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Role-play Gaming Simulation for Flood Management on Cultural Heritage: A Case Study of Ayutthaya Historic City

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Abstract**—**The main aim of this research is to develop a methodology to encourage people's awareness, knowledge and understanding on the participation of flood management for cultural heritage, as the cooperation and interaction among government section, private section, and public section through role-play gaming simulation theory. The format of this research is to develop Role-play gaming simulation from existing documents, game or role-playing from several sources and existing data of the research site. We found that role-play gaming simulation can be implemented to help improving the understanding of the existing problem and the impact of the flood on cultural heritage, and the role-play game can be developed into the tool to improve people's knowledge, understanding and awareness about people's participation for flood management on cultural heritage, moreover the cooperation among the government, private section and public section will be improved through the theory of role-play gaming simulation.

Keywords**—**Climate change, Role-play gaming simulation, Sustainable development, Public participation, Cultural heritage

I. Introduction

THE character of cultural heritage is closely related to the climate and environment. The rural landscapes have developed in response to the plant species that are able to flourish in different climatic regimes. The urban landscapes and the built heritages were designed with the local climate in mind. The stability of cultural heritage is, therefore, closely tied to its interactions with the environment. And where cultural heritage sites are in daily use and occupied by local communities, significant adaptive changes may possibly be needed. Flooding is expected to have significant impact on cultural heritage, with the invariably dirty water and the erosive character of rapid flowing water, it will damage building materials that was not designed to withstand prolonged immersion. In addition, post-flooding drying may encourage the growth of damaging microorganisms such as molds and fungi and staining.In the case of Thailand's cultural heritage, flooding as shown in Table I and Fig. 1, especially the flood incident in 2009-2011 have mainly damaged Ayutthaya historical city.

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As you can see that, the damage has been rising so we must do something to mitigate this problem in sustainable way. And the most Significant way is *People participation*, even though the government has been trying to promote Public hearing, Seminar, Handout, Questionnaire as the method for people participation but these methodologies are proved unsuccessful. There is still lack of people's awareness and understanding to participate with government sector for cultural heritage protection and mitigation. The three main objectives of this research begins with firstly to study and analyze the possibility to apply the role-play gaming simulation as a capacity building and communication tool for people's awareness, knowledge and understanding, secondly to study and analyze the cause of flood and the way to manage flood problem in community-based term, finally to design, develop and adjust the tool (Role-play gaming simulation) to provide knowledge in flood manage.

TABLE I
DAMAGE FROM FLOOD IN AYUTTHAYA AREA IN 2002-2006

Year	*Suffered Resident (Peoples)*	*Suffered Resident (Households)*	*Refuge (Peoples)*	*Decease (Peoples)*	*Damages (Baht)*
2006	269,692	77,110	42	73	2,035,086,900
2005	32,562	6520	520	-	50,450,500
2004	16,200	6500	-	-	1,250,000
2003	960	240	-	-	No data
2002	266,986	68,414	1,789	28	114,765,300

Fig. 1 Flood in Ayutthaya Year 2011

II. Community-based Flood Management and Role-play Gaming Simulation

A. Community-based Flood Management

Community activities play an important role as a front-line at each stage of flood management that is preparedness for, response to and recovery from flood disasters. It has become apparent that top-down approaches to disaster risk management failed to address the specific needs of vulnerable communities.

It should be noted here that community participation in flood risk assessment as well as in planning and implementation of risk management measures is a key to success of flood risk management plans.

Community participation for flood management can be organized through community's needs, effectiveness and efficiency, and practical implementation. Strategic approaches to organizing community participation comprise of three perspectives: maximizing resources through integrated use of local knowledge, understanding each stakeholder's expected role and degree of involvement, and enhancing motivation through social-economic incentives and systematic training. [19]

B. Gaming Simulation (GS)

The concept of Gaming Simulation that will be used for this study has two main aspects, the first one is a tool for capacity improving and second one is about collaboration improvement tool, There are many studies about Gaming Simulation and many of them show that Gaming Simulation can be apply for both learning tool and communication tool; here are some benefits of GS in the aspect of capacity improving, such as 1. They are superior to other teaching methods for helping *students develop skills such as complex problem-solving*, strategic decision making and behavioral skills, including teamwork and organizing (Salas, Wildman, & Piccolo, 2009; Tompson & Dass, 2000), 2. They allow participants to *develop a global perspective*, to connect learning with real-world situations and to get close to the realities of a competitive business world (Faria & Dickinson, 1994; Haapasalo & Hyvonen, 2001; Hoberman & Mailick, 1992; Lainema & Hilmola, 2005), 3. Because they are *dynamic*, simulation games allow *"students to experience the impact of change over time"* (Cook & Swift, 2006, p. 38). They are also particularly useful to help students understand systemic effects and unintended consequences (Machuca, 2000), 4. We can simulate certain realities, play, manipulate and experiment and experience what the consequences are or what they might become (Dieleman & Huisingh, 2010).

As a communication tool to improve collaboration, Gaming Simulation makes complex information more understandable, GS shows more potential to consider different perspectives on the problem at hand than many other types of media, such as mathematical language or computer simulation models. The "multilogue" is a variety of interpersonal interactions (such as persuasion and negotiation) that occur quite naturally among game players. (Fig. 2) Nature of gaming is very helpful when we try to create disaster risk-sharing partnerships among a wider variety of stakeholders. [22]

Games for 'communication and collaboration' help one to *understand and experience invisible mechanisms that take place when one communicates and collaborates*. In terms of the experiential learning cycle of Kolb, games for 'communication and collaboration' are very useful in various stages. [7] (Fig. 3)

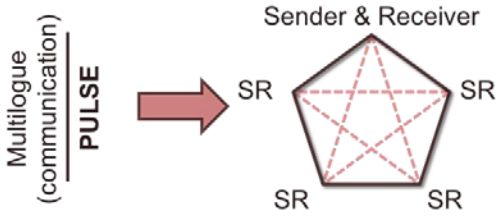

Fig. 2 Multilogue communication

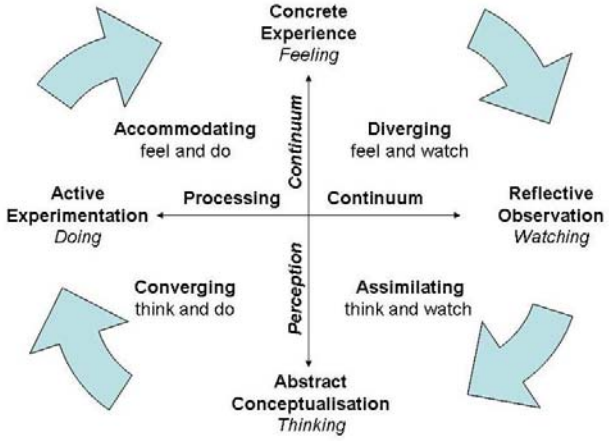

Fig. 3 Kolb learning cycle

In stage 1 they can be useful in *understanding the concrete experiences* and the realities we observe and experience. In Kolb's stage 2, when dealing with tools and techniques, they play a role in the *selection and usage of management tools and techniques.* In part three, they can be *extremely useful when one works in multi-disciplinary teams,* One of the key challenges of working in multi-disciplinary teams is to understand and respect each other, despite the fact that they don't always understand each other's analyses.

C. Role-playing

Role-playing is a methodology that applied in people participation process because role-playing suitable for non-professional participants (Kesten C. Green 2002) role-playing create more informal atmosphere than public hearing, seminar and conference that used for people participation in the present time because the players exchange their role to increase the understanding among private sector, public sector and people sector. More over Marios C. Angelides also emphasized that role-playing will make the players aware and understand their role and other player's role. Role-playing also create learning behavior and exchange of knowledge, information and understanding between players and observer and also among the players (Marios C. Angelides, Ray J. Paul 1998).

III. Research Methodology

This study consists of three main issues 1) Problem identification 2) Learning tool 3) Output (Fig. 4).

There are two methodologies apply in this research which are qualitative research through *Primary data* survey method, Observation on 7/2/2011 and Formal interview (30 samples) on 7/2/2011 to design a role-play gaming simulation that suitable for the study area and *Secondary data* documentary research from educational office, administrative office, government sector, private sector that relate to study area, Documents data, Data maps, Plans, Articles, Research papers, Existing game etc. to analyze research variable and basic element. The Qualitative data will be implemented to design Role-play gaming simulation.

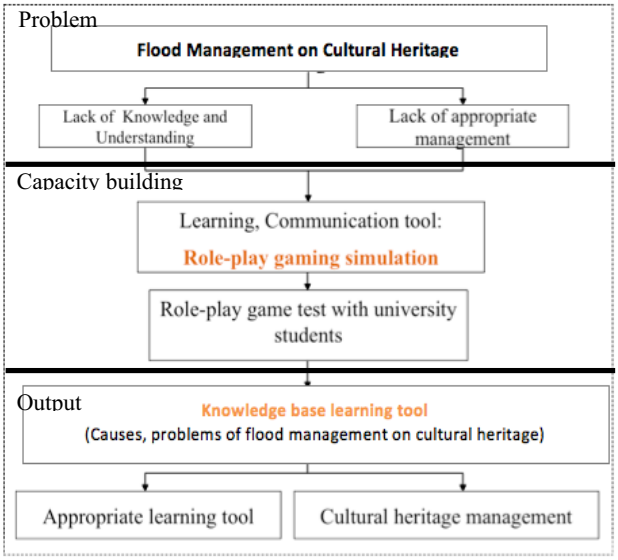

Fig. 4 Conceptual Framework

After designed Role-play gaming simulation the researchers used Role-play gaming simulation to conduct experimental research in three steps which are *Pre-test, Test* and *Post-test* to find the improvement of player's knowledge, understanding and awareness. And the final part of the research is Conclusion and Recommendation. The step of the research is shown in Fig. 5.

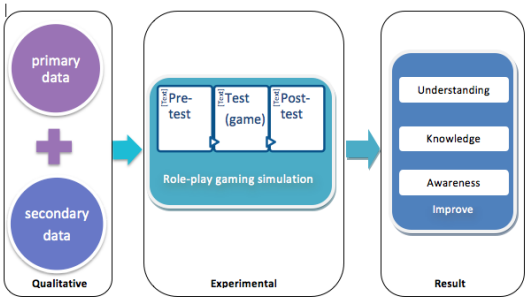

Fig. 5 Step of Research

IV. Role-played Gaming Simulation Concept

Meta level: based on reality about flood management on cultural heritage.

Game level: Knowledge transfer and exchange about flood management on cultural heritage in the game (See Table II).

TABLE II
Role-played Gaming Simulation Concept

Context (Meta level)	*Game (Game level)*
Who?: University student	1) Urban planner 2) Local administrative 3) Resident 4) School 5) Historian 6) Environmentalist 7) Tourist 8) Merchant 9) Press 10) Community network
What?: flood management on cultural heritage	: Knowledge transfer and exchange about flood management on cultural heritage between player and game designer
When?: flood management on cultural heritage in daily life	: Project development for Flood management on Ayutthaya historical city
Where?: cultural heritage area	: Ayutthaya Historical City
Why?: Improve people's awareness and understanding to participate in flood management on cultural heritage	: Simple Knowledge transfer and exchange about flood management on cultural heritage

A. 5 main contexts of the game

1. Problem and impact of flood disaster
2. Community-based flood management
3. People participation in flood management on cultural heritage
4. Awareness about the problems and appropriated way to deal with them
5. Learning about existing flood disaster and cultural heritage situation

B. Rule of the game

1. 1 game facilitator plays a role of town governor who will chooses the scenario for the players and also give a final decision on the project the player proposes.

2. Players have to think of a project to tackle with the scenario the town governor chooses under the limitation of their roles.

3. The final project should be acceptable by all of the players.

C. Role and player

Player's roles are separated by group of stakeholder, 5 Groups 10 roles (at least ten peoples).

1. Local people group (Resident, Teacher)
2. Business group (Merchant, Tourist)
3. Government group (Urban planner, Local administrative)
4. Expert group (Environmentalist, Historian)
5. Media group (Press, Community network)

Condition: Different in power, manpower, budget, role, aim and knowledge. These attributes come from interview, field survey and documentary research (ex. willingness to pay to help, how will you participate, your contribution to the community, etc.)

D. Tool

1. Ayutthaya Historical City Map (Fig. 6), 2. Scenario, sample project, 3. Player cards (Fig. 7), 4. Pre-test, 5. Post-test.

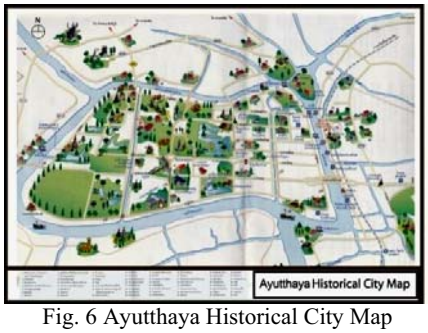

Fig. 6 Ayutthaya Historical City Map

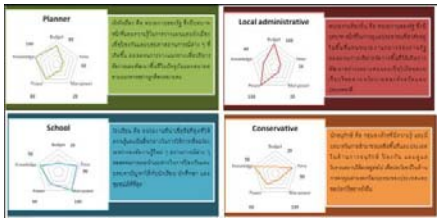

Fig. 7 Players cards

E. Simulation

In the present time, climate change situation is occurring all over the world. Thailand also effected by impact of climate change such as Tsunami, flooding, heat wave, change of temperature and seasons, etc. especially the flood disaster in the last few years, not only that these impacts effect not only human but also the cultural heritage, especially the Ayutthaya historical city, the sites and also the historical buildings has been damaged by the disaster such as flood. However the local people still lack of awareness, knowledge and understanding about the importance and consequence of flood disaster.

F. Step of the game

(1) Brief about the rule of the game and step of the game (5 minutes) 3 Facilitators, the head of the game that play as a role of town governor, cameraman, observer.

(2) Pre-test (5-10 minutes)

Pre-test questionnaire

1. Who would be responded for Flood management on cultural heritage?
2. What is the cause of Flood disaster?
3. What is the impact of Flood disaster on cultural heritage?
4. What can be done to protect and mitigate Flood disaster impact on cultural heritage?

(3) Random the role for each player (15-20 minutes)

The town governor chooses a scenario and each player thinks of a project for that scenario then consult and brainstorm within their group to propose only one project in the town meeting so there will be 5 projects in the town meeting.

(4) Town meeting (30 minutes)

Each group present their project and try to convince the other group, negotiate and consult among groups to fine the project to propose to the town governor

The town governor gives the decision and then move to another scenario or adjusts or changes the project.

(5) Each player writes a brief summary about his or her experience in role-play game (10 minutes)

(6) Debriefing (10 minutes)

1. Significant and role of each role
2. Advantage and disadvantage of each project
3. Impact of flood disaster on cultural heritage
4. Flood management on cultural heritage
5. People participation

(7) Post-test (5-10 minutes)

We use the same questionnaire as Pre-test in the Post-test step to see player's improvement.

G. Scenario

1. Climate change

Climate change occurs in every part of the world including Thailand and Ayutthaya historical city causing in rising temperature, change in season, hotter summer and colder winter, increasing in rain water, heat wave. Those impacts affect the daily life of the town people as well as cultural heritage site and historical building.

2. Prepare for flood

From the increasing of flooding problems every year, which will have the directly impact on historical building in Ayutthaya as well as the local resident and the economic from tourist market which is the main force of city development, ways to protect & mitigate flooding problems in the future.

3. Flood

Yearly rainwater is rising from 150 mm to 3000 mm by the impact of climate change. Intense precipitation is damaging the base of the temple. It leads to greater humidity in the lower parts of the buildings and, consequently, to an increase in salt contamination of the structures and to the growth of vegetation such as reeds and water lilies in the low lying area. The cultural heritage areas are damaged and the water from Chao Phraya River still overflows the embankment. Local residents suffer from flooding and tourist stop coming to Ayutthaya.

V. Result

A. Gaming Phenomena

The Role-play game has many phenomena to the player throughout the eight steps of the game as follow:

In step 1 (Briefing): the player learned and graphed some idea about the game and how to play the game.

In step 2 (Pre-test): We learned how much the player knew about the flood situation, flood management, cultural heritage. For the player, they also learned that they knew little about flood management or they have not paid attention much to this situation. Some of them could give only just one or two answers for each question. In this step, it raised the awareness of the player.

In step 3 (Random the role of the player): The player learned about the different of the stakeholders that involve in flood management, they saw the advantage and disadvantage of their role and started to think about what they could do to help or to participate in flood management. In this step, it raised the understanding of the player.

In step 4 (Scenario): The player started to learn and realized the situation of flood disaster and also the impact of it to themselves and cultural heritages. In this step, it raised the awareness and understanding of the player.

In step 5 (Town meeting): The most important step of the game, the player expressed their thoughts, opinions, ideas, etc. with other player. This step is for brainstorming, they exchanged the knowledge they have gained from thinking about their projects within the group and between the groups, and they started to see the other's point of view, learned about the ideas that they could not come up with, saw the obstacle of other stakeholders. In this step, it raised the knowledge and understanding of the player (Fig. 8).

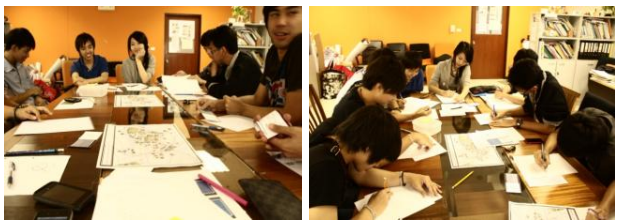

Fig. 8 Role-play game, Town meeting and post-test steps.

In step 6 (Decision making): This step is for negotiation, the player learned to communicate, to negotiate, to persuade, to working together to achieve the goal, during this step, there were several arguments and negotiations among the players, all of the players would like their project to be accepted. The most influential group in the game was the government group followed by the expert group. The media group acted like the intermediary or negotiator to bring everyone together to accept the project. In this step, it helps raise the collaboration and cooperation of the player.

In step 7 (Debriefing): Also indispensable step in the Role-play game, it gave the opportunity for the player to summarized their experience in the game, more over they were explained about the aim, important and benefit of each steps of the game. They could summarize what they have learned and got the concrete idea and knowledge of flood management. In this step, it raised the knowledge and understanding of the player.

B. Pre-test and Post-test Result

After playing the role-play game, Post-test results were better as shown in the Fig. 9 that every player could give more answers and more detail of the answers in all of the three questions.

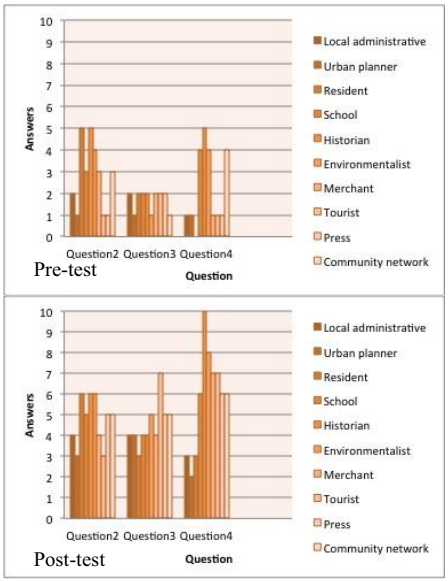

Fig. 9 Pre-test and Post-test result

Role-play game can be effectively used as a learning tool about flood management on cultural heritage for university student such as the issue of the cause, problem, ways to deal with flood and also the impact of flood disaster on cultural heritage.

During the game there were several arguments and negotiation among the roles especially between the government group which tried to propose a mega project and experts group which tried to propose education or raising awareness project but every role tried to talk and solve the conflict and found a public consensus by combining all of the project together into one mega project that they found everyone agree with. During the argument and negotiation player became more aware of their roles and the importance of their roles.

C. Debriefing and Discussion

Not only the game can transfer knowledge to the player but it can also exchange knowledge, thought and insight among player and also between player and game designer. After the game, players gave some Thoughts and Recommendations about flood management on cultural heritage that appropriate to apply in the real world and they mainly pointed the projects in three levels. (See Table III)

Moreover, they pointed out that we cannot use only one project to solve flood disaster problems and every sector has to cooperate and participate. There is the need of learning methodology and knowledge transfer & exchange tool for the improvement of knowledge, understanding and awareness in every sector.

TABLE III
THOUGH AND RECOMMENDATION FROM THE PLAYER

Knowledge, Understanding, Awareness development level	*Protection level*	*Mitigation level*
Improve people knowledge through mass media	Cultural heritage protection and management fund	Digging water trench, pump the water out of the cultural heritage area when the flood occur
Climate change/ Flood disaster campaign	Policy to reduce natural resources consumption	Damage of cultural heritage evaluation and report
Public relations and advertisement	Town zoning to separate land use	Cultural heritage repair and restoration
Workshop	Build and prepare the tool to protect cultural heritage from flooding	Fund for Suffered Resident
Community group and community knowledge center	Develop and build early warning system	Report correct information and real situation through mass media
	Prohibit development project or building and housing project in the risk area	Government providing fund for the mitigation, repair and restoration of cultural heritage
	Cultural heritage protection policy	Improve the structure of damaged historical building
	Reduce the use of private car	Introduce flood insurance
	Cultural heritage surveillance group	
	Increase green area	
	Improve the structure of historical building	

VI. CONCLUSION

Role-play gaming simulation can be implemented as a learning tool to transfer the knowledge of community-based flood management for the protection of cultural heritage as well as communication tool to raise people awareness and collaboration among the players. However, due to the limited of time, budget for this research and also staff to facilitate the game in the real community, the developed role-played gaming simulation was tested with the university student rather than the community people and real stakeholder themselves, tough the results of pre-test and post-test might be different, for further study the game should be applied in the real community and explore more on the result of post-test to see the depth and significant of the answer.

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REFERENCES

[1] C. Denpaiboon, M. Srivanit, H. Kanegae, "Adopting and adapting the Japanese of floods disaster and historical city preservation: New Approach of improvement "People empowering for disaster prevention" A Case Study of Ayutthaya the World Heritage Area in Thailand." SUMITOMO Japan, 2009.
[2] C. Denpaiboon, "Urban Gaming Simulation" Thammasat Thailand, 2010.
[3] C. S. Greenblat & R. D. Duke, "Gaming-Simulation: Rationale Design, and Applications." New York: Halsted, 1975.
[4] C. Washington-Ottombre, B. Pijanowski, D. Campbell, J. Olson, J. Maitima, A. Musili, T. Kibak, H. Kaburu, P. Hayombe, E. Owango, B. Irigia, S. Gichere, A. Mwangi, "Using a role-playing game to inform the development of land-use models for the study of a complex socio-ecological system." Agricultural Systems, 2010, pp. 117-126.
[5] G. E. Bolton, "Game theory's role in role-playing." International Journal of Forecasting, 2002, pp. 353-358.
[6] G. Wright, "Game theory, game theorists, university students, role-playing and forecasting ability." International Journal of Forecasting, 2002, pp. 383-387.
[7] H. Dielemen. & D. Huisingh, "Gaming by which to learn and teach about sustainable development." Elsevier Ltd, 2005.
[8] H. Kanegae, "Gaming Simulation." Kyoto: Ritsumeikan University, 2009.
[9] H. Shefrin, "Behavioral decision making, forecasting, game theory, and role-play." International Journal of Forecasting, 2002, pp. 375-382.
[10] I. S. Mayer, L. Carton, M. de Jong, M. Leijten, E. Dammers, "Gaming the future of an urban network." Futures 36, 2004, pp. 311-333.
[11] J. S. Armstrong, "Assessing game theory. Role playing, and unaided judgment." International Journal of Forecasting, 2002, pp. 345-352.
[12] J. L. A. Geurts, R. D. Duke and P. A. M. Vermeulen, "Policy Gaming for Strategy and Change." Long Range Planning, 2007, pp. 535-558.
[13] J. Moffat, J. Medhurst, "Modelling of human decision-making in simulation models of conflict using experimental gaming." European Journal of Operational Research, 2009, pp. 1147-1157.
[14] K. Al-Kodmany, "Using visualization techniques for enhancing public participation in planning and design: process, implementation, and evaluation." Landscape and Urban Planning, 1999, pp. 37-45.
[15] K. C. Green, "Forecasting decisions in conflict situations: a comparison of game theory, role-playing, and unaided judgment." International Journal of Forecasting, 2002, pp. 321-344.
[16] K. Johnson, C. Hays, "Building capacity and sustainable prevention innovations: a sustainability planning model." Evaluation and Program Planning 27, 2004, pp. 135-149.
[17] K. Yamori, "Action Research on Disaster Reduction Education: Building a "Community of Practice" through a Gaming Approach." Journal of Natural Disaster Science, 2009.
[18] M. C. Angelides, R. J. Paul, "A Methodology for specific, total enterprise, role-playing, intelligent gaming-simulation environment development." Decision Support Systems 25, 1998.
[19] M. Murase, "Organizing Community Participation for Integrated Flood Management." World Meteorological Organization, 2008.
[20] P. Huyakorn, "Climate change damage protection and mitigation through role-play: A case study of Ayutthaya's cultural heritage." APTU, 2011.
[21] P. Rizzi, "Gaming Simulation for Urban Management and Urban Planning." ISAGA 2004 Conference, 2004.
[22] R. D. Duke, "Gaming: the Future's Language." Sage publication, 1974.