy makers, educators, researchers and school designers, and similar parties further afield.

## 12.6 Concluding Thoughts

To conclude, I wish to share some personal thoughts about the ways the thesis has transformed my own perception of the human relationship between environment and cognition, and some of the broader implications I feel strongly this has for education, sustainability and human experience.

In section 11.3 I raised question as to why the Early Years' Curriculum doesn't include 'environments', along with 'experiences' and 'outcomes'? This non-trivial question seems to me an underlying theme of this thesis, and one which over the course of the journey came to trouble me deeply. Indeed, the research gap between task settings and performance appeared relatively innocuous at the outset, but soon seemed more the yawning chasm.

Despite the vast canon of literature on psychology and education, only a tiny fraction seemed to view environment and cognition as in any way coupled. While almost all the empirically-supported theories of ecological psychology in existence feature in the thesis's argument, most are founded on laboratory research. It seems non-trivial, in my view, that a theory from a different discipline (i.e. biological systems) ultimately proved the most appropriate for the thesis framework. In short, the literature itself seemed to share the same human blind spot as educators regarding the basic role of environment in cognition, performance and development.

One insightful exception was Iain McGilchrist's comprehensive account of the brain's specialist hemispheric functioning in 'The Master and Emissary' (2012). As already mentioned, this puts forward a robust argument that our conscious conceptualising left hemisphere may be unaware of the unconscious holistic experiencing of our right, although it underpins the left's perception of the world. McGilchrist describes the divide thus:

*"Language enables the left hemisphere to represent the world 'off-line', a conceptual version, distinct from the world of experience, and shielded from the immediate environment, with its insistent impressions, feelings and demands, abstracted from the body, no longer dealing with what is concrete, specific, individual, unrepeatable, and constantly changing, but with a disembodied representation of the world, abstracted, central, not particularised in time and place, generally applicable, clear and fixed.*

*Isolating things artificially from their context brings the advantage of enabling us to focus intently on a particular aspect of reality and how it can be modelled, so that it can be grasped and controlled. But its losses are in the picture as a whole. Whatever lies in the realm of the implicit, or depends on flexibility, whatever can't be brought into focus and fixed, ceases to exist as far as the speaking hemisphere is concerned”* (McGilchrist, 2012, p.115)

It was this passage which suggested to me that the blind spot could in fact be attributable to the basic structure of human cognition. In other words, our utter embeddedness in and dependence on our immediate environment and the consequences of this for our experience and development may be unavailable to consciousness. Or in McGilchrist’s words, “*the left hemisphere sees truth as internal coherence of the system, not correspondence with the reality we experience*” (McGilchrist, 2012, p.).

Thus, I believe there to be a paradox at the heart of this thesis, namely, that our relationship with natural environments is fundamental to effective human functioning and development, and yet we may be hardwired to be unaware of it. Perhaps until recent centuries, the relationship never needed to be accessible to consciousness, being just a fact of day-to-day life as it is for all other living things? The autonomous left-brain needed not to concern itself with the whole picture, only those discrete affordances relevant to our species, survival and personal goals. As Maturana and Varela state, “*we do not see what we do not see, and what we do not see does not exist*” (1992, p.242). Faced with the socioenvironmental challenges and indoor culture of the c21st, however, the blind spot has chilling implications, particularly for the next generation. For if we do not help them to ‘see’, there is the risk they may be ignorant of the existence of that upon which their existence depends.

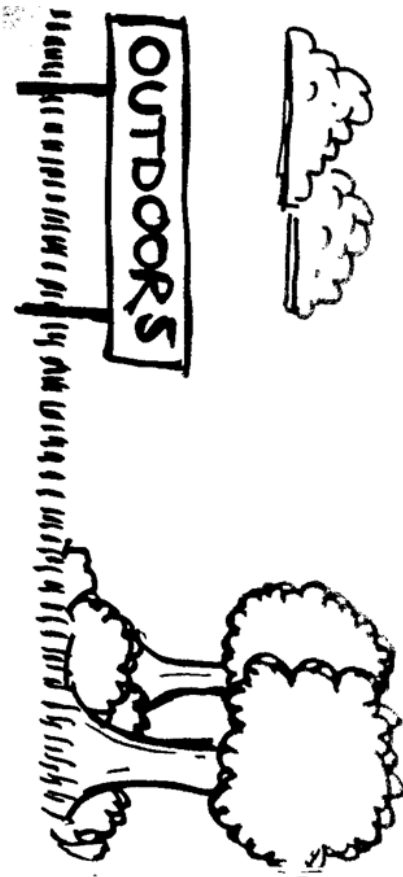
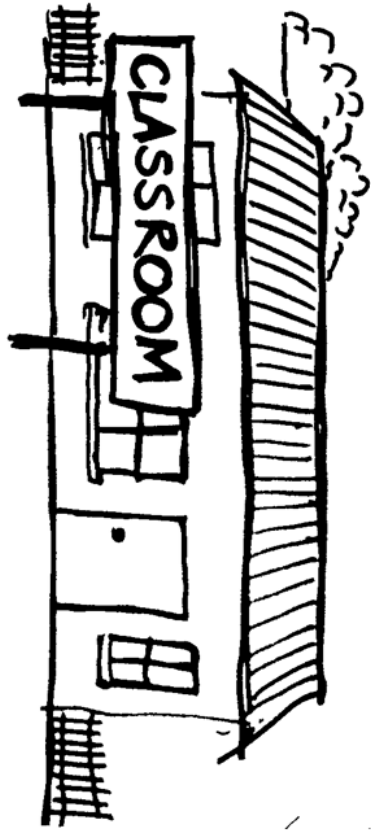
Nevertheless, it is also my strong view that acknowledging the blind spot, it, and exploring its possibilities and limitations, is an opportunity which promises manifold benefits. In terms of early years’ education, the thesis suggests natural settings could support not only attainment, but also resilience, persistence, self-confidence, creativity, interpersonal skills, physical fitness and care for the natural world. In these respects, one must ask if there is an approach for Scottish education better able to deliver both immediate curricular objectives, and a generation equipped to face and resolve the uncertainties and challenges of the future.

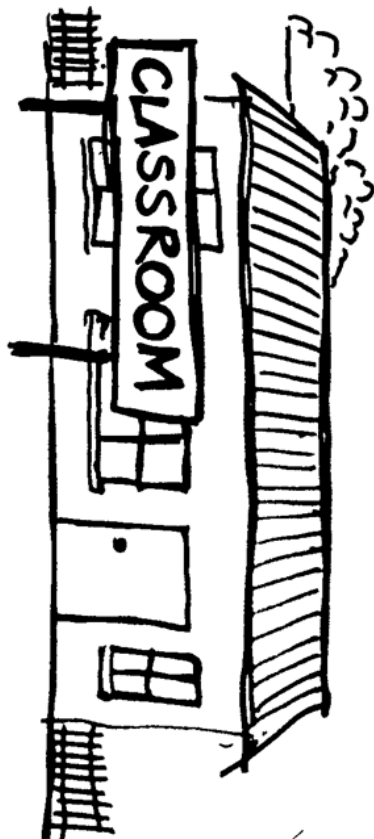
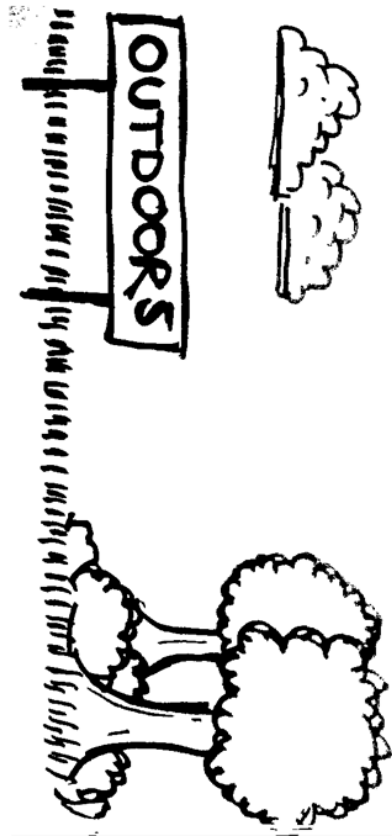
# APPENDICES

## Appendix A: Questionnaire Materials











## **Appendix B: Parental Information and Consent Forms**

### **PARTICIPATING SCHOOLS: PhD Research Purpose and Procedure**

**The Purpose** of this research is to investigate if and how outdoor learning contributes to creative and linguistic development in Primary School. Whilst there is much evidence to support the health and wellbeing benefits of nature experiences, their contribution to academic achievement is largely unexplored. It is hoped findings may improve the learning experiences of schoolchildren in Scotland and further afield, as well as supporting Longridge's own understanding and practice. The PhD is co-sponsored by the Forestry Commission and Heriot-Watt University and involves case studies from across Scotland.

Best efforts will be made to ensure the research doesn't impact on school practices or experiences, and all activities will be supervised and covered by necessary Ethical Approvals, Risk Assessments, and PVG membership.

The Research **Procedure** will consist of:

- (i) 2 x Simple Tasks (one per term). These have been devised by the class teacher to complement their teaching plan and the curriculum. Each Task will involve two performances of the same activity (e.g. 'imagine an alien adventure') by P2/1 and P6/5 buddy groups, once in their classroom and once in the wood adjacent to the school. For the second Task, the order of setting will be reversed. The Task Outcome will be a picture for the younger children, and a written story, for the older ones.
- (ii) Some simple questions to the children about their Task Outcome and;
- (iii) Upon completion of all Tasks, a few questions about how they felt about the particular task and setting.

Please note that these are not tests of individual intelligence or ability, the aim is an objective study of systemic relationships between different settings, and their effects on children's performance.

**Confidentiality:** The following data will be recorded: (i) audiovisual recordings of session activities and the outcomes from which transcriptions will be made; (ii) interviewer notes; and (iii) questionnaire data. These will be subject to statistical, qualitative and systems analyses (by the researcher only).

All data will be maintained in accordance with the Data Protection Act, and coded so that children's anonymity will be protected in any publications or presentations resulting from this work. If there is any intention to use any of the visual material in any publications or presentations, a separate release statement will be obtained from you after the recording has been made.

**Finding out about result:** If interested, you can learn about the findings of the study by contacting the researcher, Jamie McKenzie Hamilton, after Jan-Mar 2015 at [contact details]. The school will be sent notification of the thesis and any related publications, and the researcher is happy to agree to a presentation to the school of pertinent findings from the case study.

## **NURSERY PILOT: PhD Pilot Questionnaire: Info Sheet for Parents**

**What is the PhD?** I am Jamie McKenzie Hamilton, a local resident. My Forestry Commission and Heriot-Watt University sponsored PhD is investigating if and how outdoor learning contributes to linguistic development in Early Years. Whilst there is much evidence to support the health and wellbeing benefits of nature experiences, their contribution to academic achievement is largely unexplored. This is a novel area of research and it is hoped findings will help to improve the learning and experiences of schoolchildren in Scotland and further afield. I would be more than happy to send the finished thesis to any participating teachers and parents, if requested to do so.

**Why this Nursery?** I am coming to the end of the 2<sup>nd</sup> year of my PhD now and the core fieldwork with my school case studies is now complete. This involved children performing the same activity in both an indoor and an outdoor setting, so that their linguistic experiences could be compared between each

It has been decided worthwhile to do a short follow-up questionnaire to test the children's recollections of the activities and perception of different settings. However, I need to test the appropriateness of the methodology and questions for the age group before taking them to my case studies. As this is my local nursery, and I know the teachers well, it seemed the obvious choice.

**What's involved?** A short 9 question interview: this will take approximately 3-5 minutes and includes 4 questions about the children's perceptions of an indoor (nursery) and outdoor (their garden) setting, and 5 questions comparing the last session (and possibly two sessions) they attended nursery.

Only children who will be going to primary school next year will receive the questionnaire. Answers will be audio recorded using a Flip Camera. Recordings will play no part in the final thesis. After they have been used to hone methodology and question wording, they will be deleted.

### **Ethical Assurances:**

- (i) Management of all data will satisfy the Data Protection Act and the strictest confidentiality of all stakeholders will be maintained at all times.
- (ii) Best efforts will be made to ensure my data gathering does not impact on nursery practices or experiences. All of researcher activities will be under teacher supervision, will involve teacher input, and will be covered by the necessary Disclosure Statement, Ethical Approvals, Risk Assessments, and references.
- (iii) All stakeholders have the right to refuse to participate and have any data pertaining to relevant participants withdrawn from the study at any time.

If any teachers or parents have any questions or ideas about the proposal then they should feel free to contact me at [contact details].

## REFERENCES

- Abdi, H. (2003). Factor rotations in factor analyses. *Encyclopedia for Research Methods for the Social Sciences*. Sage: Thousand Oaks, CA, 792–795.
- AIR. (2005). Effects of Outdoor Education Programs for Children in California. American Institutes of Research. Sacramento.
- Alloway, T. P., & Alloway, R. G. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *Journal of Experimental Child Psychology*, 106(1), 20–29. <https://doi.org/10.1016/j.jecp.2009.11.003>
- Ames, G. J., & Murray, F. B. (1982). When two wrongs make a right: Promoting cognitive change by social conflict. *Developmental Psychology*, 18(6), 894–897. <https://doi.org/10.1037/0012-1649.18.6.894>
- Aspinall, P., Mavros, P., Coyne, R., & Roe, J. (2013). The urban brain: analysing outdoor physical activity with mobile EEG. *British Journal of Sports Medicine*. <https://doi.org/10.1136/bjsports-2012-091877>
- Audit Scotland. (2014). School Education. Audit Scotland.
- Bagot, K. L. (2004). Perceived restorative components: A scale for children. *Children Youth and Environments*, 14(1), 107–129.
- Bagot, K. L., Kuo, F. E., & Allen, F. C. L. (2007). Amendments to the perceived restorative components scale for children (PRCS-C II). *Children Youth and Environments*, 17(4), 124–127.
- Baker, J. A. (2006). Contributions of teacher–child relationships to positive school adjustment during elementary school. *Journal of School Psychology*, 44(3), 211–229. <https://doi.org/10.1016/j.jsp.2006.02.002>
- Baker-Ward, L., Ornstein, P. A., Gordon, B. N., Follmer, A., & Clubb, P. A. (1995). How shall a thing be coded? Implications of the use of alternative procedures for

- scoring children's verbal reports. In M. S. Zaragoza, J. R. Graham, G. C. N. Hall, R. Hirschman, & Y. S. Ben-Porath (Eds.), *Memory and testimony in the child witness* (pp. 61–85). Thousand Oaks, CA, US: Sage Publications, Inc.
- Barker, R. G. (1969). *Ecological Psychology: Concepts and Methods of Studying the Environment of Human Behavior* (1st Edition). Stanford University Press.
- Barker, R. G. (1990). Recollections Of The Midwest Psychological Field Station. *Environment and Behavior*, 22(4), 503–513.  
<https://doi.org/10.1177/0013916590224007>
- Barnett, D., & Ratner, H. H. (1997). The Organization and Integration of Cognition and Emotion in Development. *Journal of Experimental Child Psychology*, 67(3), 303–316. <https://doi.org/10.1006/jecp.1997.2417>
- Barnett, W. S. (1995). Long-Term Effects of Early Childhood Programs on Cognitive and School Outcomes. *The Future of Children*, 5(3), 25–50.  
<https://doi.org/10.2307/1602366>
- Bartosh, O. (2003). Environmental education: Improving student achievement (Doctoral dissertation). Evergreen State College. Washington State.
- Bassegy, M. (1999). *Case Study Research in Educational Settings*. Buckingham England ; Philadelphia: Open University Press.
- Bateson, P., & Martin, P. (2000). *Design For A Life: How Behaviour Develops* (New Ed edition). London: Vintage.
- BBC News. (2015). Scottish budget 2016/17: John Swinney defends council budget cuts. Retrieved 20 December 2015, from <http://www.bbc.co.uk/news/uk-scotland-scotland-politics-35119691>
- Bell, P. A., Greene, T., Fisher, J., & Baum, A. S. (2006). *Environmental Psychology* (5th ed.). Psychology Press.
- Berlyne, D. E. (1971). *Aesthetics and psychobiology*. Appleton-Century-Crofts.

- Berto, R., Massaccesi, S., & Pasini, M. (2008). Do eye movements measured across high and low fascination photographs differ? Addressing Kaplan's fascination hypothesis. *Journal of Environmental Psychology*, 28(2), 185–191.  
<https://doi.org/10.1016/j.jenvp.2007.11.004>
- Biddle, B. J., & Adams, R. S. (1967). *An Analysis of Classroom Activities: A Final Report*. Center for Research in Social Behavior, University of Missouri.
- Blair, D. (2009). The Child in the Garden: An Evaluative Review of the Benefits of School Gardening. *The Journal of Environmental Education*, 40(2), 15–38.  
<https://doi.org/10.3200/JOEE.40.2.15-38>
- Blatchford, P., & Mortimore, P. (1994). The Issue of Class Size for Young Children in Schools: what can we learn from research? *Oxford Review of Education*, 20(4), 411–428. <https://doi.org/10.1080/0305498940200402>
- Bower, J., Barclay, A., & Hawkey, S. (2002). Tehidy Woods Forest School Evaluation Report, Camborne, Pool and Redruth Success Zone (unpublished report), in Davis, B., & Waite, S. (2005). *Forest Schools: an evaluation of the opportunities and challenges in early years*. Final Report. University of Plymouth. p.16.
- Boyatzis, R. E. (1998). *Transforming Qualitative Information: Thematic Analysis and Code* (First Printing edition). SAGE Publications, Inc.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.  
<https://doi.org/10.1191/1478088706qp063oa>
- Bronson, M. B. (2002). *Self-Regulation in Early Childhood: Nature and Nurture*. New York: Guilford Press.
- Bruner, D. r. (1986). *Actual Minds, Possible Worlds* (New edition edition). Cambridge, Mass.: Harvard University Press.

- Bryman, A. (2012). *Social Research Methods* (4 edition). Oxford ; New York: OUP Oxford.
- Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development*, 72(4), 1032–1053.
- Carrington, D. (2016, March 25). Three-quarters of UK children spend less time outdoors than prison inmates – survey. *The Guardian*. Retrieved from [http://www.theguardian.com/environment/2016/mar/25/three-quarters-of-uk-children-spend-less-time-outdoors-than-prison-inmates-survey?CMP=share\\_btn\\_fb](http://www.theguardian.com/environment/2016/mar/25/three-quarters-of-uk-children-spend-less-time-outdoors-than-prison-inmates-survey?CMP=share_btn_fb)
- Ceci, S. J., & Bruck, M. (1993). Suggestibility of the child witness: A historical review and synthesis. *Psychological Bulletin*, 113(3), 403–439.  
<https://doi.org/10.1037/0033-2909.113.3.403>
- Charmaz, K. (2011). Grounded theory methods in social justice research. In *The Sage handbook of qualitative research* (Vol. 4, pp. 359–380).
- Chawla, L. (2006). Learning to love the natural world enough to protect it. *Barn*, 57–78.
- Checkland, P. B. (1978). The origins and nature of 'hard' systems thinking. *Journal of Applied Systems Analysis*. *Journal of Applied Systems Analysis*, 5(2), 99–110.
- Cherry, K. (2015a). How Do Psychologists Define Attention? Retrieved 20 August 2015, from <http://psychology.about.com/od/cognitivepsychology/f/attention.htm>
- Cherry, K. (2015b). What is a cross-sectional study? About.com. Retrieved from <http://psychology.about.com/od/cindex/g/cross-sectional.htm>
- Christie, B., Beames, S., Higgins, P., Nicol, R., & Ross, H. (2014). Outdoor Learning provision in Scottish Schools. *Scottish Educational Review*, 46(1), 48–64.
- Christie, B., Higgins, P., & Nicol, R. (2015). Curricular outdoor learning in Scotland. In B. Humberstone, H. Prince, & K. A. Henderson (Eds.), *Routledge International Handbook of Outdoor Studies* (Vol. 11, pp. 113–120). New York: Routledge.

- Christopher, J. A. (2005). Tech Mind For The Masses!: Hard and Soft System Methodologies: The Differences. Retrieved from <http://qeynotes.blogspot.co.uk/2005/04/hard-and-soft-system-methodologies.html>
- Cobb, E. (1959). The Ecology of Imagination in Childhood. *Daedalus*, 88(3), 537–548.
- Cobb, E. (1977). *Cobb: the Ecology of the Imagination in Childhood*. Columbia University Press.
- Corbetta, M., & Shulman, G. L. (2002). Control of goal-directed and stimulus-driven attention in the brain. *Nature Reviews Neuroscience*, 3(3), 201–215. <https://doi.org/10.1038/nrn755>
- Corsaro, W. A., & Molinari, L. (2008). Entering and Observing in Children’s Worlds. A Reflection on a Longitudinal Ethnography of Early Education in Italy. In Christensen, P., & James, A. ed. In *Research with Children: Perspectives and Practice* (2nd ed., Vol. Ch.12, pp. 239–259). Routledge. New York and London.
- Costantini, M., & Sinigaglia, C. (2011). Grasping Affordance: A Window onto Social Cognition. *Joint Attention: New Developments in Psychology, Philosophy of Mind, and Social Neuroscience*, 431.
- Cozby, P. (2014). *Methods in Behavioral Research* (12 edition). McGraw-Hill Higher Education.
- Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, 11(6), 671–684. [https://doi.org/10.1016/S0022-5371\(72\)80001-X](https://doi.org/10.1016/S0022-5371(72)80001-X)
- Creswell, J. W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.
- Creswell, J. W., & Clark, V. L. P. (2011). *Designing and Conducting Mixed Methods Research* (2nd edition). Los Angeles: SAGE Publications, Inc.

- Crook, M. A., & Langdon, F. J. (1974). The effects of aircraft noise in schools around London airport. *Journal of Sound and Vibration*, 34(2), 221–232.  
[https://doi.org/10.1016/S0022-460X\(74\)80306-8](https://doi.org/10.1016/S0022-460X(74)80306-8)
- Cross Validated. (2011). What are the differences between Factor Analysis and Principal Component Analysis? Retrieved 13 June 2015, from <http://stats.stackexchange.com/questions/1576/what-are-the-differences-between-factor-analysis-and-principal-component-analysis>
- Crotty, M. J. (1998). *The Foundations of Social Research: Meaning and Perspective in the Research Process*. London ; Thousand Oaks, Calif: SAGE Publications Ltd.
- Csikszentmihalyi, M. (2000). *Beyond Boredom and Anxiety: Experiencing Flow in Work and Play* (Anniversary edition). San Francisco, Calif: Jossey-Bass.
- Csikszentmihalyi, M. (2008). *Flow: The Psychology of Optimal Experience* (1ST edition). New York: Harper Perennial Modern Classics.
- Csikszentmihalyi, M., Abuhamdeh, S., Nakamura, J., & Flow, A. E. (2005). Flow. *Handbook of Competence and Motivation. The Guilford Press, New York.*, 598–608.
- Dadvand, P., Nieuwenhuijsen, M. J., Esnaola, M., Fornes, J., Basagaña, X., Alvarez-Pedrerol, M., ... Sunyer, J. (2015). Green spaces and cognitive development in primary schoolchildren. *Proceedings of the National Academy of Sciences*, 112(26), 7937–7942. <https://doi.org/10.1073/pnas.1503402112>
- Davis, B., & Waite, S. (2005). Forest Schools: an evaluation of the opportunities and challenges in early years. Final Report. University of Plymouth.
- DCSF. (2010). Pockets of poverty : the challenge for schools with small proportions of FSM pupils. Department for Children, Schools and Families.
- De Bono, E. (2009). *Six Thinking Hats*. Penguin.



- Deci, E. L., & Ryan, R. M. (2000). The ‘What’ and ‘Why’ of Goal Pursuits: Human Needs and the Self-Determination of Behavior. *Psychological Inquiry*, 11(4), 227–268. [https://doi.org/10.1207/S15327965PLI1104\\_01](https://doi.org/10.1207/S15327965PLI1104_01)
- Deci, E. L., & Ryan, R. M. (2002). Overview of self-determination theory: An organismic dialectical perspective. In *Handbook of Self-determination Research* (pp. 3–33). University Rochester Press.
- Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist*, 26(3–4), 325–346.
- DeSantis, L., & Ugarriza, D. N. (2000). The concept of theme as used in qualitative nursing research. *Western Journal of Nursing Research*, 22(3), 351–372.
- Desimone, R., & Duncan, J. (1995). Neural Mechanisms of Selective Visual Attention. *Annual Review of Neuroscience*, 18(1), 193–222. <https://doi.org/10.1146/annurev.ne.18.030195.001205>
- Dettweiler, U. (2015). Designing Mixed Methods Research. Fitting the statistical to the empirical model, paper presented at the the PhD Course „Udeskole and Outdoor Learning“ from April 28th-30th, at Skovskolen, University of Copenhagen.
- Dettweiler, U., Ünlü, A., Lauterbach, G., Becker, C., & Gschrey, B. (2015). Investigating the motivational behavior of pupils during outdoor science teaching within self-determination theory. *Frontiers in psychology*, 6.
- Dewey, J. (1997). *Experience and Education* (Reprint edition). New York: Pocket Books.
- Dillon, J., Rickinson, M., Teamey, K., Morris, M., Choi, M. Y., Sanders, D., & Benefield, P. (2006). The value of outdoor learning: evidence from research in the UK and elsewhere. *School Science Review*, 87(320), 107.

- Docherty, S., & Sandelowski, M. (1999). Focus on qualitative methods: Interviewing children. *Research in Nursing & Health*, 22(2), 177–185.
- Donaldson, J. (1999). *The Gruffalo* (Illustrated edition edition). New York: Macmillan Children's Books.
- Donaldson, M. (1986). *Children's Minds* (New Ed). HarperCollins.
- Duffin, M., Powers, A., Tremblay, G., & PEER Associations. (2004). Place-based Education Evaluation Collaborative: Report on cross-program research and other program evaluation activities, 2003-2004.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., ... Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, 43(6), 1428–1446. <https://doi.org/10.1037/0012-1649.43.6.1428>
- Early, D. M., Pianta, R. C., & Cox, M. J. (1999). Kindergarten Teachers and Classrooms: A Transition Context. *Early Education and Development*, 10(1), 25–46. [https://doi.org/10.1207/s15566935eed1001\\_3](https://doi.org/10.1207/s15566935eed1001_3)
- Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review*, 66(3), 183–201. <https://doi.org/10.1037/h0047707>
- Education Scotland. (2004). What is Curriculum for Excellence? - The curriculum - Learning and teaching. Retrieved 21 December 2015, from <http://www.educationscotland.gov.uk/learningandteaching/thecurriculum/whatiscurriculumforexcellence/>
- Edwards, D., Elliott, A., Hislop, M., Martin, S., Morris, J., O' Brien, L., ... Valatin, G. (2009). A Valuation of the Economic and Social Contribution of Forestry for People in Scotland [online]. Forestry Commission, Edinburgh. Retrieved from [http://www.forestry.gov.uk/PDF/fcrp101.pdf/\\$FILE/fcrp101.pdf](http://www.forestry.gov.uk/PDF/fcrp101.pdf/$FILE/fcrp101.pdf)

- Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, 14(4), 532–550.  
<https://doi.org/10.5465/AMR.1989.4308385>
- Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Utriainen, K., & Kyngäs, H. (2014). Qualitative Content Analysis A Focus on Trustworthiness. SAGE Publications Ltd. Retrieved from <http://sgo.sagepub.com/content/4/1/2158244014522633>
- Engel de Abreu, P. M. J., Abreu, N., Nikaedo, C. C., Puglisi, M. L., Tourinho, C. J., Miranda, M. C., ... Martin, R. (2014). Executive functioning and reading achievement in school: a study of Brazilian children assessed by their teachers as 'poor readers'. *Frontiers in Psychology*, 5.  
<https://doi.org/10.3389/fpsyg.2014.00550>
- Ernst, J. A., & Monroe, M. (2004). The effects of environment-based education on students' critical thinking skills and disposition toward critical thinking. *Environmental Education Research*, 10(4), 507–522.  
<https://doi.org/10.1080/1350462042000291038>
- Evans, G. W. (1984). *Environmental Stress* (New Ed edition). Cambridge: Cambridge University Press.
- Evans, G. W. (1991). Environmental Stress. In *Handbook of Environmental Psychology* (Reprint edition, Vol. 1, pp. 571–610). Malabar, Fla: Krieger Publishing Company.
- Evergreen (Association). (2000). Nature nurtures: Investigating the potential of school grounds. Evergreen.
- Fabian, H., & Dunlop, A.-W. (2007). *Outcomes of Good Practice in Transition Processes for Children Entering Primary School. Working Papers in Early Childhood Development, No. 42*. Bernard van Leer Foundation. Retrieved from <http://eric.ed.gov/?id=ED522698>

- Fägerstam, E. (2012). *Space and Place: Perspectives on Outdoor Teaching and Learning*. Phd Dissertation. Linköping University.
- Fägerstam, E., & Blom, J. (2013). Learning biology and mathematics outdoors: effects and attitudes in a Swedish high school context. *Journal of Adventure Education & Outdoor Learning*, *13*(1), 56–75.
- Field, A. (2005). *Discovering Statistics Using SPSS* (Second Edition). London: Sage Publications Ltd.
- Fjørtoft, I. (2001). The Natural Environment as a Playground for Children: The Impact of Outdoor Play Activities in Pre-Primary School Children. *Early Childhood Education Journal*, *29*(2), 111–17.
- Fjørtoft, I. (2004). Landscape as Playscape: The Effects of Natural Environments on Children's Play and Motor Development. *Children, Youth and Environments*, *14*(2), 21–44.
- Flavell, J. H. (1971). First Discussant's Comments: What is Memory Development the Development of? *Human Development*, *14*(4), 272–278.  
<https://doi.org/10.1159/000271221>
- Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, *12*(2), 219–245. <https://doi.org/10.1177/1077800405284363>
- Forrester, J. W. (1971). Counterintuitive behavior of social systems. *Technology Review*, *73*(3), 52–68.
- Fredrickson, B. L. (1998). What Good Are Positive Emotions? *Review of General Psychology : Journal of Division 1, of the American Psychological Association*, *2*(3), 300. <https://doi.org/10.1037/1089-2680.2.3.300>
- Frost, J. L., & Strickland, E. (1985). Equipment choices of young children during free play. *When Children Play: Proceedings of the International Conference on Play and Play Environments*, 93–101.

- Gathercole, S. E., & Alloway, T. P. (2007). Understanding working memory: A classroom guide. Lontoo: Harcourt Assessment. Retrieved from <http://www.york.ac.uk/res/wml/Classroom%20guide.pdf>
- Gauvrit, N., Soler-Toscano, F., & Zenil, H. (2014). Natural scene statistics mediate the perception of image complexity. *Visual Cognition*, 22(8), 1084–1091.
- Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal*, 29(13), 1465–1474.  
<https://doi.org/10.1002/smj.722>
- Gibson, E., & Rader, N. (1979). Attention: The Perceiver as Performer. In G. A. Hale & M. Lewis (Eds.), *Attention and Cognitive Development* (pp. 1–21). Springer US.  
[https://doi.org/10.1007/978-1-4613-2985-5\\_1](https://doi.org/10.1007/978-1-4613-2985-5_1)
- Gibson, J. J. (1986). *The Ecological Approach To Visual Perception* (New edition). Psychology Press.
- Glaser, B. G., & Strauss, A. L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New Brunswick: Transaction Publishers.
- Glass, D. C., & Singer, D. G. (1972). *Urban stress: experiments on noise and social stressors*. Retrieved from <http://infoscience.epfl.ch/record/46168>
- Grahn, P., Maartensson, F., Lindblad, B., Nilsson, P., & Ekman, A. (1997). Outdoors at day nurseries. Layout of playgrounds and its effect on play, motor function and power of concentration. *Stad and Land, no.* Retrieved from <http://agris.fao.org/agris-search/search/display.do?f=1997/SE/SE97003.xml;SE9711270>
- Grahn, P. ;Maartensson. (1997). Outdoors at day nurseries. Layout of playgrounds and its effect on play, motor function and power of concentration. *Stad and Land, no.* Retrieved from <http://agris.fao.org/agris-search/search/display.do?f=1997/SE/SE97003.xml;SE9711270>

- Grinde, B., & Patil, G. G. (2009). Biophilia: does visual contact with nature impact on health and well-being? *International Journal of Environmental Research and Public Health*, 6(9), 2332–2343.
- GTCS. (2012). The Standards for Registration: mandatory requirements for Registration with the General Teaching Council for Scotland. General Teaching Council for Scotland.
- Guldberg, H. (2007). Are Children being held Hostage by Parental Fears? Retrieved 10 October 2010, from <http://www.spiked-online.com/index.php?/site/article/3465/>
- Gump, P. V. (1967). The classroom behavior setting: Its nature and relation to student behavior. U.S. Office of Education Cooperative Research Branch, Project NO. 5-0334. Final report. Mimeo.
- Gump, P. V. (1978). School Environments. In I. Altman & J. F. Wohlwill (Eds.), *Children and the Environment* (pp. 131–174). Springer US. Retrieved from [http://link.springer.com/chapter/10.1007/978-1-4684-3405-7\\_5](http://link.springer.com/chapter/10.1007/978-1-4684-3405-7_5)
- Gutman, L. M., & Vorhaus, J. (2012). The impact of pupil behaviour and wellbeing on educational outcomes. Retrieved from <http://dera.ioe.ac.uk/16093/1/DFE-RR253.pdf>
- Hacking, I. (1983). *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science*. Cambridge Cambridgeshire ; New York: Cambridge University Press.
- Halperin, J. M., & Healey, D. M. (2011). The Influences of Environmental Enrichment, Cognitive Enhancement, and Physical Exercise on Brain Development: Can we Alter the Developmental Trajectory of ADHD? *Neuroscience and Biobehavioral Reviews*, 35(3), 621–634. <https://doi.org/10.1016/j.neubiorev.2010.07.006>
- Harry Potter Wiki. (2015). Room of Requirement. Retrieved 1 December 2015, from [http://harrypotter.wikia.com/wiki/Room\\_of\\_Requirement](http://harrypotter.wikia.com/wiki/Room_of_Requirement)

- Hart, R. A. (1979). *Children's Experience of Place: A Developmental Study*. John Wiley & Sons Inc.
- Hartig, T., Korpela, K., Evans, G. W., & Gärling, T. (1997). A measure of restorative quality in environments. *Scandinavian Housing and Planning Research, 14*(4), 175–194. <https://doi.org/10.1080/02815739708730435>
- Hartig, T., Mang, M., & Evans, G. W. (1991). Restorative Effects of Natural Environment Experiences. *Environment and Behavior, 23*(1), 3–26. <https://doi.org/10.1177/0013916591231001>
- Hattie, J., Marsh, H. W., Neill, J. T., & Richards, G. E. (1997). Adventure Education and Outward Bound: Out-of-Class Experiences That Make a Lasting Difference. *Review of Educational Research, 67*(1), 43–87. <https://doi.org/10.3102/00346543067001043>
- Haywood, H. C., Brooks, P., & Burns, S. (1992). *Bright Start: Cognitive curriculum for young children*. Charlesbridge Pub. Retrieved from <http://psycho.formation.univ-lille3.fr/master/psychoenfance/PDFCONF/conf25octobre2000.pdf>
- Hedderwick, M. (2010). *Katie Morag And The Tiresome Ted*. London: Red Fox Picture Books.
- Heft, H. (1988). Affordances of Children's Environments: a functional approach to environmental description. *Children's Environments Quarterly*.
- Heft, H. (1988). Affordances of children's environments: a functional approach to environmental description. *Children's Environments Quarterly, 5*(3), 29–37.
- Herald Scotland. (2014). UK statisticians: Scotland is the most highly-educated country in Europe. Retrieved 21 December 2015, from [http://www.heraldscotland.com/news/13163915.UK\\_statisticians\\_\\_Scotland\\_is\\_the\\_most\\_highly\\_educated\\_country\\_in\\_Europe/](http://www.heraldscotland.com/news/13163915.UK_statisticians__Scotland_is_the_most_highly_educated_country_in_Europe/)

- Hicks, M. R. (2013). Why the Increase in ADHD? Retrieved 19 November 2015, from <http://www.psychologytoday.com/blog/digital-pandemic/201308/why-the-increase-in-adhd>
- Higgins, P. (2002). Outdoor education in Scotland. *Journal of Adventure Education & Outdoor Learning*, 2(2), 149–168. <https://doi.org/10.1080/14729670285200261>
- Higgins, P., & Nicol, R. (2013). Outdoor Education. In T. G. K. Bryce, W. M. Humes, D. Gillies, A. Kennedy, D. Gillies, & A. Kennedy (Eds.), *Scottish Education: Referendum* (4th Revised edition, Vol. 68, pp. 620–627). Edinburgh University Press.
- Higgins, P., Nicol, R., Beames, S., Christie, B., & Scrutton, R. (2013). Education and Culture Committee Outdoor Learning Submission from Professor Peter Higgins. Moray House School of Education, University of Edinburgh. Retrieved from [http://www.scotlandsfuturesforum.mobi/S4\\_EducationandCultureCommittee/Inquiries/Prof\\_Higgins\\_submission.pdf](http://www.scotlandsfuturesforum.mobi/S4_EducationandCultureCommittee/Inquiries/Prof_Higgins_submission.pdf)
- HMIE. (2011). Principles of inspection and review. HMIE. Retrieved from <http://www.hmie.gov.uk/NR/ronlyres/0980BB93-8806-40D9-806C-AA35532BA931/0/PrinciplesofInspectionandReview2010FINAL.pdf><http://www.hmie.gov.uk/NR/ronlyres/0980BB93-8806-40D9-806C-AA35532BA931/0/PrinciplesofInspectionandReview2010FINAL.pdf>
- Hockey, R. (Ed.). (1983). *Stress and Fatigue in Human Performance*. Wiley-Blackwell.
- Hookway, C. (2015). Pragmatism. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Spring 2015). Retrieved from <http://plato.stanford.edu/archives/spr2015/entries/pragmatism/>
- Horst, A. (2015). Parametric v. Non-Parametric Data. Retrieved from <http://statsthewayilikeit.com/about/parametric-v-non-parametric-data/>



- Howie, E. K., & Pate, R. R. (2012). Physical activity and academic achievement in children: A historical perspective. *Journal of Sport and Health Science, 1*(3), 160–169. <https://doi.org/10.1016/j.jshs.2012.09.003>
- Hughes, D. C. (1973). An Experimental Investigation of the Effects of Pupil Responding and Teacher Reacting on Pupil Achievement. *American Educational Research Journal, 10*(1), 21–37. <https://doi.org/10.3102/00028312010001021>
- Hughes, F. P. (2009). *Children, Play, and Development* (Fourth Edition edition). Los Angeles: SAGE Publications, Inc.
- Instantly. (2012). What is TOM and Why is it Important? Retrieved from <https://blog.instant.ly/blog/2012/08/what-is-tom-and-why-is-it-important>
- Isen, A. M. (1990). The Influence of Positive and Negative Affect on Cognitive Organization: some implications for development. In N. L. Stein, B. Leventhal, & T. R. Trabasso (Eds.), *Psychological and Biological Approaches To Emotion*. Hillsdale, N.J: Psychology Press.
- Jackson, P. W. (1990). *Life in Classrooms*. Teachers College Press.
- Jacobs, J. E., & Klaczynski, P. A. (Eds.). (2012). *The Development of Judgment and Decision Making in Children and Adolescents* (Reprint edition). Hove: Psychology Press.
- James, A., Jenks, C., & Prout, A. (1998). *Theorizing Childhood*. Cambridge: Polity Press.
- James, W. (2012). *Psychology: The Briefer Course*. Dover Publications.
- Johansson, R. (2003). Case study methodology. , Stockholm. *In the International Conference on Methodologies in Housing Research. Stockholm*.
- Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: theory and research*. Interaction Book Company.

- Johnson, D. W., Johnson, R. T., & Smith, K. (2007). The State of Cooperative Learning in Postsecondary and Professional Settings. *Educational Psychology Review*, 19(1), 15–29. <https://doi.org/10.1007/s10648-006-9038-8>
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*, 1(2), 112–133. <https://doi.org/10.1177/1558689806298224>
- Kaarby, K. M. E. (2004). Children Playing in Nature, . (pp. 121–129). Presented at the Questions of Quality Proceedings of a Conference on Defining, Assessing and Supporting Quality in Early Childhood Care and Education, Dublin: Centre for Early Childhood Development & Education.
- Kahn Jr., P. H. (1997). Developmental Psychology and the Biophilia Hypothesis: Children’s Affiliation with Nature. *Developmental Review*, 17(1), 1–61. <https://doi.org/10.1006/drev.1996.0430>
- Kahn Jr., P. H., & Kellert, S. R. (Eds.). (2002). *Children and Nature: Psychological, Sociocultural and Evolutionary Investigations*. MIT Press.
- Kahn, P. H., & Friedman, B. (1995). Environmental Views and Values of Children in an Inner-City Black Community. *Child Development*, 66(5), 1403–1417. <https://doi.org/10.1111/j.1467-8624.1995.tb00942.x>
- Kail, R. V., Jr. (1979). *The Development of Memory in Children*. San Francisco: W.H.Freeman & Co Ltd.
- Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge University Press.
- Kellert, S. R., & Wilson, E. O. (1995). *The Biophilia Hypothesis*. Island Press.
- Khan, M. (2014). Outdoor as Learning Environment for Children at a Primary School of Bangladesh (pp. 112–119). Presented at the 45th Annual Conference of the Environmental Design Research Association, EDRA.

- Kim, S. (2013). Neuroscientific Model of Motivational Process. *Frontiers in Psychology, 4*. <https://doi.org/10.3389/fpsyg.2013.00098>
- Kirkby, M. (1989). Nature as refuge in children's environments. *Children's Environments Quarterly, 6*(1), 7–12.
- Klatte, M., Bergström, K., & Lachmann, T. (2013). Does noise affect learning? A short review on noise effects on cognitive performance in children. *Frontiers in Psychology, 4*. <https://doi.org/10.3389/fpsyg.2013.00578>
- Klem, A. M., & Connell, J. P. (2004). Relationships Matter: Linking Teacher Support to Student Engagement and Achievement. *Journal of School Health, 74*(7), 262–273.
- Kohlberg, L. (1984). The psychology of moral development: The nature and validity of moral stages. *Harpercollins College Div, 2*.
- Kolb, D. A. (1983). *Experiential Learning: Experience as the Source of Learning and Development* (1st ed.). Financial Times/ Prentice Hall.
- Korpela, K. (2002). Children's environment. In *Handbook of environmental psychology*, (pp. 363–373).
- Korpela, K., Kyttä, M., & Hartig, T. (2002). Restorative Experience, Self-Regulation, and Children's Place Preferences. *Journal of Environmental Psychology, 22*(4), 387–398. <https://doi.org/10.1006/jevp.2002.0277>
- Kounali, D., Robinson, T., Goldstein, H., & Lauder, H. (2008). The probity of free school meals as a proxy measure for disadvantage. Retrieved 18 May 2015, from <http://www.bath.ac.uk/research/harps/Resources/The%20probity%20of%20FSM%20revised%2014.7.08.pdf>

- Kvale, S., & Brinkmann, S. (2008). *InterViews: Learning the Craft of Qualitative Research Interviewing* (Second Edition edition). Los Angeles: SAGE Publications, Inc.
- Kyttä, M. (2003). *Children in outdoor contexts: affordances and independent mobility in the assessment of environmental child friendliness*. Espoo: Helsinki Univ. of Technology, Centre for Urban and Regional Studies.
- Kytta, N. (2006). Environmental child-friendliness in the light of the Bullerby Model. In *Children and Their Environments: Learning, Using and Designing Spaces* (pp. 141–158). Cambridge University Press.
- Ladd, G. W., & Price, J. M. (1987). Predicting Children's Social and School Adjustment Following the Transition from Preschool to Kindergarten. *Child Development, 58*(5), 1168–1189. <https://doi.org/10.2307/1130613>
- Lai, E. R. (2011). Metacognition: A literature review. *Always Learning: Pearson Research Report*. Retrieved from [http://images.pearsonassessments.com/images/tmrs/metacognition\\_literature\\_review\\_final.pdf](http://images.pearsonassessments.com/images/tmrs/metacognition_literature_review_final.pdf)
- Larson, C. O., Dansereau, D. F., Hythecker, V. I., O'Donnell, A., Young, M. D., Lambiotte, J. G., & Rocklin, T. R. (1986). Technical training: An application of a strategy for learning structural and functional information. *Contemporary Educational Psychology, 11*(3), 217–228. [https://doi.org/10.1016/0361-476X\(86\)90018-4](https://doi.org/10.1016/0361-476X(86)90018-4)
- Laumann, K., Garling, T., & Stormak, K. M. (2001). Rating Scale Measures of Restorative Components of Environment. *Journal of Environmental Psychology, 21*(1), 31–44. <https://doi.org/10.1006/jevp.2000.0179>
- Learning and Teaching Scotland. (2010). Curriculum for Excellence Through Outdoor Learning. Learning and Teaching Scotland. Retrieved from

[http://www.educationscotland.gov.uk/images/cfeoutdoorlearningfinal\\_tcm4-596061.pdf](http://www.educationscotland.gov.uk/images/cfeoutdoorlearningfinal_tcm4-596061.pdf)

Lewin, K. (1946). Behavior and development as a function of the total situation. In *Manual of child psychology* (pp. 791–844). Hoboken, NJ, US: John Wiley & Sons Inc.

Lewis, M., Sullivan, M. W., & Michaelson, L. (1984). The cognitive-emotional fugue. In C. E. Izard, J. Kagan, & R. B. Zajonc (Eds.), *Emotions, cognition, and behavior* (pp. 264–288).

Lieberman, G. A., & Hoody, L. L. (1998). *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning. Results of a Nationwide Study*. State Education and Environment Roundtable, 16486 Bernardo Center Drive, Suite 328, San Diego, CA 92128; Tel: 619-676-0272; Web site: <http://www.seer.org>. Retrieved from <http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?acno=ED428943>

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry* (1st ed.). Beverly Hills, Calif: SAGE Publications, Inc.

Lloyd, A., & Gray, T. (2010). Place-based outdoor learning and environmental sustainability within Australian Primary School. *Education*, 2010.

Lombard, M., Snyder-Duch, J., & Campanella Bracken, C. (2010). Intercoder Reliability. Matthew Lombard. Retrieved from <http://matthewlombard.com/reliability/#Which%20measure%28s%29%20of%20intercoder%20reliability%20should%20researchers%20use>

Louv, R. (2010). *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder*. Atlantic Books.

- Lovell, R. (2009). An evaluation of physical activity at Forest School. PhD Thesis. Edinburgh University.
- Luria, A. (1990). *Cognitive Development: It's Cultural and Social Foundations* (New Ed). Harvard University Press.
- Malone, K., & Tranter, P. J. (2003). School Grounds as Sites for Learning: Making the most of environmental opportunities. *Environmental Education Research*, 9(3), 283–303. <https://doi.org/10.1080/13504620303459>
- Mannion, G., Mattu, L., & Wilson, M. (2015). Teaching, learning, and play in the outdoors: a survey of school and pre-school provision in Scotland. Scottish Natural Heritage. Retrieved from <https://dspace.stir.ac.uk/handle/1893/21623>
- Margetts, K. (1999). Transition to school: Looking forward. *In AECA National Conference*, 14–17.
- Massey, S. (2002). The Benefits of a Forest School Experience for Children in their Early Years, unpublished evaluation (unpublished evaluation), in Davis, B., & Waite, S. (2005). Forest Schools: an evaluation of the opportunities and challenges in early years. Final Report. University of Plymouth. p.16.
- Mastin, L. (2015a). Episodic and Semantic Memory. Retrieved from [http://www.human-memory.net/types\\_episodic.html](http://www.human-memory.net/types_episodic.html)
- Mastin, L. (2015b). Memory Recall and Retrieval. Retrieved from [http://www.human-memory.net/processes\\_recall.html](http://www.human-memory.net/processes_recall.html)
- Mastin, L. (2015c). What is Memory? Retrieved from [http://www.human-memory.net/intro\\_what.html](http://www.human-memory.net/intro_what.html)
- Maturana, H., R., & Varela, F., J. (1992). *The Tree of Knowledge: The Biological Roots of Human Understanding* (3rd Revised edition). Shambhala Publications Inc.

- Mayall, B. (2008). Conversations with Children. Working with Generational Issues. In Christensen, P., & James, A. ed. In *Research with children: Perspectives and practices* (Vol. Ch.5, p. p.109-124). Routledge. New York and London.
- Maynard, T. (2003). Forest School Swansea Neath Port Talbot: An Evaluation, University of Wales Swansea (unpublished report) in Davis, B., & Waite, S. (2005). Forest Schools: an evaluation of the opportunities and challenges in early years. Final Report. University of Plymouth. p.16.
- Mcgilchrist, I. (2012). *The Master and His Emissary: The Divided Brain and the Making of the Western World* (2nd edition). New Haven, Conn.; London: Yale University Press.
- McLeod, S. (2010). Preoperational Stage - Egocentrism | Simply Psychology. Retrieved 19 June 2015, from <http://www.simplypsychology.org/preoperational.html>
- McLeod, S. (2015). Jean Piaget. Retrieved 19 June 2015, from [www.simplypsychology.org/piaget.html](http://www.simplypsychology.org/piaget.html)
- McLeod, S. A. (2007). Experimental Design. Simply Psychology. Retrieved from <http://www.simplypsychology.org/experimental-designs.html>
- McLeod, S. A. (2012). Experimental Method. Simply Psychology. Retrieved from <http://www.simplypsychology.org/experimental-method.html>
- Meadows, D. H. (2012). *Limits to Growth: The 30-Year Update* (3 edition). Chelsea Green Publishing.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook* (Second Edition edition). Thousand Oaks: SAGE Publications, Inc.
- Miller, R. A. (1984). Children's use of the outdoor environment. Master's Thesis. Department of Landscape Architecture, University of Washington.
- Moore, R. C. (1986). *Childhood's Domain: Play and Place in Child Development*. Croom Helm.

- Moore, R. C. (1989). Plants as play props. *Children's Environments Quarterly*, 6(2), 3–6.
- Moore, R. C. (1990). *Childhood's Domain: Play and Place in Child Development*. Mig Communications.
- Morecroft, J. (2010). Systems Dynamics. In Reynolds, M., & Holwell, S. ed. In *Systems Approaches to Managing Change: A Practical Guide*. (Vol. Ch.2, p. p.25-85). Springer. London.
- Mygind, E. (2005). *Udeundervisning i folkeskolen: Et casestudie om en naturklasse på Rødkilde Skole og virkningerne af en ugentlig obligatorisk naturdag på yngste klassetrin i perioden 2000-2003*. Museum Tusulanum Press.
- Mygind, E. (2007). A comparison between children's physical activity levels at school and learning in an outdoor environment. *Journal of Adventure Education and Outdoor Learning*, 7(2), 161–176. <https://doi.org/10.1080/14729670701717580>
- Mygind, E. (2009). A comparison of childrens' statements about social relations and teaching in the classroom and in the outdoor environment. *Journal of Adventure Education and Outdoor Learning*, 9(2), 151–169.  
<https://doi.org/10.1080/14729670902860809>
- Nakamura, J., & Csikszentmihalyi, M. (2009). Flow Theory and Research. In *Oxford handbook of positive psychology*, (p. ch 18, pp195).
- NEETF. (2000). Environment-Based Education: Creating High Performance Schools and Students. *National Environmental Education Training Foundation*. Washington DC. Retrieved from <http://eric.ed.gov/?id=ED451033>
- Nicholson, S. (1971). How NOT to cheat children. The theory of loose parts. 62, 30±34. *Landscape Architecture*, (62), 30–34.



- Nicolopoulou, A. (1993). Play, Cognitive Development, and the Social World: Piaget, Vygotsky, and Beyond. *Human Development*, 36(1), 1–23.  
<https://doi.org/10.1159/000277285>
- Nielsen, G., Mygind, E., Bølling, M., Otte, C. R., Schneller, M. B., Schipperijn, J., Ejbye-Erns, Niels., Bentsen, P. (2016). A quasi-experimental cross-disciplinary evaluation of the impacts of education outside the classroom on pupils' physical activity, well-being and learning: the TEACHOUT study protocol. *BMC Public Health*, 16, 1117. <https://doi.org/10.1186/s12889-016-3780-8>
- O' Kane, C. (2008). The Development of Participatory Techniques. Facilitating Children's Views about Decisions Which Affect Them. In Christensen, P., & James, A. ed. In *Research with Children: Perspectives and Practice* (2nd ed., Vol. Ch. 6, pp. 125–155). Routledge. New York and London.
- O'Brien, L. (2009). Learning outdoors: the Forest School approach. *Education 3-13*, 37(1), 45–60. <https://doi.org/10.1080/03004270802291798>
- Olshausen, B. A., & J, D. (2000). Vision and the coding of natural images. *AMERICAN SCIENTIST*, 88, 238245.
- Oxford English Dictionary. (2015). play - definition of play in English from the Oxford dictionary. Retrieved 27 December 2015, from <http://www.oxforddictionaries.com/definition/english/play>
- Palmer, S. (2016). Why the iPad is a far bigger threat to our children than anyone realises. Retrieved 6 February 2016, from <http://www.dailymail.co.uk/femail/article-3420064/Why-iPad-far-bigger-threat-children-realises-Ten-years-ago-psychologist-SUE-PALMER-predicted-toxic-effects-social-media-sees-worrying-new-danger.html>

- Parten, M. B. (1932). Social participation among pre-school children. *The Journal of Abnormal and Social Psychology*, 27(3), 243–269.  
<https://doi.org/10.1037/h0074524>
- Perkins, H. V. (1965). Classroom Behavior and Underachievement. *American Educational Research Journal*, 2(1), 1–12. <https://doi.org/10.2307/1162063>
- Perner, J., Kloo, D., & Gornik, E. (2007). Episodic memory development: theory of mind is part of re-experiencing experienced events. *Infant and Child Development*, 16(5), 471–490. <https://doi.org/10.1002/icd.517>
- Pessoa, L. (2009). Cognition and emotion. *Scholarpedia*, 4(1), 4567.  
<https://doi.org/10.4249/scholarpedia.4567>
- Peters, S. (2000). Multiple Perspectives on Continuity in Early Learning and the Transition to School. Retrieved from <http://eric.ed.gov/?id=ED447916>
- Pettigrew, A. M. (1990). Longitudinal Field Research on Change: Theory and Practice. *Organization Science*, 1(3), 267–292. <https://doi.org/10.1287/orsc.1.3.267>
- Piaget, J. (1951). *The child's conception of the world: By Jean Piaget ; translated by Joan and Andrew Tomlinson*. Distributed by National Book Network.
- Piaget, J. (1962). *Play, Dreams, and Imitation in Childhood*. W. W. Norton & Co.
- Piaget, J., & Cook, M. (1998). *The origins of intelligence in children*. Madison, Conn.: International Universities Press.
- Piaget, J., & Inhelder, B. (2015). *Memory and Intelligence*. Psychology Press.
- Pitts, S. C., Prost, J. H., & Winters. (2005). Quasi-Experimental Designs in Developmental Research: Design and Analysis Considerations. In *Handbook of Research Methods in Developmental Science* (Vol. 5, pp. 81–101). John Wiley & Sons.
- Playday. (2010). Playday Opinion Poll Summary. Playday. Retrieved from <http://www.playday.org.uk/pdf/Playday-2010-opinion-poll-findings.pdf>

- Poole, D. A., & Lindsay, D. S. (1995). Interviewing preschoolers: Effects of nonsuggestive techniques, parental coaching, and leading questions on reports of nonexperienced events. *Journal of Experimental Child Psychology*, 60(1), 129–154.
- Posner, M. I. (2008). The Neuropsychology of Attention. In P. Mariën & J. Abutalebi (Eds.), *Neuropsychological Research: A Review* (1 edition, Vol. 18, pp. 331–348). Hove England ; New York: Psychology Press.
- Preyer, W. T. (2001). *The Mind of the Child: Part 1. The Senses and the Will*. New York: Adamant Media Corporation.
- Punch, S. (2002). Research with Children The Same or Different from Research with Adults? *Childhood*, 9(3), 321–341.  
<https://doi.org/10.1177/0907568202009003005>
- Radziki, M. J., & Taylor, R. A. (2008). Origin of system dynamics: Jay W. Forrester and the history of system dynamics. *US Department of Energy's Introduction to System Dynamics*.
- Raine, L. B., Lee, H. K., Saliba, B. J., Chaddock-Heyman, L., Hillman, C. H., & Kramer, A. F. (2013). The Influence of Childhood Aerobic Fitness on Learning and Memory. *PLoS ONE*, 8(9), e72666.  
<https://doi.org/10.1371/journal.pone.0072666>
- Rawsthorne, L. J., & Elliot, A. J. (1999). Achievement Goals and Intrinsic Motivation: A Meta-Analytic Review. *Personality and Social Psychology Review*, 3(4), 326–344. [https://doi.org/10.1207/s15327957pspr0304\\_3](https://doi.org/10.1207/s15327957pspr0304_3)
- Reed, E. S. (1996). *Encountering the world: toward an ecological psychology*. Oxford University Press.
- Reichertz, J. (2004). Abduction, deduction and induction in qualitative research. In *A Companion to Qualitative Research* (Vol. 4.3, pp. 299–310). SAGE.

- Reynolds, M., & Holwell, S. (Eds.). (2010). *Systems Approaches to Managing Change: A Practical Guide* (2010 edition). London ; New York: Springer.
- Rickinson, M., Dillon, J., Teamey, K., Morris, M., Choi, M. Y., Sanders, D., & Benefield, P. (2004). A review on outdoor learning. Field Studies Council, Shrewsbury, UK.
- Robson, C. (2011). *Real World Research 3e* (3rd Edition edition). Chichester: John Wiley & Sons.
- Roe, J. (2008). The restorative power of natural and built environments. PhD Thesis. Heriot-Watt University. Retrieved from [http://www.ros.hw.ac.uk/bitstream/10399/2250/1/RoeJ\\_0908\\_sbe.pdf](http://www.ros.hw.ac.uk/bitstream/10399/2250/1/RoeJ_0908_sbe.pdf)
- Roe, J., & Aspinall, P. A. (2011). The emotional affordances of forest settings: an investigation in boys with extreme behavioural problems. *Landscape Research*, 36(5), 535–552.
- Roe, J. J., Aspinall, P. A., Mavros, P., & Coyne, R. (2013). Engaging the brain: the impact of natural versus urban scenes using novel EEG methods in an experimental setting. *Environmental Sciences*, (1), 93–104. <https://doi.org/10.12988/es.2013.3109>
- Roebbers, C. M., Moga, N., & Schneider, W. (2001). The Role of Accuracy Motivation on Children's and Adults' Event Recall. *Journal of Experimental Child Psychology*, 78(4), 313–329. <https://doi.org/10.1006/jecp.2000.2577>
- Roebbers, C. M., & Schneider, W. (2002). Stability and consistency of children's event recall. *Cognitive Development*, 17(1), 1085–1103. [https://doi.org/10.1016/S0885-2014\(02\)00075-8](https://doi.org/10.1016/S0885-2014(02)00075-8)
- Ross, H., Higgins, P., & Nicol, R. (2007). Outdoor Study of Nature: teachers' motivations and contexts. *Scottish Educational Review*, 39(2), 160.

- Roy, D. E. (2013). Cognitive Factors, *Encyclopedia of Behavioral Medicine*, 447–448.  
[https://doi.org/10.1007/978-1-4419-1005-9\\_1116](https://doi.org/10.1007/978-1-4419-1005-9_1116)
- Ryan, G. W., & Bernard, H. W. (2003). Techniques to Identify Themes. *Field Methods*, 15(1), 85–109. <https://doi.org/10.1177/1525822X02239569>
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, 25(1), 54–67. <https://doi.org/10.1006/ceps.1999.1020>
- Ryan, R. M., & Grolnick, W. S. (1986). Origins and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psychology*, 50(3), 550–558.  
<https://doi.org/10.1037/0022-3514.50.3.550>
- Salatas, H., & Flavell, J. H. (1976). Retrieval of Recently Learned Information: Development of Strategies and Control Skills. *Child Development*, 47(4), 941–948. <https://doi.org/10.2307/1128429>
- Saldana, J. (2012). *The Coding Manual for Qualitative Researchers* (Second Edition edition). Los Angeles: SAGE Publications Ltd.
- Sanders, W. L., Wright, S. P., & Horn, S. P. (1997). Teacher and Classroom Context Effects on Student Achievement: Implications for Teacher Evaluation. *Journal of Personnel Evaluation in Education*, 11(1), 57–67.  
<https://doi.org/10.1023/A:1007999204543>
- Santostefano, S. (1986). Cognitive controls, metaphors, and contexts: an approach to cognition and emotion. In D. J. Bearison & H. Zimiles (Eds.), *Thought and Emotion: Developmental Perspectives* (pp. 175–210). Hillsdale, N.J: Psychology Press.

- Schneider, W. (2008). The Development of Metacognitive Knowledge in Children and Adolescents: Major Trends and Implications for Education. *Mind, Brain, and Education*, 2(3), 114–121. <https://doi.org/10.1111/j.1751-228X.2008.00041.x>
- Schutte, A. R., Torquati, J. C., & Beattie, H. L. (2015). Impact of Urban Nature on Executive Functioning in Early and Middle Childhood. *Environment and Behavior*, 0013916515603095. <https://doi.org/10.1177/0013916515603095>
- Scott, J. (2008). Children as Respondents. The Challenge for Quantitative Methods. In Christensen, P., & James, A. ed. In *Research with Children: Perspectives and Practice* (Vol. Ch.4, p. p.87-108). Routledge. New York and London.
- Scottish Executive. (2004). A Curriculum for Excellence: Progress and Proposals. Scottish Executive. Retrieved from <http://www.scotland.gov.uk/Resource/Doc/98764/0023924.pdf>
- Scottish Executive. (2006). A Curriculum for Excellence. Scottish Executive.
- Scottish Government. (2008). *The early years framework*. Edinburgh: Scottish Government.
- Scottish Government. (2009). Reduce number of working age people with severe literacy and numeracy problems [Info Page]. Retrieved 21 December 2015, from <http://www.gov.scot/About/Performance/scotPerforms/indicators/literacyAndNumeracy>
- Scottish Government. (2010). Curriculum for Excellence: Pre-school into primary transitions. Retrieved 20 May 2015, from [http://www.educationscotland.gov.uk/Images/EYTransitions\\_tcm4-630848.pdf](http://www.educationscotland.gov.uk/Images/EYTransitions_tcm4-630848.pdf)
- Scottish Government. (2011a, December 9). Improve levels of educational attainment [Info Page]. Retrieved 12 January 2016, from <http://www.gov.scot/About/Performance/scotPerforms/indicator/attainment>

- Scottish Government. (2011b, December 9). National Indicators [Info Page]. Retrieved 12 January 2016, from <http://www.gov.scot/About/Performance/scotPerforms/indicator>
- Scottish Government. (2012). Learning for sustainability report. Scottish Government. Retrieved from <http://www.gov.scot/Topics/Education/Schools/curriculum/ACE/OnePlanetSchools/LearningforSustainabilityreport>
- Scottish Government. (2013a). Scottish Government response to Learning for Sustainability Report. Scottish Government.
- Scottish Government, S. A. H. (2013b, December 20). Free School Meals. Retrieved 18 May 2015, from <http://www.gov.scot/Topics/Education/Schools/HLivi/schoolmeals/FreeSchoolMeals>
- Scottish Government, S. A. H. (2014a, April 30). Scottish Survey of Literacy and Numeracy 2013 (Numeracy) [Statistics Publication]. Retrieved 20 December 2015, from <http://www.gov.scot/Publications/2014/04/5692/0>
- Scottish Government, S. A. H. (2014b, June 17). Summary statistics for attainment, leaver destinations and healthy living, No.4: 2014 Edition [Statistics Publication]. Retrieved 18 May 2015, from <http://www.gov.scot/Publications/2014/06/9242/6>
- Scottish Government, S. A. H. (2015). Scottish Survey of Literacy and Numeracy 2014 (Literacy) [Statistics Publication]. Retrieved 20 December 2015, from <http://www.gov.scot/Publications/2015/04/7639>
- Seeman, A. (Ed.). (2012). *Joint Attention: New Developments in Psychology, Philosophy of Mind, and Social Neuroscience*. The MIT Press.

- Shuttleworth, M. (2006). Field Experiments. Explorable. Retrieved from <https://explorable.com/field-experiments>
- Simone, M. F. (2003). *Back to the Basics: Student Achievement and Schoolyard Naturalization. Masters Thesis*. Trent University, Peterborough, Ontario.
- Skarpness, L. R., & Carson, D. K. (1987). Correlates of kindergarten adjustment: Temperament and communicative competence. *Early Childhood Research Quarterly*, 2(4), 367–376. [https://doi.org/10.1016/0885-2006\(87\)90022-6](https://doi.org/10.1016/0885-2006(87)90022-6)
- Smith, E. E., & Kosslyn, S. M. (2013). *Cognitive Psychology: Mind and Brain* (1 edition). Pearson.
- Sobel, D. (1993). *Children's special places: exploring the role of forts, dens, and bush houses in middle childhood*. Wayne State University Press.
- Sobel, D. (2013). *Beyond Ecophobia: Reclaiming the Heart in Nature Education* (2 edition). Great Barrington, MA: Orion Society.
- Squire, L. R. (2004). Memory systems of the brain: A brief history and current perspective. *Neurobiology of Learning and Memory*, 82(3), 171–177. <https://doi.org/10.1016/j.nlm.2004.06.005>
- State Education and Environment Roundtable. (2000). The Effects of Environment-based Education on Student Achievement. Phase 1. SEER.
- State Education and Environment Roundtable. (2005). The Effects of Environment-based Education on Student Achievement. Phase 2. SEER.
- Stein, N. L., Leventhal, B., & Trabasso, T. R. (Eds.). (1990). *Psychological and Biological Approaches To Emotion*. Hillsdale, N.J: Psychology Press.
- Stolpe, K., & Björklund, L. (2013). Students' long-term memories from an ecology field excursion: Retelling a narrative as an interplay between implicit and explicit memories. *Scandinavian Journal of Educational Research*, 57(3), 277–291. <https://doi.org/10.1080/00313831.2012.656278>



- Sustainable Development Commission. (2008). Health, place and nature: how outdoor environments influence health and well-being: a knowledge base. *Sustainable Development Commission*. Retrieved from <http://research-repository.st-andrews.ac.uk/handle/10023/2180>
- Swanson, H. L. (1994). Short-Term Memory and Working Memory Do Both Contribute to Our Understanding of Academic Achievement in Children and Adults with Learning Disabilities? *Journal of Learning Disabilities*, 27(1), 34–50. <https://doi.org/10.1177/002221949402700107>
- Szczepanski, A., Malmer, K., Nelson, N., & Dahlgren, L. O. (2007). Utomhuspedagogikens särart och möjligheter ur ett lärarperspektiv [‘the distinctive nature and potential of outdoor education from a teacher perspective’]. *En Interventionsstudie Bland Lärare I Grundskolan. In Press, Didaktisk Tidskrift*. Retrieved from [http://www.researchgate.net/profile/Anders\\_Szczepanski/publication/237516082\\_Utomhuspedagogikens\\_srart\\_och\\_mjligheter\\_ur\\_ett\\_lrarperspektiv\\_En\\_interventionsstudie\\_bland\\_lrare\\_i\\_grundskolan/links/0c96053b1bcc10d15000000.pdf](http://www.researchgate.net/profile/Anders_Szczepanski/publication/237516082_Utomhuspedagogikens_srart_och_mjligheter_ur_ett_lrarperspektiv_En_interventionsstudie_bland_lrare_i_grundskolan/links/0c96053b1bcc10d15000000.pdf)
- Takayama, N., Lee, K., Morikawa, T., Tsunetsugu, Y., Park, B. J., & Kagawa, T. (2014). Emotional, restorative and vitalizing effects of forest and urban environments at four sites in Japan. *International Journal of Environmental Research and Public Health*, 11(7), 7207–7230.
- Tashakkori, A., & Teddlie, C. (2010). *SAGE Handbook of Mixed Methods in Social & Behavioral Research*. SAGE.
- Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2001). Coping with ADD The surprising connection to green play settings. *Environment and Behavior*, 33(1), 54–77.

- Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2002). View of Nature and Self-Discipline: evidence from inner city children. *Journal of Environmental Psychology, 22*(1–2), 49–63. <https://doi.org/10.1006/jevp.2001.0241>
- Taylor, A. F., Wiley, A., Kuo, F. E., & Sullivan, W. C. (1998). Growing Up in the Inner City Green Spaces as Places to Grow. *Environment and Behavior, 30*(1), 3–27. <https://doi.org/10.1177/0013916598301001>
- Thelen, E. (1996). *A Dynamic Systems Approach to the Development of Cognition and Action* (New edition). MIT Press.
- Thornton, S. (1995). *Children Solving Problems (Developing Child)*. Harvard University Press.
- Tomasello, M. (1995). Joint attention as social cognition. In C. Moore, P. J. Dunham, & P. Dunham (Eds.), *Joint Attention: Its Origins and Role in Development: Its Origin and Role in Development* (Vol. Ch 6, pp. 103–130). Psychology Press.
- Tripp, D. H. (1985). Case Study Generalisation: an agenda for action. *British Educational Research Journal, 11*(1), 33–43. <https://doi.org/10.1080/0141192850110104>
- Trochim, W. M. K. (2006a). Quasi-Experimental Design. Research Methods Knowledge Base. Retrieved from <http://www.socialresearchmethods.net/kb/quasiexp.php>
- Trochim, W. M. K. (2006b). Time in research. Research Methods Knowledge Base. Web Center for Social Research Methods. Retrieved from <http://www.socialresearchmethods.net/kb/timedim.php>
- Tuan, Y. (1978). Children and the Natural Environment. In I. Altman & J. F. Wohlwill (Eds.), *Children and the Environment* (pp. 5–32). Springer US. Retrieved from [http://link.springer.com/chapter/10.1007/978-1-4684-3405-7\\_2](http://link.springer.com/chapter/10.1007/978-1-4684-3405-7_2)

- Ulrich, R. L. (1993). Biophilia, biophobia, and natural landscapes. In E. O. Wilson & S. R. Kellert (Eds.), *The Biophilia Hypothesis* (pp. 73–137). Island Press.
- Ulrich, R. S. (1979). Visual landscapes and psychological well-being. *Landscape Research*, 4(1), 17–23.
- Uren, N., & Stagnitti, K. (2009). Pretend play, social competence and involvement in children aged 5–7 years: The concurrent validity of the Child-Initiated Pretend Play Assessment. *Australian Occupational Therapy Journal*, 56(1), 33–40.  
<https://doi.org/10.1111/j.1440-1630.2008.00761.x>
- Uttal, D. H., & Perlmutter, M. (1989). Toward a broader conceptualization of development: The role of gains and losses across the life span. *Developmental Review*, 9(2), 101–132. [https://doi.org/10.1016/0273-2297\(89\)90025-7](https://doi.org/10.1016/0273-2297(89)90025-7)
- Veenman, M. V. J., Kok, R., & Blöte, A. W. (2005). The relation between intellectual and metacognitive skills in early adolescence. *Instructional Science*, 33(3), 193–211. <https://doi.org/10.1007/s11251-004-2274-8>
- Veenman, M. V. J., Van Hout-Wolters, B. H. A. M., & Afflerbach, P. (2006). Metacognition and learning: conceptual and methodological considerations. *Metacognition and Learning*, 1(1), 3–14. <https://doi.org/10.1007/s11409-006-6893-0>
- Vygotsky, L. (1978a). *Mind in Society: Development of Higher Psychological Processes* (New edition). Harvard University Press.
- Vygotsky, L. (1978b). *Mind in Society: Development of Higher Psychological Processes* (New edition). Harvard University Press.
- Vygotsky, L. (2011). *Play And its Role in The Mental Development of The Child*. (www.all-about-psychology.com, Ed., C. Mulholland, Trans.). www.all-about-psychology.com.

- Vygotsky, L. S. (1967). Play and Its Role in the Mental Development of the Child. *Soviet Psychology*, 5(3), 6–18. <https://doi.org/10.2753/RPO1061-040505036>
- Vygotsky, L. S. (1986). *Thought and Language* (2nd Revised edition). MIT Press.
- Waddell, M. (1995). *Farmer Duck* (New edition edition). London: Walker Books Ltd.
- Waite, S. (2007). ‘Memories are made of this’: some reflections on outdoor learning and recall. *Education 3-13*, 35(4), 333–347. <https://doi.org/10.1080/03004270701602459>
- Waite, S., & Davis, B. (2007). The contribution of free play and structured activities in Forest School to learning beyond cognition: an English case. In *Learning beyond Cognition, Copenhagen: the Danish University of Education* (pp. 257–274). Copenhagen: the Danish University of Education.
- Waite, S., Evans, J., & Rogers, S. (2013). Educational Opportunities from Outdoor Learning as Children begin the Primary Curriculum: Briefing Report. ESRC.
- Ward Thompson, C. (2004). *Open space and social inclusion: local woodland use in central Scotland*. Edinburgh: Forestry Commission.
- Warren, S., & Vincent, C. (2001). ‘This won’t take long...’: Interviewing, ethics and diversity. *International Journal of Qualitative Studies in Education*, 14(1), 39–53. <https://doi.org/10.1080/09518390010007674>
- Watson, P. (2011). Free school meals measure - is it the best way to assess deprivation? Retrieved from <https://montrose42.wordpress.com/2011/03/17/free-school-meals-measure-is-it-the-best-measure-for-deprivation/>
- Webb, E. J., Campbell, D. T., & Swartz, R. D. (1999). *Unobtrusive Measures* (Revised Edition edition). Thousand Oaks, Calif: Sage Publications.
- Webb, M. (2008). ‘A definitive critique of experiential learning theory.’ Unpublished doctoral thesis. Department of Organizational Behavior, Weatherhead School of Management, Case Western Reserve University.

- Wells, G. (2009). *The Meaning Makers: Learning to Talk and Talking to Learn* (2nd ed.). Multilingual Matters.
- Wells, N. M. (2000). At Home with Nature Effects of 'Greenness' on Children's Cognitive Functioning. *Environment and Behavior*, 32(6), 775–795.  
<https://doi.org/10.1177/00139160021972793>
- Wells, N. M. (2014). The Role of Nature in Children's Resilience: Cognitive and Social Processes. In *The Greening in the Red Zone* (pp. 95–109). Springer. Netherlands.
- Wells, N. M., & Donofrio, G. A. (2011). Urban planning, the natural environment and public health. In *Encyclopedia of Environmental Health* (Vol. Ch 5., pp. 565–575).
- Wells, N. M., & Evans, G. W. (2003). Nearby Nature. *Environment and Behavior*, 35(3), 311–330. <https://doi.org/10.1177/0013916503035003001>
- Wells, N. M., Evans, G. W., & Yang, Y. (2010). Environments and Health: Planning Decisions as Public-Health Decisions. *Journal of Architectural and Planning Research*, 27(2), 124–143.
- Wikibooks. (2014). Social Research Methods / Experiments. Retrieved from [http://en.wikibooks.org/wiki/Social\\_Research\\_Methods/Experiments](http://en.wikibooks.org/wiki/Social_Research_Methods/Experiments)
- Wilson, E. (1990). *Biophilia* (New edition). Harvard University Press.
- Wilson, E. O. (2007). Biophilia and the conservation ethic. In *Evolutionary perspectives on environmental problems* (pp. 249–257). Transaction Publishers.
- Woodland Trust. (2010). Space for People: Targeting action for woodland access. Retrieved from <http://www.woodlandtrust.org.uk/en/aboutus/publications/Documents/space-for-people-new.pdf>

- Wooley, H., Pattacini, L., & Somerset-Ward, A. (2009). Children and the natural environment: experiences, influences and interventions - Summary. Natural England Research Reports, Number 040. Natural England. Retrieved from <http://publications.naturalengland.org.uk/publication/37005>
- Wright, D., & Meadows, D. H. (2009). *Thinking in Systems: A Primer* (First edition). London u.a.: Earthscan: Routledge.
- Yeboah, D. A. (2002). Enhancing Transition from Early Childhood Phase to Primary Education: Evidence from the research literature. *Early Years*, 22(1), 51–68. <https://doi.org/10.1080/09575140120111517>
- Yilmaz-Tüzün, Ö., & Topçu, M. S. (2009). Elementary students' metacognition and epistemological beliefs considering science achievement, gender and socioeconomic status. *Elementary Education Online*, 8(3), 676–693.
- Yin, R. K. (2013). *Case Study Research: Design and Methods* (Fifth Edition edition). Los Angeles: SAGE Publications, Inc.
- Zamani, Z., & Moore, R. C. (2013). The Comparison of Cognitive Play Affordances Within Natural and Manufactured Preschool Settings. *Landscape Research*, 1. Retrieved from [http://works.bepress.com/zahra\\_zamani/9/](http://works.bepress.com/zahra_zamani/9/)