

國立交通大學

理學院科技與數位學習學程

碩士論文

設計教育型適地性遊戲模型
以發展學習者對長年野生糧食作物全方位思考

Design of an Educational Location-based Game Prototype
Evolving Learners' Whole System Thinking Toward
Wild Perennial Crops

研究生：吳孟娟

指導教授：孫春在教授

中華民國一百〇一年十二月

設計教育型適地性遊戲模型
以發展學習者對長年野生糧食作物全方位思考
Design of an Educational Location-based Game Prototype Evolving
Learners' Whole System Thinking Toward Wild Perennial Crops

研究生：吳孟娟
指導教授：孫春在

Student: Meng-Chuan Wu
Advisor: Chuen-Tsai Sun



Degree Program of E-Learning

December 2012

Hsinchu, Taiwan, Republic of China
中華民國一百〇一年

設計教育型適地性遊戲模型 以發展學習者對長年野生糧食作物全方位思考

學生：吳孟娟

指導教授：孫春在教授

國立交通大學理學院科技與數位學習學程

摘要

適地性遊戲發源於街頭遊戲文化，多以娛樂為目的，缺乏於偏鄉、離線環境進行及以教學為目標的遊戲設計。本研究設計一款利用 GPS 手機進行適地性遊戲之遊戲模型，讓玩家於離線環境下進行「長年野生糧食作物」打卡遊戲，同時也參與對抗地球暖化及生物多樣性保育行動。

研究者與「興地球」組織合作，以行動研究法協同設計與施作「興地球學院培訓課程」。以新竹縣尖石鄉泰雅族梅嘎滾部落為遊戲設計與教學點。透過訪談耆老，找出部落傳統智慧與長年野生糧食作物之關聯性，進而設計教學課程與實作遊戲，並招募二十五位大專與企業志工擔任學習者。研究者透過參與觀察法，記錄並分析蒐集資料，最後進行研究問題之探討。

研究主要發現為「興地球學院培訓課程」以野化長年野生糧食作物、科技、飲食文化、教育四大主題建立學習者對長年野生糧食作物全方位思考。以遊戲融入教學為策略，並取材泰雅族傳統智慧，發展出七個實作遊戲，提高學習者之學習興趣與動機。以「開放街道地圖」作為遊戲地圖資料來源，建立以長年野生糧食作物為中心、泰雅觀點之地圖，最後讓學習者透過支持離線開放街道地圖之手機程式與全球定位系統功能，於偏鄉區域進行適地性遊戲之實驗。

研究結論分成三大部分：

1. 此系列課程融入遊戲對學習者之影響：(1)學習者可透過遊戲累積學習經驗，並據以具備信心分享他人；(2)學習者主動結合個人知識與專業於遊戲中提高玩興，並將遊戲中之學習應用於真實世界，產生反思與行動；(3)遊戲中，角色扮演與反轉角色扮演技巧融入、真實事件為基礎之故事背景，以及現實世界為遊戲場景，促進學習者對服務對象產生同理心；(4)小組協同合作與小組競爭，促進高成就學員分享知識予低成就學員，低成就學員則提高溝通與表達能力。
2. 適地性遊戲之發展潛力：(1)可發展跨領域學習，如數學與地理；(2)遊戲設計者除結合巧合元素外，意料外事件亦可帶給學習者擬真的遊戲經驗，使學習者與特定地點產生意義；(3)遊戲評量可結合量化與質化評量指標，以及綜合不同專業教師之評量觀點，並發展虛擬勳章系統作為獎勵，以更全面性地呈現學習者之表現。
3. 提出遊戲模型在界面設計、遊戲角色設定與獎勵系統之改進意見，並探討結合部落傳統智慧以及利用開放地圖計劃平台之適地性遊戲須考量開放部落傳統智慧之倫理問題，應積極邀請部落參與遊戲設計，部落並應具有決定資料開放層面之權力。

關鍵字: 適地性遊戲、手機、全球定位系統、體驗學習、長年野生糧食作物、全方位思考、開放街道地圖、原住民族傳統智慧、泰雅族

Design of an Educational Location-based Game Prototype Evolving Learners' Whole System Thinking Toward Wild Perennial Crops

Student: Meng-Chuan Wu

Advisors: Chuen-Tsai Sun

Degree Program of E-Learning College of Science National Chiao Tung University

ABSTRACT

Location-based Game (LBG), which evolves from street game culture, was mainly designed for entertainment and implemented in rural areas and offline environment while LBG of pedagogic tradition was less developed. My research aims to design an educational LBG prototype to encourage players to do check-ins for Wild Perennial Crops (WPCs) in the offline environment while players could fight against climate change and participate in biodiversity conservation during gaming.

I have collaborated with Rewilding Earth (RE) to design and deploy Rewilding Earth Academy (REA) which is a teaching program with action research method. The field station for game design and teaching program is an Atayal Tribe, Mekarang. Program designers found the generic knowledge between indigenous knowledge and WPCs through local senior interviews and field learning from which to design teaching and gaming materials. RE recruited 25 learners from university and enterprise. During the program, I used participatory observation method to make records and collect data and further analyzed them in order to answer my research questions.

According to my research findings, REA used 4 approaches, WPCs, technology, food culture and education to build up learners' "Whole System Thinking" toward WPCs and developed 7 game episodes to engage and motivate learners and everyone of them obtains knowledge and wisdom from Atayal. OpenStreetMap (OSM) was adopted to develop a WPC centered and Atayal perspective map and the game prototype had been tested by players using GPS smart phones that support offline OSM to do check-ins for WPCs and explore around rural areas.

From data analysis and field observations, I drew my research conclusions into 3 points:

1. Impact of the integration of gaming in a series of teaching programs on the learners: 1) the learners gained learning experiences from playing and gained confidence for sharing, 2) the learners contributed personal knowledge during gaming and practiced knowledge learned from games to engage public issues in the real world, 3) the learners' empathy to targeted service group was fostered by role playing and virtual stories based on real events and scenes, 4) the learners' competence was improved through group collaboration and group competition.
2. Findings in LBG design: 1) it has potentials to foster multidisciplinary learning, such as Mathematics and Geography, 2) unplanned events enhance authentic playing experience, 3) evaluation that combines quantitative and qualitative dimensions, evaluators from different expertise and a virtual badge reward system could show learners' performance in a holistic way.
3. Make suggestions to the WPC game prototype and discuss LBG that involves indigenous knowledge and uses OSM as a participatory mapping platform should consider the ethical issues that indigenous people engagement in the game design is crucial and they should the authority to decide the scale and level of open data.

Keywords: Location-based Gaming, Mobile, GPS, Experiential learning, Wild Perennial Crops, Whole System Thinking, OpenStreetMap, Indigenous knowledge, Atayal

Acknowledgement

Today is Christmas Day, and I finished my thesis writing on this blessing day. I have been wandering in the wild of research for almost 4 years and I finally found a way to the promised land in 2012 with the help of some friends and support from my family.

I would like to send my gratitude to my beloved friends and family in the acknowledgement of my thesis.

Firstly, to my advisor Prof. Sun who encouraged me to continue studying while I worked for community university in Taiwan. I took the challenge then and without his patience and confidence in me, I can't overcome. From him, I learned how to do a decent research and do it right. Prof. Sun as a key founder of Community University Movement in Taiwan, I am very honored to be your comrade in engaging this adult education reform for 12 years.

Secondly, to my fellows of Rewilding Earth. When I hardly continued my writing, Joy Tang guided me to break my personal restrictions and boundaries and find novel process to draw the framework of my research with her tender heart and strong will. She taught me to face my problem in communications and helped me to overcome it. This experience has given me the strength and belief to overcome future challenges in my life. Arne Garvi encouraged me to improvise and to be true to my heart, letting go of my masks and unlearning like a child. Luckily, I found my talents to be a plant lover because of him. Apple Jia who is my soulmate, best friend and the only person I could share my appreciation in arts at the same level in this lonely planet, has been companying with me for 16 years, gave me a free space to paint my thesis and your unconditional love is the light while I loosing confidence.

Thirdly, to Mekarang Church. Pastor Rimuy and Kinfu, they embrace me without any question and condition and take me as one of their members. Pastor Sangas and other seniors and deacons of Mekarang Church lead me to know the beauty and value of indigenous knowledge but most important thing is their wisdom and open mind, the very important treasure given by God, that makes indigenous people the critical gardener on earth.

Finally, to my family which is the silent supporter but is the foundation basis of me as a human being.

Thank them all for giving me a precious gift on this blessing day. I am very proud to be their student, friend and family member.

25 December 2012, in Hsinchu City.



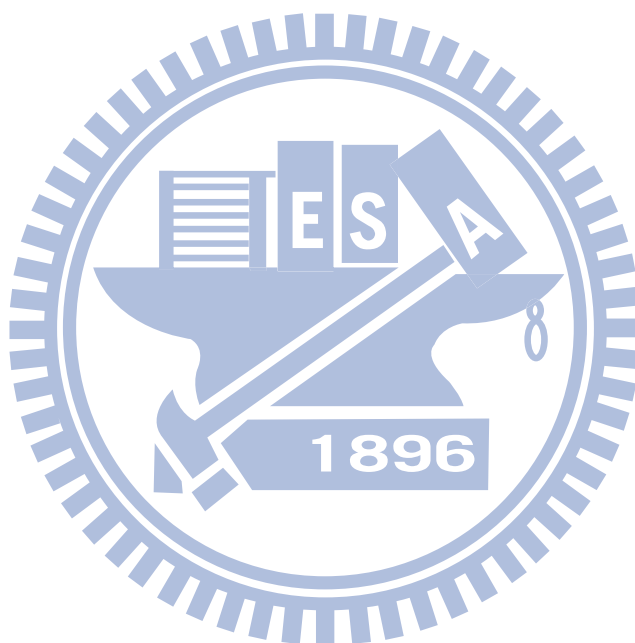
Table of Contents

Chapter 1 :Introduction.....	1
1.1 Research Background.....	1
1.2 A Location-based Game Prototype of WPC Check-in Game.....	1
1.3 Problem Statement.....	3
1.3.1 Old Paradigm of Education Can't Cope with a Changing World.....	3
1.3.2 Traditional Education Ruins Students' Appetite to Learn.....	3
1.3.3 Challenges of Location-based Games development in Rural Areas.....	5
1.4 Research Questions.....	7
1.5 Research Goals.....	8
Chapter 2 :Literature Review.....	9
2.1 Location-Based Game.....	9
2.2 Wild Perennial Crops.....	12
2.3 Rewilding Earth Academy.....	14
2.4 Whole System Thinking.....	15
Chapter 3 :Research Method.....	17
3.1 Introduction.....	17
3.2 Selected Methods and Research Process.....	17
3.3 Passive Transfer Method.....	19
3.4 The Wild Perennial Crops Classroom - Mekarang.....	20
Chapter 4 :Rewilding Earth Academy 2012.....	25
4.1 REA 12 Schedule and Operation Process.....	25
4.2 The Game Space.....	26
4.3 An English Speaking Environment.....	27
4.4 Learner Source and Background.....	27
4.4.1 Learner Attendance.....	28
4.4.2 Learner Competence.....	28
4.5 Four Approaches, White Space and Game Design.....	28
4.5.1 WPC.....	28
4.5.2 Technology.....	34
4.5.3 Food Culture.....	35
4.5.4 Education and White Space.....	36
4.5.5 Hands-on Activities.....	40
4.5.5.1 Hands-on 1. Coming of Age Test in Mekarang.....	41
4.5.5.2 Hands-on 2. Journey into the Unknown.....	42
Chapter 5 :Mapping in the REA 12.....	45
5.1 Using OpenStreetMap as Map Data Source for Gaming.....	45
5.2 To develop the Indigenous Knowledge Maps with OSM.....	45
5.3 Mapping Steps.....	46
5.4 Mapping Outputs.....	46
5.5 Usage of Maps Supported by OSM.....	50

Chapter 6 :Game Rule and Game Result - Episode. 1-3.....	57
6.1 Episode 1: Monkey Perspective and Sensitivity.....	57
6.2 Game Rule.....	57
6.3 Goal.....	57
6.4 Game Result.....	57
6.5 Episode 2: Technology After the Nuclear Disaster.....	59
6.5.1 Game Scenario.....	59
6.5.2 Mission.....	59
6.5.3 Goal.....	59
6.5.4 Score.....	60
6.5.5 Game Result.....	60
6.6 Episode 3: Atayal Cuisine from the Wild.....	64
6.6.1 Game Scenario.....	64
6.6.2 Mission.....	64
6.6.3 Goal and Score.....	64
6.6.4 Program.....	64
6.6.5 Game Result.....	65
6.6.5.1 Presentation of Group 1.....	65
6.6.5.2 Presentation of Group 2.....	67
Chapter 7 :Game Rule and Game Result - Episode. 4-6.....	73
7.1 Episode 4: Colonial Taiwan, 1895-1945.....	73
7.1.1 Game Setting.....	73
7.1.2 Game Rule.....	73
7.1.3 Game Result.....	73
7.1.3.1 Group 1: Mapping Plan.....	74
7.1.3.2 Group 1: Role Missions Assignment.....	75
7.1.3.3 Group 2: Mapping Plan.....	77
7.1.3.4 Group 2: Role Missions Assignment.....	77
7.2 Episode 5: Industrial Taiwan, 1945-2012.....	79
7.2.1 Game Setting.....	79
7.2.2 Game Rule.....	79
7.2.3 Map Material.....	80
7.2.4 Game Result.....	80
7.2.4.1 Group 1: Mapping Plan.....	80
7.2.4.2 Group 1: Role Missions Assignment.....	80
7.2.4.3 Group 2: Mapping Plan.....	82
7.2.4.4 Group 2: Role Missions Assignment.....	83
7.3 Episode 6: Post-Disaster Taiwan, 2012-2100.....	84
7.3.1 Game Setting.....	84
7.3.2 Game Rule.....	85
7.3.3 Game Result.....	85

7.3.3.1 Group 1: Mapping Plan.....	85
7.3.3.2 Group 2: Mapping Plan.....	86
Chapter 8 :Game Rule and Game Result – Hands-on.....	87
8.1 Hands-on 1. Coming of Age Test in Mekarang.....	87
8.1.1 Earth Legend.....	87
8.1.2 Goal for Test.....	87
8.1.3 Program.....	87
8.1.4 Navigation Tools.....	87
8.1.5 Atayal Plants of Interest.....	87
8.1.6 Map Material.....	88
8.1.6.1 Game Result: Group 1.....	88
8.1.6.2 Game Result: Group 2.....	89
8.2 Hands-on 2. Journey into the Unknown.....	90
8.2.1 Earth Legend	90
8.2.2 Unknown Journeys	90
8.2.2.1 Program.....	90
8.2.2.2 Game Result: Group 1.....	90
8.2.2.3 Game Result: Group 2.....	93
8.2.2.4 Game Result: Group 3.....	93
8.2.2.5 Game Result: Group 4.....	95
8.2.2.6 Game Result: Group 5.....	96
Chapter 9 :Conclusions and Discussions.....	99
9.1 Introduction.....	99
9.2 Impact on the Learners.....	99
9.2.1 The Learners Gained Learning Experiences from Playing and Confidence to Share with Other People.....	99
9.2.2 The Learners Contributed Personal Knowledge Inside and Outside of Games.	100
9.2.3 The Learners' Empathy Toward Targeted Service Group Was Fostered by the Role-playing and the Virtual Stories Based on Real Events and Scenes in Games.....	100
9.2.4 The Learners' Competence Was Improved Through Group Collaboration and Group Competition.....	101
9.3 Findings in LBG Design.....	102
9.3.1 Potentials to Foster Multidisciplinary Learnings	102
9.3.2 Incorporating Coincidence and Unplanned Events in the Real World in Game Design.....	102
9.3.3 Evaluation - Combining Quantitative and Qualitative Dimensions.....	103
9.4 Making Suggestions to the WPC Game Prototype.....	106
9.4.1 Mobile Phone App Design.....	106
9.4.2 WPC Icon Design.....	106
9.4.3 Game Character Development.....	106
9.4.4 Reward System.....	107
9.4.5 OSM as a Participatory Mapping Platform and its Related Ethical Issues.....	107

References.....	109
Appendix.....	113



Index of Tables

Table 1: The research methods.....	17
Table 2: Basic Information of Mekarang Tribe.....	22
Table 3: Salon scheme, date, keynote speaker, DDD on gaming and mission on mapping area of REA 12.....	25
Table 4: Salon Operation Process.....	25
Table 5: Name, sex and department of the learners.....	27
Table 6: RE's findings in the relation between WPCs and the traditional knowledge of Atayal people, field observations on WPCs and the integration of the above into games of REA 12.	29
Table 7: Atayal WPCs, identification features and pictures.....	32
Table 8: The comparison of game setting of Episode 4, 5 and 6.....	39
Table 9: The comparison of role-playing in 6 domains of Episode 4, 5 and 6.....	40
Table 10: Creation of object tags for REA 12 on OSM.....	46
Table 11: Map mission area and map materials used in REA 12.....	50
Table 12: Episode 2 Score Rule.....	60
Table 13: Score Rule of Episode 3.....	64
Table 14: Game rules of Episode 4.....	73
Table 15: Presenter, mission assignment and connections among roles of Group 1 in Episode 4.....	75
Table 16: Presenter and mission assignment of Group 2 in Episode 4.....	77
Table 17: Game rules of Episode 5.....	79
Table 18: Game rules of Episode 6.....	85
Table 19: The usage and result of group evaluation in Episode 1, 2 and 3.....	104
Table 20: Evaluators and evaluation dimensions of Episode 1, 2 and 3.....	105

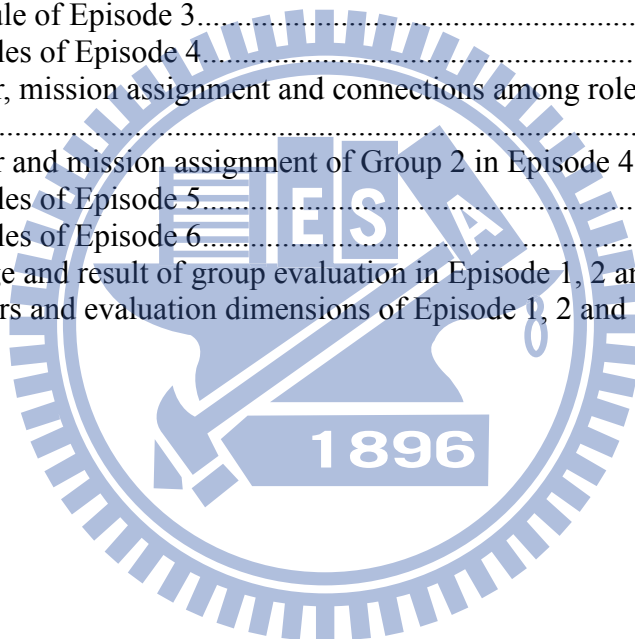




Illustration Index

Illustration 1: Using a GPS smart phone to do tracking, way points and photo taking of WPCs in rural areas.....	2
Illustration 2: Using an iPhone app, myTracks, to do tracking, add way points and take photos of WPCs.	2
Illustration 3: A learner was doing WPC check-ins in a raining day at the entrance of the Kaway Path.....	2
Illustration 4: Learners were doing WPC check-ins on the Kaway Path in Hands-on 1.....	2
Illustration 5: The comparison between OpenStreetMap and Google Maps in the area of Mekarang.	7
Illustration 6: "Savannah" is an educational game for children to simulate lions' behaviors in savannah. Players navigate the augmented environments with mobile handheld devices.....	9
Illustration 7: "Uncle Roy All Around You" is a city touring game. Players use handheld computers with the map and incoming messages to explore the city and search for Uncle Roy.	9
Illustration 8: Snapshots of Japanese TV program "全員逃走中".....	10
Illustration 9: The four game patters of LBG.....	11
Illustration 10: The GPS track that RE recorded was the data acquisition for the game maps of REA 12.....	12
Illustration 11: White Space, the six domains and the customization of Whole System Thinking toward WPCs.....	15
Illustration 12: The research process.....	18
Illustration 13: Mekarang Village and Hsinchu City's satellite map in Google Maps.....	20
Illustration 14: Mekarang is in 竹 62, many hot spring hotels are constructing along 竹 61 and the road stretches to the higher mountainous tribes such as Cinsbu (鎮西堡) and Smangus (司馬庫斯) is 竹 60.	21
Illustration 15: Brooks, mountains, villages, roads and important places around and inside of Mekarang Village in Google Maps.....	21
Illustration 16: The overlook of game space of REA 12.....	26
Illustration 17: The learners were playing as macaques to find food in the wild.....	29
Illustration 18: A learner mimicked macaque behavior.....	29
Illustration 19: The cement wall beside the green car and the power pole was designed to stop the flooding from the re-entrant.....	31
Illustration 20: The location where the green car parked is the re-entrant and its high humidity supports wild banana trees, Common Tree Fern and Giant Elephant's Ear to grow.....	31
Illustration 21: The learners were checking devices in hand.....	35
Illustration 22: The learners played the game in the raining day.....	35
Illustration 23: A learner used a brick as the pen to draw the map on the stone.....	35
Illustration 24: A learner used Giant Elephant's Ear as the shelter.....	35
Illustration 25: Mekarang people used rice to ferment raw pork.....	36
Illustration 26: Ikea sells the basket made of banana leaves.....	36
Illustration 27: The wild banana fruit has seeds inside.....	36
Illustration 28: The wild banana fruits.....	36
Illustration 29: Suburbs of SimCity.....	37
Illustration 30: Wind Farm of SimCity.....	37
Illustration 31: The learners did the mapping plan outside of Mekarang Church to image what impact will bring to the local environment.	38

Illustration 32: The learners were grouped to investigate WPCs on Church Road in Episode 6.	38
Illustration 33: The learners were marking WPCs on Church Road in Episode 6.	39
Illustration 34: The learners were discussing "Church Road Undevelopment Plan" in Episode 6.	39
Illustration 35: The learners were using the GPS cellphone and print-out map to find the entrance of the Kaway Path.	41
Illustration 36: The learners were approaching to the entrance of the Kaway Path.	41
Illustration 37: The learners were discussing the map drawing.	42
Illustration 38: The group presentation and reflection.	42
Illustration 39: Locations of villages in Jianshi Township.	43
Illustration 40: A learner asked the local people about the target place's location.	43
Illustration 41: A learner asked Senior Dali about Naro's location.	43
Illustration 42: The zoom-in area of Mekarang Road, OpenStreetMap used in Episode 1 and 3.	52
Illustration 43: The zoom-in area of School Road, OpenStreetMap used in Episode 2.	53
Illustration 44: The print-out map in A3 size, OpenCycleMap, used in Episode 4-5.	54
Illustration 45: The print-out map in A3 size, OpenStreetMap Mapnik in Google Earth, used in Episode 6.	54
Illustration 46: The print-out map in A3 size, "Google Aerial" Base Layer, "OpenStreetMap Mapnik" and "Hillshading" Overlays, Transparent Map Comparisons, used in Episode 6.	55
Illustration 47: The print-out map in A3 size, "Landscape" Base Layer, OpenCycleMap, used in Episode 6.	55
Illustration 48: The zoom-out area of the Kaway Path, OpenStreetMap used in Hands-on 1.	56
Illustration 49: The zoom-in area of the Kaway Path, print-out map in A1 size, OpenStreetMap used in Hands-on 1.	56
Illustration 50: The presentation of Group 1 in Episode 1.	58
Illustration 51: The presentation of Group 3 in Episode 1.	58
Illustration 52: The presentation of Group 4 in Episode 1.	59
Illustration 53: The presentation of Group 1 in Episode 2.	61
Illustration 54: The presentation of Group 2 in Episode 2.	62
Illustration 55: The presentation of Group 3 in Episode 2 (Part 1).	63
Illustration 56: The presentation of Group 3 in Episode 2 (Part 2).	63
Illustration 57: The front of mapping plan of Group 1 in Episode 4.	74
Illustration 58: The back of mapping plan of Group 1 in Episode 4.	74
Illustration 59: The mapping plan of Group 2 in Episode 4.	77
Illustration 60: The mapping plan of Group 1 in Episode 5.	80
Illustration 61: The mapping plan of Group 2 in Episode 5.	82
Illustration 62: The mapping plan of Group 1 in Episode 6.	86
Illustration 63: The mapping plan of Group 2 in Episode 6.	86
Illustration 64: The mapping result of Group 1 in Hands-on 1.	88
Illustration 65: WPC check-in result on the Kaway Path of Group 1 in Hands-on 1.	88
Illustration 66: The mapping result of Group 2 in Hands-on 1.	89
Illustration 67: WPC check-in result on the Kaway Path of Group 2 in Hands-on 1.	89
Illustration 68: GPS track and WPC check-ins from Mekarang Church to Senior Dali's house of Group 1 in Hands-on 2, Google Earth.	91
Illustration 69: Another view on GPS track and WPC check-ins from Mekarang Church to Senior Dali's house of Group 1 in Hands-on 2, Google Earth.	91

Illustration 70: Zoom-in on GPS track and WPC check-ins from Mekarang Church to Senior Dali's house of Group 1 in Hands-on 2, Google Earth.....	92
Illustration 71: Storytelling on the encounter with Senior Dali of Group 1 in Hands-on 2.....	92
Illustration 72: Storytelling on the exploration of Group 2 in Hands-on 2.....	93
Illustration 73: GPS track and WPC check-ins from Mekarang Church to Slaq of Group 3 in Hands-on 2, Google Earth.....	94
Illustration 74: Zoom-in on GPS track and WPC check-ins from Mekarang Church to Slaq of Group 3 in Hands-on 2, Google Earth.....	94
Illustration 75: Storytelling on the exploration of Group 3 in Hands-on 2.....	95
Illustration 76: Storytelling on the exploration of Group 4 in Hands-on 2.....	95
Illustration 77: GPS track, photos and WPC check-ins from Mekarang to Slaq of Group 5 in Hands-on 2, MS PowerPoints.....	96
Illustration 78: GPS track and WPC check-ins from Mekarang to Slaq of Group 5 in Hands-on 2, Google Earth.....	97
Illustration 79: Another view on GPS track and WPC check-ins from Mekarang to Slaq of Group 5 in Hands-on 2, Google Earth.....	97
Illustration 80: A Picture of banana trees on the track from Mekarang to Slaq of Group 5 in Hands-on 2, Google Earth.....	98
Illustration 81: This is a tana tree founded on 竹 62.....	102
Illustration 82: This tana tree is between power pole "梅花高幹 62" and "梅花高幹 63".....	102



