

TABLE OF CONTENTS

CHAPTER 1	Introduction	1
CHAPTER 2	Literature Review	4
2.1	Theoretical background of creativity	4
2.2	Game for learning	5
2.3	Computer support collaboratively for creativity learning	6
2.3.1	Group Support System	6
2.3.2	Creativity Support Tool	8
2.3.3	Bounded Rationality	9
2.4	Pervious and related study	10
CHAPTER 3	Idea Storming Cube: an online group creativity support tool	12
3.1	Putting all into a Magic Cube	12
3.2	Design of limited view to explore ideas in the brainstorming process	13
3.3	Design of game-based creativity learning environment	15
3.4	System architecture	17
3.5	User modeling in ISC	18
3.5.1	Formal User Profile (fUP)	18
3.5.2	fUP Analysis Agent	21
3.5.3	Brainstorming with User Profile Contrast Agent (UPCA)	24
3.6	Learning strategies: Basic Mode versus Agent-Assisting Mode	29
3.6.1	Basic mode interaction design	30
3.6.2	Agent-assisting mode interaction design	31
3.7	Use Case	35
CHAPTER 4	Pilot study on game situation for creative thinking	40
4.1	Pilot design	40
4.2	Data Analysis	41
4.3	Results	42
CHAPTER 5	Main Study	46
5.1	Participants in the experiment	46

5.2	Experimental design	46
5.3	Brainstorming with different supportive mechanisms	48
5.4	Measurement	50
5.5	Data analysis.....	52
5.6	Results	53
5.6.1	Individual-level outcome.....	53
5.6.2	Group-level outcome	57
5.6.3	Transfer test	61
5.7	Discussion.....	62
CHAPTER 6	Conclusion.....	66
REFERENCES	.....	69
APPENDIX A	.....	73
APPENDIX B	.....	75
APPENDIX C	.....	76
APPENDIX D	.....	77
APPENDIX E	.....	79

LIST OF FIGURES

Figure 2-1: Csikszentmihalyi's model of creativity [5]	5
Figure 2-2: GSS-Creativity research model [2].....	7
Figure 3-1: a) Different views of one thing	13
Figure 3-2: One side of a Magic Cube as seen from a user's view	14
Figure 3-3: Rotating the first row of the cube	14
Figure 3-4: Rules for operating the game.....	15
Figure 3-5: Scoring rules for the game.....	16
Figure 3-6: System architecture.....	17
Figure 3-7: Bipartite-graph-based user models of Idea-Reason pair	19
Figure 3-8: A partial Domain Model authored in XML [44]	19
Figure 3-9: Building a preliminary user profile from the text file that the user uploads	21
Figure 3-10: The procedure <i>Idea_Identification</i> for building the individual fUP.....	22
Figure 3-11: The procedure <i>Node_Mapping</i> for finding the node in Domain fUP.....	23
Figure 3-12: The procedure <i>Node_Adding</i> for adding a node to user's fUP.....	24
Figure 3-13: The new idea nodes beyond Domain fUP	27
Figure 3-14: The procedure for mapping a new idea with the potential idea space.....	28
Figure 3-15: Different learning strategies in ISC: BM and AAM	29
Figure 3-16: Showing yellow arrows before rotating and after rotating the cube	31
Figure 3-17: The procedure <i>Agent_Support</i> for generating a stimulating idea	33
Figure 3-18: (A) Generation ideas in the agent's view (B) obtaining new ideas from the agent after rotating the cube	34
Figure 3-19: (A) Only rotating certain user's view with agent (B) after rotating	35
Figure 3-20: Screenshots of Login and instruction	35
Figure 3-21: The ideas generated by the users as recorded by ISC	36
Figure 3-22: Providing rotation arrow by dynamic computing XOR set of user's fUP.....	38
Figure 3-23: A user gets another's idea card by rotating a row	38
Figure 4-1: The frequency of valid ideas in all participants' responses.....	42
Figure 4-2: The ratio of valid idea decreases at the time goes on	44

Figure 4-3: The coverage of each category	45
Figure 5-1: An information-sharing window in ISC_{info} group	49
Figure 5-2: The same representation without the information-sharing windows in ISC_{game} group and $ISC_{game-agent}$ group	49
Figure 5-3: The plotting figures of the number of submitted ideas and valid ideas.....	55
Figure 5-4: The plotting figure of the mean of unique valid idea in each group	59

LIST OF TABLES

Table 4-1: The mean, SD of invalid ideas, valid ideas and the R_v	43
Table 4-2: The count average, expected count, and coverage of each category	44
Table 5-1: The comparison of three groups	46
Table 5-2: The comparison of the measurements between ISC and TTCT	51
Table 5-3: Descriptive statistics of participants' the number of submitted ideas, valid ideas, and new potential ideas among the ISC_{info} group, ISC_{game} group, and $ISC_{game-agent}$ group	53
Table 5-4: The results of Scheffe test for the number of submitted ideas and valid ideas.....	54
Table 5-5: Descriptive statistics of each participants' coverage of each category, number of participants: ISC_{info} group (n=12), ISC_{game} group (n=24), and $ISC_{game-agent}$ group (n=18).	55
Table 5-6: The results of Scheffe test for the categories of human development and policy. .	56
Table 5-7: Descriptive statistics of the number of unique ideas from each group: ISC_{info} group, ISC_{game} group, and $ISC_{game-agent}$ group	57
Table 5-8: The results of Scheffe test for the number of unique ideas of group.....	58
Table 5-9: Descriptive statistics of the group idea coverage in each category. Number of groups: ISC_{info} group (n=4), ISC_{game} group (n=8), and $ISC_{game-agent}$ group (n=6)	59
Table 5-10: The results of Scheffe test for the count of unique ideas in Human Development and Policy	60
Table 5-11: Descriptive statistics, ANOVA and effect size of the transfer test.....	61
Table 5-12: The results of Scheffe test for the count of unique ideas in Human Development and Policy	62
Table 5-13: The significant different results of the pair ISC_{game} - $ISC_{game-agent}$	63