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Soft Systems Methodology in Education

Applying a Critical Realist Approach
to Research on Teacher Education

 Springer

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to Research on Teacher Education

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ISBN 978-3-030-99224-8 ISBN 978-3-030-99225-5 (eBook)
<https://doi.org/10.1007/978-3-030-99225-5>

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This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Acknowledgements and Dedications

Our thanks are due to those former colleagues and students who have discussed ideas about teacher education with us. As former teachers, and as academics and teacher educators, we are united by a commitment to finding strategies for improving the preparation of teachers entering this challenging and rewarding profession. This is vital in terms of improving the education of current and future generations studying in schools across the globe. We are indebted to the faculty, teachers and students (pre-service teachers) in Australia, Canada and England for their participation in the empirical research for this book. Jenny is also grateful to the UK Higher Education Academy for funding the research and Dr Sally Bentley and the University of Bedfordshire for granting sabbatical leave. Particular thanks are due to Professor Derrick Armstrong, Dr Tony Loughland and Dr Hoa Thi Mai Nguyen for arranging and hosting the visiting scholarship at the University of Sydney and Professor Shirley Van Nuland in Ontario for facilitating access to the Canadian gatekeepers.

We would like to thank colleagues at Springer Nature, particularly Malini Arumugam and Bernadette Ohmer, for their support and advice during the writing process. We are grateful to Dr Beatriz Acevedo of Anglia Ruskin University and Dr Andrea Raiker of the University of Bedfordshire for reading draft sections of the book and for providing insightful, critical feedback. Our sincere thanks go to our illustrator, who goes by the pseudonym Dannyboy, for his creative and comical portrayals of the metaphors along with the constructive discussion generated during the illustration process. His other outputs can be viewed at cardinky.com.

This book was written during difficult times. Across the globe we see floods, wildfires, the melting of icebergs and the thawing of permafrost. We cannot deny the ramifications of climate change. We cannot deny that our human choices and actions have impacted the planet adversely. Within our overpopulated, networked world, humans are increasingly vulnerable. Now, amid a global pandemic, we recognise this more than ever. While living systems are dynamic and tend towards a state of stability, our human activities and interventions disrupt the situation and generate unintended consequences. To address this problem demands a systemic view of an interconnected world. Nothing less than a paradigm shift is required. Systems thinking demands that we move from an analytical approach, where we break down

problems, towards a holistic approach that recognises complexity, connectedness, structure and relationships. Our book presents a small-scale research project applying a system's view. We hope that it will prompt you to read widely, beyond the references provided, and scrutinise this emerging worldview. To design a sustainable society, current and future generations of school children should be introduced to systems thinking to enable them to think creatively and holistically, integrating concepts from a broad curriculum.

We dedicate this book to the younger generation and especially to Emily, Lotte and Fred. Finally, love and thanks go to our partners Terry and Jacqui for their support and critical appraisal during the writing of this book.

Introduction

Inception of the Research

This book began as a Sir Ron Cooke international scholarship and research project sponsored by the UK Higher Education Academy (HEA) in 2013/14.¹ The research project was motivated by the context in which the researcher was working at the time. The aim was to compare the effects of the policy landscapes in each of three jurisdictions, on pre-service teacher education programmes. In many countries, government policy spells out the imperative for the education system to produce a workforce that allows the country to compete economically. This expectation requires a match between the skills of the workforce and the fluctuating demands of the economy. A common claim made in many government publications is that the most important factor impacting pupils' learning and performance is the quality of their teachers. Increasingly, the results in the Programme for International Student Assessment (PISA) international tests of 16 year olds form the basis for league tables of a large number of countries, generating dissatisfaction in many countries and the frequent emulation of the policies of the higher performing jurisdictions. As a result, in the UK, several Government White Papers have advocated policy borrowing from other countries. Our initial aim was to explore the concept of policy borrowing within initial teacher education. Linked to the concept of policy borrowing is the associated relationship between cause and effect. Educational contexts differ significantly between jurisdictions; social situations are complex and consist of many interacting factors resulting in different outcomes. We cannot assume that the adoption of a policy in a second jurisdiction will result in the same overall outcomes as in the originating jurisdiction. This points us to the fundamental premise of Systems Theory, that a system is an organised whole that has elements that when formed into a particular structure generate new outcomes, entitled emergent properties. Changing the content or the structure of a system frequently produces

¹In March 2018, the HEA merged with the Leadership Foundation and the Equality Challenge Unit to form Advance HE.

unintended consequences. Consequently, we decided to explore teacher education under different policy regimes utilising Soft Systems Methodology (SSM).

The Purpose of this Book

This book presents the derivation of a research strategy based on systems thinking and the adoption of the early stages of SSM, underpinned by a Critical Realist ontology. This research strategy is then applied to a comparative international project, the Practicum Study, examining the practicum element of initial teacher education from a variety of perspectives. Finally, we evaluate the research strategy and its application to the Practicum Study. Our main objective in writing this book is to present a new research strategy, to test the strategy and to demonstrate its application through the example of the Practicum Study. This book is uncommon. One rarely finds the full description of a research strategy presented in parallel with a research project that employs that strategy.

The stimulus for this work was the funded research project that focussed on comparative educational policy across different jurisdictions. The Practicum Study provides both the driver and the exemplar for the development of the ‘Womposo’ research strategy. Womposo is based on the principles of systems thinking, specifically the early stage of SSM, and we develop this research strategy in Chap. 4 and apply it to the research project that we entitle the Practicum Study in Chaps. 7, 8, 9, 10, and 11. The Practicum Study focuses on the perceptions of different stakeholders regarding the practicum, the period that pre-service teachers (PSTs) spend in schools during their teacher education course. The book is intended for readers who wish to adopt this new research strategy in qualitative studies in any of the social sciences.

Audience

This book is designed primarily for postgraduate students and researchers in education, and it is also suitable for researchers in other social science disciplines and in health, business studies, information systems and any discipline where one collects qualitative data from people. Although challenging, it may also be of interest to undergraduate students undertaking final year research projects. We explore the application of SSM as a qualitative research tool to generate theory and to shed light on how individuals and social groups adapt to problem situations. Grounded within the literature from philosophy and science, the authors consider the tenets of systems thinking. These tenets acknowledge that emergent features appear at higher levels of complexity within a hierarchy, and unintended consequences can occur when making decisions in complex situations with interacting components.

Sections of this book will be of interest to those researchers grappling with the underpinning ontology and epistemology of their research. To address this underpinning philosophy, our aim is to provide a clear, succinct introduction to systems thinking, to the initial stages of SSM and to critical realism. We include several examples to aid the reader's comprehension. Our adoption of metaphor, illustration and concrete example should assist those individuals who, like us, say, 'I'm not sure if I can fathom this, if only there was an example....' It is common in research methods books that focus on the student market to present small, discrete examples of the application of research approaches. It is, however, rare to find an entire research investigation presented alongside the derivation and explanation of a research strategy. This book provides numerous images and examples to elaborate, and illuminate, the explanation of the complex underpinning concepts. It also presents a complete research study illustrating the application of the research strategy that we derive herein: 'Worldview, Metaphor and Power of Social Objects' (Womposo).

Integrating Soft System Methodology with Critical Realism

Our initial intention was to develop a way of using SSM as a form of 'explanatory' research rather than as a form of 'action research', as it was designed and applied by Peter Checkland. However, in exploring the literature on Systems Thinking, Minger's (2014) *Systems Thinking, Critical Realism and Philosophy* introduced us to the underpinning philosophy of critical realism. As critical realism is unambiguously based on a Systems Thinking view of the world, it aligns with much of Checkland's work on SSM. Roy Bhaskar is the originator of critical realism; his work is highly theoretical and, for the reader unfamiliar with the literature on the philosophy of social science, difficult to understand. However, others' interpretation of his work is more comprehensible. We contend that Bhaskar's ontology provides us with a coherent underpinning philosophy, or meta-theory, that aligns with systems thinking. There are relatively few authors who describe the application of critical realism in research; we reference a number of these, with Sharon Tao being a key contributor in education. We have adopted some elements of her approach. As you will see, if you read further, critical realism provides a middle way between the two extreme epistemologies of positivism and interpretivism and contends that the world is 'mind-independent' but 'informed by theory'.

How to Read this Book

This book was designed to be read in sequence, but it is uncommon for a reader to approach a textbook in this manner. Hence, throughout the chapters, we suggest occasions on which it may be appropriate to study in detail or to refer to other

chapters. The underlying structure of the book can best be understood by exploring each of the four parts.

Part I provides the reader with an introduction to systems thinking and critical realism and derives the Womposo research strategy. The reader may be at the early stages of research with only a notion of a research topic to explore. At this stage, Part I addresses the importance of ontology and epistemology as a starting point. Chapter 1 introduces systems thinking and SSM. Chapters 2 and 3 on critical realism can be read as a pair, but some of the systems thinking concepts from Chap. 1 would probably be helpful before the reader approaches critical realism. Alternatively, if readers hope to gain an initial idea of the research stages of a project, then they might begin with Chap. 4. This chapter provides some signposts to useful research methods texts and compiles our Stepping-Stones model, describing the stages that are needed within a research project. Our research strategy, the Worldview, Metaphor and Power of Social Objects (Womposo), is presented in Chap. 4. If readers are to comprehend this, they will need some understanding of SSM from Chap. 1 and some understanding of the approach of Elder-Vass, Scott and Tao from Chap. 3.

PART I: Systems Thinking, Soft Systems Methodology (SSM) and Critical Realism

1	Systems Thinking and Soft Systems Methodology (SSM)	History and principles of systems thinking; factors that led Checkland to develop SSM; an outline description of SSM; an example of the application of SSM; rich pictures and the derivation of CATWOE
2	Critical Realism as an Underpinning Philosophy	Meaning and importance of ontology and epistemology; Critical Realism as a middle way; the nature of causation; induction, retroduction and deduction; stratification, parts, wholes, and emergence
3	Critical Realism in the Social Sciences	Key tenets of critical realism; ontological rigour in the social sciences; Elder-Vass' categories of social structure, Scott's categorisation of social objects and Tao's application of the Capability Approach
4	Developing the Worldview, Metaphor and Power of Social Objects Research Strategy	Signposting of research methods texts; the research onion model; the stepping-stones template for a research project; derivation of the Worldview, Metaphor and Power of Social Objects (Womposo) research strategy

Part II provides the background context to the Practicum Study. Chapters 5 and 6 are freestanding chapters and present the necessary contextual background about education in the three jurisdictions and the nature of the practicum in a wide geographic area. These chapters are probably of most interest to students enrolled on education studies programmes. However, they also provide the early researcher with examples of the nature of background literature required in a research project and they inform the data presentation in Part III. Chapter 7 describes the research decisions and stages. It is the research methodology chapter of the Practicum Study.

PART II: Practicum Study: Context

5	The Three Jurisdictions: England, New South Wales and Ontario	Outline of the school and teacher education systems in England, New South Wales and Ontario; discussion of regulation, operation and funding; curriculum, assessment and inspection; markets and choice
6	The Literature on Policy Borrowing and Practicum	Summary of the literature on policy borrowing; description of research undertaken and conceptual analyses available; exploration of the research on the practicum; focus on the PST and the mentor as relevant stakeholders
7	Research Stages of the Practicum Study	Description of research decisions and stages for Practicum Study; use of Stepping-Stones model as template; conceptual framework; Womposo strategy explained; sampling and data collection

Part III presents the data, its interpretation and the findings of the research. The reader who wishes to start here and focus on the data in the Practicum Study, as an example of applying the Womposo strategy, will need to browse Chaps. 4 and 7 before reading the three data Chaps. – 8, 9 and 10. These three chapters each consider the data from one stakeholder perspective and describe Activities 1, 2, 3 and 4 of Womposo. The three stakeholder perspectives are the pre-service teacher (PST), the mentor and the faculty advisor. In addition to several tables, the data from each focus group is presented either by professional illustrations of a derived metaphor or by rich pictures, produced by a member of the focus group. The three chapters can be read in any sequence but for clarity are best read in order. Chapter 11 follows from Chaps. 8, 9, and 10 and should, initially, be read in sequence. It seeks to categorise the value functioning of each stakeholder. It relates the research findings to the literature discussed in Chap. 6 and it responds to the aims of the Practicum Study by identifying the causal factors.

PART III: Practicum Study: Data Collection and Interpretation

8	The Perspectives of Pre-service Teachers	Data collected from PSTs in the three jurisdictions; sampling and gatekeepers; activities 1, 2, 3 and 4 of Womposo for PST stakeholder group; professional illustrations of metaphors
9	Faculty Advisors' Perspectives on Becoming a Teacher	Data collected from Faculty Advisors in the three jurisdictions; activity 1, 2, 3 and 4 of Womposo for faculty advisor group; description of the universities and the terminology within jurisdictions; rich pictures drawn by focus groups
10	Mentors' Expectations and Perspectives	Data collected from mentors in schools; description of the schools; activity 1, 2, 3 and 4 of Womposo; illustrations of metaphors and rich pictures
11	Findings from the Practicum	Categorising of the value functioning of each stakeholder; identification of links to literature; other causal factors identified; presents findings and main causal factors

Part IV presents a short summary of the book and is useful for someone wishing to read an overview of the findings. It presents and discusses the four mechanisms or causal factors identified through the Practicum Study. It relates the findings to several concepts raised earlier in the book: the influence of policy and policy borrowing, the problem situation and problems, models of teacher learning, stratified ontology, and SSM and homeostasis. The Practicum Study is evaluated to consider ethical issues raised, and compliance with the principles of reliability, validity, generalisability and triangulation. The benefits and limitations of Womposo are examined, and a model for evaluating Womposo, based on functionality, usability and utility is devised and applied.

Part IV: Appraising the Womposo Research Strategy

12	Evaluating the Practicum Study and the Womposo Research Strategy	Nature of the book; further exploration of the four causal mechanisms; problem situation and problems; stratified ontology; evaluation of Practicum Study; evaluation of Womposo for functionality, usability and utility; critical realism as the middle way.
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Omissions and Intentions

This book does not describe the full detail of the application of SSM. If you wish to use the whole of SSM as an action research strategy, then follow the pointers in various chapters to the relevant texts by Checkland and other authors. Neither is this book a comprehensive explanation of the application of critical realism in a social context, for that we direct you to the work of Elder-Vass, Scott and Tao. In terms of being a research methods text, we do not cover a wide range of methods and approaches. Instead, we recommend many useful texts that satisfy this purpose. Our aim is to introduce the reader, with a limited background in philosophy, systems thinking or critical realism, to the ontological and epistemological concepts that underpin our Womposo research strategy. We then aim to take the reader through our Stepping-Stones model of research stages as we adopt the Womposo strategy. Our example captures the views of pre-service teachers, school mentors and university faculty advisors, about the practicum experience, across three jurisdictions.

Contents

Part I Systems Thinking, Soft Systems Methodology and Critical Realism

1	Systems Thinking and Soft Systems Methodology	3
	Introduction	3
	The Attraction of Soft Systems Methodology	4
	A Whistle Stop Tour of the History of Systems Thinking	5
	General Systems Theory	5
	Cybernetics and VSM	6
	Operations Research	7
	Autopoiesis	8
	Readings in Systems Thinking	9
	System Definitions and Concepts	9
	Emergence	10
	Hierarchies	11
	Feedback	12
	Homeostasis	12
	Open and Closed Systems	13
	Background and Motivation of Checkland	13
	Checkland's Writing	14
	Messes and Wicked Problems	15
	Swamp of Relevance	16
	Headline Aspects of SSM	17
	Ontology and Epistemology	18
	Critique of SSM's Ontology	20
	Critique of SSM: Radical Change Theory	21
	Our Interpretation of Checkland's Model	22
	Activity 1.1: Finding Out	23
	Activity 1.2: Modelling	24
	Activity 1.3: Using Models to Structure Debate	25
	Activity 1.4: Action to Improve the Situation	25

Using SSM to Explore the Higher Education Admission System	26
HE Admission System, Activity 1.1: Finding Out	26
HE Admission System, Activity 1.2: Modelling.	29
HE Admission System, Activity 1.3: Using Models to Structure Debate	30
HE Admission System, Activity 1.4: Action to Improve the Situation.	31
Conclusion	31
References.	32
2 Critical Realism as an Underpinning Philosophy	35
Introduction.	35
The Need for an Underpinning Philosophy	36
The Importance of Ontology and Epistemology.	37
The Ontological and Epistemological Spectrum	37
The Growth of the Scientific Method	38
The Nature of Causation	39
The Practicum Study Narrative.	40
The Origin of Critical Realism	41
Domains and Causal Powers.	42
The Epistemic Fallacy.	43
Real, Actual and Empirical Powers.	44
Induction, Deduction and Retroduction	46
Example: Flammable Furniture	47
Stratification, Parts, Wholes, and Emergence	48
Example: The Log and the Wood	49
Identifying Parts and Wholes	50
Conclusion	51
References.	52
3 Critical Realism in the Social Sciences	55
Introduction.	55
Moving from Science to Social Science	56
A Naturalist Epistemology	57
Transitive and Intransitive Objects	58
Context of Discovery and Context of Justification	59
Epistemological Spectrum	60
Key Tenets of Critical Realism	60
First Tenet of Critical Realism	61
Second Tenet of Critical Realism	62
Third Tenet of Critical Realism	62
Fourth Tenet of Critical Realism.	64
Ontological Rigour in the Social Sciences	64
Structure and Agency	66
Social Evolution	67
Truth and Data Collection Methods	68

Scott's Five Social Objects	68
Vertexicality	69
Norm Circles	70
Interaction Groups	71
Associations	72
Organisations	72
Elder-Vass' Five-Stage Social Ontology	73
Introduction to the Capability Approach	74
Sen's Capability Approach Model	75
Description of the Capability Approach	75
Conclusion	76
References	77
4 The Stepping-Stones Model and the Worldview, Metaphor and Power of Social Objects (Womposo) Strategy	81
Introduction	81
Research Methods Texts	82
Research Onion Model: Ontology and Epistemology	84
Exploring the Layers of the Research Onion	84
Stepping-Stones Research Stages	87
Stepping-Stones: Topic and Aims	88
Stepping-Stones: Paradigm	90
Stepping-Stones: Strategy	92
Stepping-Stones: Research Design	93
Stepping-Stones: Methods	95
Stepping-Stones: Sample, Collect, Interpret	96
Stepping-Stones: Comparison with Literature	96
Mapping out the Womposo Research Strategy	97
The Learning Cycle Model of SSM	98
Activity 1 and Activity 2 of the Womposo Research Strategy	99
Integrating SSM with Critical Realism	100
Approach of Elder-Vass to Critical Realism in the Social Sciences	101
Activity 3 and Activity 4 of the Womposo Research Strategy	102
Integrating Social Structures, Social Objects and the Capability Approach	104
Conclusion	105
References	105

Part II Practicum Study: Context

5 The Three Jurisdictions: England, New South Wales and Ontario	111
Introduction	111
Accessing the Three Jurisdictions	113
Policy in Schools: Hierarchy and Markets	113

Schools in England: Regulation, Operation and Funding	114
Schools in England: Curriculum, Assessment and Inspection	116
Schools in England: Markets and Choice	117
Schools in New South Wales: Regulation, Operation and Funding	117
Schools in New South Wales: Curriculum, Assessment and Inspection	118
Schools in New South Wales: Markets and Choice	119
Schools in Ontario: Regulation, Operation and Funding	119
Schools in Ontario: Curriculum, Assessment and Inspection	120
Schools in Ontario: Markets and Choice	121
Comparison of School Education in the Three Jurisdictions	121
Policies in English Initial Teacher Education	123
Policies in New South Wales' Initial Teacher Education	125
Policies in Ontario's Initial Teacher Education	126
Synthesis	127
Conclusion	129
References	129
6 The Literature on Policy Borrowing, Learning, Professional Identity and the Practicum	133
Introduction	133
Policy Change and Policy Borrowing	134
The Rescaling of Political Authority	136
Example of Policy Adoption	137
Adoption and Legitimisation of Policy Initiatives	138
National Standards	138
Teachers' Standards in Three Jurisdictions	140
Learner Identity	142
Professional Identity	143
Three Paradigms of Teaching	144
Reflective Practice	145
Legitimate Peripheral Participation	147
From Communities of Practice to Codes of Practice	148
Systematic Reviews of Literature on the Practicum	149
Role of the Mentor	150
Agency	150
Reality Shock	151
The Craft of Teaching and the Practice	152
Conclusion	153
References	154
7 Research Stages of the Practicum Study	159
Introduction	159
Context and Objectives of the Practicum Study (Topic and Aims)	161
Aims of the Practicum Study (Topic and Aims)	162
Policy Borrowing (Paradigm)	163

Systemic Effects (Paradigm)	164
Ontology, Epistemology and Axiology (Paradigm)	164
The Middle Way (Paradigm)	165
Womposo (Strategy)	166
Conceptual Framework for the Practicum Study (Strategy)	166
Selecting the Jurisdictions (Research Design)	168
Gatekeepers (Research Design)	169
Collecting Data (Research Design)	169
Validity, Triangulation and Reliability (Research Design)	170
Sampling of Data (Sampling, Collecting and Interpreting the Data) . . .	171
Ethics Approval (Methods)	172
Ethics Creep (Methods)	175
Analysis and Synthesis (Methods)	177
Collecting and Recording Data (Sampling, Collecting and Interpreting the Data)	177
Comparison with Literature	179
Metaphors (Womposo)	179
Illustrations (Womposo)	180
Conclusion	181
References	182

Part III Practicum Study: Data Collection and Interpretation

8 The Perspectives of Pre-service Teachers	187
Introduction	187
Activity 1: Finding Out	190
Modelling at Old Possum University, NSW: Activity 2	192
Conceptualising: Activity 3 Expounding the Method	194
Conceptualising at Old Possum University, NSW: Activity 3	196
Explaining at Old Possum University, NSW: Activity 4	197
Modelling at University of Wallaby Creek, NSW: Activity 2	198
Conceptualising at University of Wallaby Creek, NSW: Activity 3	200
Explaining at University of Wallaby Creek, NSW: Activity 4	200
Modelling at Australian Koala University, NSW: Activity 2	202
Conceptualising at Australian Koala University, NSW: Activity 3	204
Explaining at Australian Koala University, NSW: Activity 4	204
Modelling at University of Grey Seal Province, Ontario: Activity 2 . . .	206
Conceptualising at University of Grey Seal Province, Ontario: Activity 3	209
Explaining at University of Grey Seal Province, Ontario: Activity 4 . . .	210
Modelling at Caribou Metropolitan University, Ontario: Activity 2 . . .	211
Conceptualising at Caribou Metropolitan University, Ontario: Activity 3	213
Explaining at Caribou Metropolitan University, Ontario: Activity 4 . . .	213
Modelling at Raccoon Technical University, Ontario: Activity 2	215

Conceptualising at Raccoon Technical University, Ontario: Activity 3	217
Explaining at Raccoon Technical University, Ontario: Activity 4	218
Modelling at Badgerford University, England: Activity 2	220
Conceptualising at Badgerford University, England: Activity 3	221
Explaining at Badgerford University, England: Activity 4	223
Modelling at Roe Deer Valley University, England: Activity 2	224
Conceptualising at Roe Deer Valley University, England: Activity 3	226
Explaining at Roe Deer Valley University, England: Activity 4	227
Conclusion	228
References	229
9 Faculty Advisors' Perspectives on Becoming a Teacher	231
Introduction	231
Activity 1: Finding out	234
Modelling at Old Possum University, NSW: Activity 2	235
Conceptualising at Old Possum University, NSW: Activity 3	238
Explaining at Old Possum University, NSW: Activity 4	239
Modelling at University of Wallaby Creek, NSW: Activity 2	240
Conceptualising at Wallaby Creek University, NSW: Activity 3	242
Explaining at Wallaby Creek University, NSW: Activity 4	243
Modelling at Australian Koala University, NSW: Activity 2	245
Conceptualising at Australian Koala University, NSW: Activity 3	248
Explaining at Australian Koala University, NSW: Activity 4	249
Modelling at University of Grey Seal Province, Ontario: Activity 2 ...	250
Conceptualising at University of Grey Seal Province, Ontario: Activity 3	252
Explaining at University of Grey Seal Province, Ontario: Activity 4 ...	252
Modelling at Caribou Metropolitan University, Ontario: Activity 2 ...	254
Conceptualising at Caribou Metropolitan University, Ontario: Activity 3	256
Explaining at Caribou Metropolitan University, Ontario: Activity 4 ...	256
Modelling at Raccoon Technical University, Ontario: Activity 2	259
Conceptualising at Raccoon Technical University, Ontario: Activity 3	261
Explaining at Raccoon Technical University, Ontario: Activity 4	262
Modelling at Badgerford University, England: Activity 2	263
Conceptualising at Badgerford University, England: Activity 3	265
Explaining at Badgerford University, England: Activity 4	265
Modelling at Roe Deer Valley University, England: Activity 2	268
Conceptualising at Roe Deer Valley University, England: Activity 3 ...	270
Explaining at Roe Deer Valley University, England: Activity 4	270
Conclusion	272
References	273

10	Mentors' Expectations and Perspectives	275
	Introduction	275
	Activity 1: Finding Out	277
	Modelling at Old Possum University, NSW: Activity 2	278
	Conceptualising at Old Possum University, NSW: Activity 3	280
	Explaining at Old Possum University, NSW: Activity 4	282
	Modelling at University of Wallaby Creek, NSW: Activity 2	283
	Conceptualising at Wallaby Creek University, NSW: Activity 3	285
	Explaining at Wallaby Creek University, NSW: Activity 4	286
	Modelling at Australian Koala University, NSW: Activity 2	287
	Conceptualising at Australian Koala University, NSW: Activity 3	289
	Explaining at Australian Koala University, NSW: Activity 4	291
	Modelling at Caribou Metropolitan University, Ontario: Activity 2	292
	Conceptualising at Caribou Metropolitan University, Ontario:	
	Activity 3	294
	Explaining at Caribou Metropolitan University, Ontario: Activity 4	296
	Modelling at Raccoon Technical University, Ontario: Activity 2	297
	Conceptualising at Raccoon Technical University,	
	Ontario: Activity 3	299
	Explaining at Raccoon Technical University, Ontario: Activity 4	300
	Modelling at Badgerford University, England: Activity 2	301
	Conceptualising at Badgerford University, England: Activity 3	303
	Explaining at Badgerford University, England: Activity 4	305
	Modelling at Roe Deer Valley University, England: Activity 2	306
	Conceptualising at Roe Deer Valley University, England: Activity 3	308
	Explaining at Roe Deer Valley University, England: Activity 4	310
	Conclusion	311
	References	312
11	Findings from the Practicum Study	315
	Introduction	315
	The Stakeholders	317
	The Value Functioning Continuum: PST Stakeholders	317
	Relationship Between the Literature and Confident PSTs	318
	Relationship Between the Literature and Keen PSTs	319
	Relationship Between the Literature and PSTs Suffering	
	Reality Shock	320
	The Value Functioning Continuum: Faculty Advisor Stakeholders	321
	Relationship Between the Literature and Status Aware	
	Faculty Advisors	322
	Relationship Between the Literature and Nurturing Faculty	
	Advisors	323
	Relationship Between the Literature and Faculty Advisors	
	Worried About Losing Status	324
	The Value Functioning Continuum: Mentor Stakeholders	325

Relationship Between the Literature and Mentors Seeking	
Personal Development	326
Relationship Between the Literature	
and Mentors Supporting PSTs	327
Relationship Between the Literature and Mentors	
and Accountability	328
Literature Themes Emerging	329
Agency	329
Communities of Practice and Codes of Practice.	330
From Identity to Reality Shock.	331
Rescaling of Political Authority	331
Aspects Raised Yet Not Identified in the Literature	332
Findings of the Practicum Study.	333
Causal Factor 1: Stakeholder Position	334
Causal Factor 2: Context for PSTs	335
Causal Factor 3: Influence on Faculty Advisors	335
Causal Factor 4: Influences on Mentors	336
Conclusion	336
References.	337

Part IV Appraising the Womposo Research Strategy

12 Evaluating the Practicum Study and the Womposo

Research Strategy	341
Summary of This Book.	341
Outline of This Concluding Chapter.	342
Contribution to Knowledge: Causal Factors.	343
Mechanism 1: Stakeholder Position	344
Mechanism 2: Context	345
Mechanism 3: School Culture.	345
Mechanism 4: Policy and Status.	346
The Influence of Policy.	346
The Problem Situation and the Problems Within	
the Practicum Study	348
Addressing the Problems	349
Models of Teacher Learning Espoused.	350
Stratified Ontology	351
Other Techniques that Can Be Applied in Systems Thinking.	352
SSM and Homeostasis	353
From Systems to Policy Borrowing	355
Critical Realism as a Middle Way.	356
Ethical Issues Arising	357
Evaluating Reliability, Validity, Triangulation and Generalisation.	359
Benefits and Limitations of Womposo	359

Evaluation of Womposo for Its Functionality, Usability and Utility . . . 360

Functionality 362

Usability and Utility 362

Scoring Womposo 363

Conclusion 364

References 365

Index. 369

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¹ Gilbert, J.F. (2001). *Barriers to the Adoption of ICT in Teaching and Learning in Higher Education*. University of Lancaster.

1990s and commenced PhDs in education in the late 1990s. During his early career, Simon taught in primary schools while Jenny was initially a computer programmer and then taught mathematics in secondary and further education. Both have long careers in multiple English universities, Simon working in faculties of education, while Jenny taught in science and technology faculties and business schools. Coincidentally, both have held roles supporting teaching and learning in higher education. It was when Jenny moved into teacher education at Anglia Ruskin University in 2012 that she met Simon and together they led the department successfully through Ofsted inspections. Some years later, a chance meeting while acting as external examiners prompted them to propose a text on applying soft systems methodology in education to Springer Nature.

Abbreviations

ACER	Australian Council for Educational Research
ACARA	Australian Curriculum, Assessment and Reporting Authority
AITSL	Australian Institute for Teaching and School Leadership
BERA	British Educational Research Association
CATWOE	Customer, Actor, Transformation, Worldview, Owner, Environment
DEC	Department of Education, New South Wales
DfE	Department for Education, UK
EQAO	Education Quality and Accountability Office
ECTS	European Credit Transfer and Accumulation System
EU	European Union
GCSE	General Certificate of Secondary Education
GST	General Systems Theory
HAT	Highly Accomplished Teacher
HEA	Higher Education Academy
ISI	Independent Schools Inspectorate
ITE	Initial Teacher Education
MTeach	Master of Teaching
MERID	Mentor Roles in Dialogue
MT	Mentor Teacher
NAPLAN	National Assessment Programme – Literacy and Numeracy
NCEE	National Centre on Education and the Economy
NCTL	National College for Teaching and Leadership
NFER	National Foundation for Educational Research
NDP	New Democratic Party
NQT	Newly Qualified Teacher
NSW	New South Wales
NESA	New South Wales Education Standards Authority
NGO	Non-governmental Organisation
OSV	Object, Subject, Verb
OFSTED	initially Office for Standards in Education

Ofsted	subsequently Office for Standards in Education, Children's Services and Skills
OR	Operations Research
OECD	Organisation for Economic Co-operation and Development
PGCE	Postgraduate Certificate in Education
PFI	Public Finance Initiative
PISA	Programme for International Student Assessment
PST	Pre-service Teacher
QTS	Qualified Teacher Status
QAA	Quality Assurance Agency
SCITT	School Centred Initial Teacher Training
SSM	Soft Systems Methodology
SATs	Standard Attainment Tests
TC	Teacher Candidate
UK	United Kingdom
UCAS	Universities and Colleges Admission Service
UCL	University College London
VSM	Viable Systems Model
Womposo	Worldview, Metaphor and Power of Social Objects

Part I
Systems Thinking, Soft Systems
Methodology and Critical Realism

Chapter 1

Systems Thinking and Soft Systems Methodology



Abstract This opening chapter expounds the concept of systems thinking, beginning with a rapid tour of its history. The terminology of systems thinking is surveyed: including the terms open and closed systems, boundaries, hierarchies, emergent features, autopoiesis and homeostasis. A system comprises an organised set of interacting components such that the whole is greater than the sum of the parts. This feature, the generation of a new property at a certain level of complexity, is termed emergence. Several examples are discussed to illustrate the systemic nature of various technical artefacts, natural objects, and human activity systems. The work of Peter Checkland is explored, and the development of his action research approach entitled Soft Systems Methodology (SSM) is discussed, focussing on his most recent modification of SSM, the four-activity model. The drawing of a rich picture, indicating the perspectives of different stakeholders, helps the researcher to model a problem situation using the mnemonic CATWOE and this process facilitates the generation of a root definition. A worked example of a problem situation is presented, describing a higher education admission system as perceived from three different perspectives or worldviews.

Keywords Autopoiesis · Cybernetics · Emergence · Feedback · General Systems Theory · Homeostasis · Problem situation · Rich picture · Root definition · Worldview

Introduction

Soft Systems Methodology (SSM) is an approach employed in project management, organisational development and information systems development. In the latter, SSM has been used extensively to gain agreement on the purpose of a new system. It was devised by Checkland (1981) who noted that despite certain projects having a robust technical specification they often do not deliver on time, to budget and to quality standards. His attempt to apply a rigorous approach to messy human activity systems, in order to decide what to do to improve the situation, yielded SSM (ibid). This chapter begins by explaining the researcher's initial attraction to SSM

and its particular relevance to the development of Information Systems. Some time is spent considering the establishment of General Systems Theory and exploring the ways that systems thinking has developed since the early twentieth Century, across a range of disciplines. The key thinkers and their ideas are introduced to the reader: von Bertalanffy (1950), Beer (1959), Wiener (1950), Ackoff and Emery (1972), and Maturana and Varela (1980). The terminology of systems thinking is explored: the concepts of open and closed systems, boundaries, hierarchies, emergent features, autopoiesis and homeostasis.

Having explored the history of systems thinking, the reader will then be acquainted with Checkland's background and his motivation, his move from hard systems to soft systems. The drivers and the provenance of SSM are then explained. Checkland asserts that the two most important aspects of systems thinking are the two related pairs: emergence and hierarchy, and communication and control. In his action research methodology, SSM, Checkland introduces a number of noteworthy terms: human activity system; problem situation; rich picture; *Weltanschauung*/Worldview; conceptual model and root definition. These terms are explained, and we briefly explore Checkland's differentiation between the 'real world' and the 'systems world'. This comparison leads to a discussion of two critiques of Checkland's methodology. The application of the early stages of SSM, together with an example, follows a description of SSM. This description combines the terminology that Checkland uses in a number of his books and publications.

The Attraction of Soft Systems Methodology

The researcher was introduced to SSM in the late 1980s. She used the approach while teaching Information Systems, also entitled Informatics, over many years, drawn to the methodology by its emphasis on exploring a situation using manifold perspectives. It is very common in Information Systems development to produce a well-designed computer system that nevertheless does not solve the organisation's problems. This situation can be likened to knitting a cardigan for a six-month old baby, only to discover that by the time the cardigan is complete, the baby is a year old and the cardigan no longer fits. However soft the wool, however carefully chosen the colour and pattern, however well knitted and beautiful the final product, it is not the right product for its chosen purpose. Of course, in the knitting situation, the cardigan could be bestowed on another baby. However, in the case of the information system that is designed for a particular organisation, it is highly unlikely that an expensive, bespoke product could be sold elsewhere. It is crucial, therefore, to determine at the early stages of development, precisely what is needed, as this avoids wasting time later retracing one's steps. There will inevitably be technical problems to surmount when designing and developing an information system, but the human issues are of a different order of magnitude and complexity. These issues arise because stakeholders within an organisation occupy diverse roles, hold different perspectives and have different agendas; they see the purpose of the system

differently. SSM provides a methodology for identifying the perceptions of the different stakeholders. Once these perceptions have been identified it can be possible to find an accommodation between stakeholders. Alternatively, it might accentuate the need for management to take an executive decision on the purpose of the system, in light of the corporate aims. Those readers interested in using SSM, in relation to Information Systems, are directed to Checkland and Holwell's (1998) 'Information, systems and information systems: Making sense of the field'.

A Whistle Stop Tour of the History of Systems Thinking

As the preamble to his description of systems thinking, Checkland (1981) summarises the history of science. He deems the scientific method to be a product of western civilisation and an invention, rather than a discovery. He contends that when using the scientific method, scientists are seeing the world from one particular point of view. Checkland's interpretation is that the two important outcomes from the scientific revolution were the application of rationalism and the application of empiricism; together they enable science to produce testable knowledge. Checkland moves on from science to consider the classification of human knowledge. While he holds that the disciplines we study are defined by mankind, nevertheless these disciplines are categorised by their increasing complexity. He proposes layers of disciplines, starting at the base with those he considers most straightforward - mathematics, then moving up to astronomy and physics, and from physics to chemistry to biology, psychology and finally sociology. As one moves up through the layers, there is an increasing level of complexity and a greater degree of organisation. Questions of epistemology and the nature of knowledge are explored further in Chaps. 2 and 3. Checkland's (ibid) survey of the historical bedrock of disciplines and knowledge is his starting point; he continues by surveying the development of Systems Thinking. He covers a considerable amount of ground, and his key influences are 'General Systems Theory' (von Bertalanffy, 1950); the 'Viable Systems Model' (Beer, 1959); 'Cybernetics' (Wiener, 1950); and 'Social Systems Science' (Ackoff, 1979). We will begin by retracing Checkland's footsteps and will add an important addition, that of 'Autopoiesis' (Maturana & Varela, 1980).

General Systems Theory

The development of systems thinking in the early twentieth century is normally considered to be the brainchild of the biologist Ludwig von Bertalanffy (Checkland, 1981). Based in Palo Alto, California, he was one of the "founding fathers of the systems movement". (Flood, 1999, p. 32). Von Bertalanffy's (1950) General Systems Theory is a mathematico-logical theory, a subset of mathematics concerned with proof, that goes beyond biology to cover all subjects. This theory includes the

claim that there are mathematical laws that cover situations arising in very different disciplines, the isomorphic laws in science (*ibid*). For example, the formula to describe the behaviour of molecules constrained within certain vessels mirrors that found within a population who find themselves constrained by the amount of food or space available (*ibid*, p. 138). General Systems Theory includes the concept of wholeness and organisation, and von Bertalanffy also discusses open and closed systems and the concept of hierarchy, where an organism is segregated into subordinate systems. He claims that reality is a “tremendous hierarchical order of organised entities, leading, in a superposition of many levels, from physical and chemical to biological and sociological systems” (von Bertalanffy, 1950, p. 164). Similar ideas were advanced about 40 years earlier than those of von Bertalanffy when Alexander Bogdanov, a Russian, posited the theory of *tektology*, the science of structures (Checkland, 1981; Flood, 1999). However, Bogdanov’s ideas were not published outside Russia until the 1970s (Gorelik, 1975). Bogdanov’s Russian publication in 1922 included many later systems concepts including as Gorelik (*ibid*) reports “An organised complex, or a system, is defined as a complex where the whole is greater than the sum of its parts” (*ibid*, p. 348).

Cybernetics and VSM

Another significant development in systems thinking was the formation of the discipline of cybernetics, generally defined as the art and science of communication and control (Flood, 1999). While it is often thought to refer to the control of machines, it also refers to the control of living objects. The term cybernetics was coined by Norbert Wiener (1950) although he borrowed it from early philosophers; the term is taken from the Greek and means ‘the steersman’. Wiener formed part of a group of mathematicians, engineers and neuroscientists with much of their work funded by research for the military (Checkland, 1981). The work on cybernetics was sustained and adapted by Stafford Beer with his ‘Viable Systems Model’ (VSM) (Flood, 1999; Jackson, 2009). In ‘Cybernetics and Management’ Beer (1959) “concludes that there are three main properties of a cybernetic system. They are exceedingly complex, probabilistic, and self-regulatory. They are also purposive, meaning that from a particular view-point the system is organised to achieve some end” (Flood 1999, p. 37).

Beer posits that viable systems can self-regulate in order to maintain a stable internal environment in a complex external environment by having the “requisite amount of internal variety” (Brocklesby & Mingers, 2005, p. 5). The viable system always has a purpose that can be perceived by an observer, but it is probabilistic, meaning that the result cannot be perfectly predicted. Beer’s work was undertaken in the field of management and he is well known for homomorphisms, drawing parallels between living beings and social organisations; as illustrated in his titles ‘The Brain of the Firm’ (Beer, 1972) and ‘The Heart of the Enterprise’ (Beer, 1979). Beer constructs VSM based on five functions of management that he entitles