

Table of contents

1	<i>Introduction</i>	1
1.1	Current educational approaches in engineering education	2
1.2	Problem statement.....	3
1.3	Research goal.....	4
1.4	Summary of chapters	5
2	<i>Organisational learning</i>	8
2.1	Existing perspectives on organisational learning.....	8
2.1.1	Modes of organisational learning.....	10
2.1.2	System levels of organisational learning	12
2.1.3	Types of organisational learning.....	12
2.1.4	The learning process.....	13
2.2	Identification of processes within organisational learning.....	14
2.2.1	Identification of intraorganisational learning processes	14
2.2.2	Identification of interorganisational learning processes	15
2.3	Identification of barriers within organisational learning.....	17
2.3.1	Identification of intraorganisational learning barriers	17
2.3.2	Identification of interorganisational learning barriers	20
2.4	Resulting educational requirements in networked manufacturing organisations	23
2.4.1	Individual level learning skills	24
2.4.2	Group level learning skills	26
2.4.3	Organisational level learning skills.....	28
2.4.4	Interorganisational level learning skills	28
2.5	Deduction of fundamental design characteristics for the simulation game	30
2.5.1	Identification of related learning goals	31
2.5.2	Identification of related learning scenarios	32
2.6	Organisational learning conclusions	35
3	<i>Simulation games in engineering education</i>	37
3.1	Definition of a simulation game	37
3.2	The development of simulation games as a teaching method	38
3.3	Classification of simulation games.....	39
3.3.1	Game medium	39
3.3.2	Scope of the game model	41
3.3.3	Social setting	42
3.3.4	Tutorial support	43
3.4	Comparison of different related simulation games.....	43
3.4.1	The “COSIGA” simulation game	44
3.4.2	The “GLOTRAIN” simulation game	44
3.4.3	The “City Car” simulation game.....	45
3.4.4	The “MINT” simulation game	46

3.4.5	The “Business Networking Game”	47
3.4.6	The “Chain Game”	48
3.4.7	The “Knowledge Management Simulation Game”	48
3.4.8	The “Tango” simulation game	49
3.4.9	The “KMQuest” simulation game.....	50
3.5	Conclusion of the comparison	50
4	Specification of conceptual requirements.....	54
4.1	Specification of pedagogic requirements	54
4.2	Summary of conceptual requirements	57
4.3	Specification of the overall game concept	59
4.3.1	Specification of the organisational setting of the simulation environment.....	59
4.3.2	Specification of the overall game structure.....	60
5	Development of the first game scenario	66
5.1	The product of the first scenario.....	67
5.2	The organisational structure of the first scenario.....	67
5.3	The game processes of the first scenario	69
5.3.1	Product development.....	69
5.3.2	Management and exchange of knowledge	70
5.4	Simulating intraorganisational barriers to knowledge sharing	74
5.5	Lessons learned from initial experiments	76
6	Development of the second game scenario	77
6.1	The product of the second game scenario	78
6.2	The organisational structure of the simulated network of companies	79
6.3	The life cycle of the simulated network of companies	82
6.4	Development of the “SERVICO” company.....	84
6.4.1	The organisational structure of the “SERVICO” company	84
6.4.2	The product development process of the “SERVICO” company	85
6.5	Development of the “GR8TRONICS” company.....	86
6.5.1	The organisational structure of the “GR8TRONICS” company	86
6.5.2	The product development process of the “GR8TRONICS” company	87
6.6	Development of the “SUMSANG” company	88
6.6.1	The organisational structure of the “SUMSANG” company.....	88
6.6.2	The product development process of the “SUMSANG” company	89
6.7	Simulating interorganisational barriers to knowledge sharing.....	90
6.7.1	Boundaries of space	90
6.7.2	Boundaries of time	91
6.7.3	Boundaries of culture	92
6.8	Lessons learned from initial experiments	94
7	Implementation of the simulation game platform	95
7.1	Identification of implementation requirements	95
7.1.1	Requirements to the game organisation	95
7.1.2	Requirements related to product development.....	95

7.1.3 Requirements related to management and exchange of knowledge ...	96
7.2 Technical specification of the simulation game platform.....	99
7.2.1 Specification of the underlying data model	101
7.2.2 Specification of the simulation engine.....	105
7.2.3 Specification of the user interface.....	106
7.3 Implementation of the simulation game engine	108
7.3.1 Implementation of the data model	108
7.3.2 Implementation of the web interface and the simulation engine	109
7.3.3 Optimization of the web interfaces' usability	116
8 Evaluation of the simulation game.....	122
8.1 Evaluation of simulation games	122
8.2 Identification of an evaluation method	123
8.2.1 Characteristics of questionnaire based evaluations.....	124
8.2.2 Development of a questionnaire.....	126
8.3 Presentation and Interpretation of the evaluation results	128
8.3.1 Improvement of communication skills	129
8.3.2 Improvement of trust building competence	131
8.3.3 Experience intraorganisational barriers to knowledge sharing and identification of related solution strategies	133
8.3.4 Facilitation of the development of a knowledge sharing attitude	134
8.3.5 Experience of interorganisational barriers to knowledge sharing and identification of related solution strategies	134
8.3.6 Improvement of information processing skills	137
9 Conclusion	138
10 Glossary.....	143
11 References.....	145
12 List of figures.....	176
13 Annex.....	180