

Development of a Mixed-Media Learning Environment on Global Warming for Rural Households with an Information Education in Thailand

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[Abstract] To develop a mixed-media learning environment on global warming in rural households, household members' understanding, knowledge, and attitudes were investigated. The effects of educating households about enhancements to the community were assessed both pre- and post-dissemination of information about global warming. Using a mixed-media learning technique to gather information on their understanding and knowledge, a questionnaire was used. Rural household attitudes were analyzed with a sample of 400 people aged 15-60 years old and living in Wang Nam Yen and Klong Had Districts in Sa Kaeo Province, Thailand. The Krejcie and Morgan technique selected a random sample size from 101,725 people, and the percentage, mean, standard deviation, t-test, and F-test were analyzed. It was found that the quality of the mixed media on global warming information education was at the highest level and that it confirmed criterion; rural households' perceptions of their pre- and post-understanding and knowledge from their studying using mixed media showed significant differences. Significantly ($p < .05$), the pre- and post-persistence attitudes on mixed media were differentiated at a level of .05, and their understanding knowledge was at the high level of 78.20%.

[Keywords] Development, global warming, information education, mixed medias learning, rural households, Sa Kaeo province

Introduction

Global warming is the observed rise in the average temperature of the earth's climate system (IPCC, 2013, p. 2). Since 1971, 90% of the increased energy has been stored in the oceans, mostly in the 0 to 700m region (IPCC, 2013, p. 6). Despite the oceans' dominant role in energy storage, the term "global warming" is also used to refer to increases in average temperature of the air and sea at the earth's surface (Riebeek, 2010). Since the early 20th century, the global air and sea surface temperature has increased about 0.8 °C (1.4 °F), with about two-thirds of the increase occurring since 1980 (The National Academies Press, 2011: 15). Each of the last three decades has been successively warmer at the earth's surface than any preceding decade since 1850 (IPCC, 2513, p. 3).

Scientific understanding of the cause of global warming has been increasing. In its fourth assessment (AR4, 2007) of the relevant scientific literature, the Intergovernmental Panel on Climate Change (IPCC) reported that scientists were more than 90% certain that most of global warming was being caused by increasing concentrations of greenhouse gases produced by human activities (National Research Council, 2010, p.1). In 2010, that finding was recognized by the national science academies of all major industrialized nations (Kirby, 2001). Affirming these findings in 2013, the IPCC stated that the largest driver of global warming is carbon dioxide emissions from fossil fuel combustion, cement production, and land use changes, such as deforestation (IPCC, 2013, p.10). Its 2013 report states: "Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. This evidence for human influence has grown since AR4. It is extremely likely (95-100%) that human influence has been the dominant cause of the observed warming since the mid-20th century." (IPCC AR5 WG1 Summary for Policymakers) (IPCC, 2013, p.2).

Climate model projections were summarized in the 2013 Fifth Assessment Report (AR5) by the IPCC. It indicated that during the 21st century, the global surface temperature is likely to further rise from 0.3 to 1.7 °C (0.5 to 3.1 °F) for their lowest emissions scenario using stringent mitigation and 2.6 to 4.8 °C (4.7 to 8.6 °F) for their highest (Stocker et al., 2013). The ranges of these estimates arise from the use of models with differing sensitivities to greenhouse gas concentrations (Schneider, 2006).

Future climate change and associated impacts will vary from region to region around the globe (Parry et al., 2007). The effects of an increase in global temperature include a rise in sea levels and a change in the amount and pattern of precipitation, as well as a probable expansion of subtropical deserts (Jian, Gabriel, and Thomas, 2007). Warming is expected to be strongest in the Arctic, with the continuing retreat of glaciers, permafrost, and sea ice. Other likely effects of the warming include more frequent extreme weather events, including heat waves, droughts, heavy rainfall, ocean acidification, and species extinctions due to shifting temperatures. Effects significant to humans include threats to food security from decreasing crop yields and the loss of habitat from inundation (Battisti & Naylor, 2009).

Global warming is no longer a conspiratorial hoax, nor a phony threat created by some environmentalists with a hidden agenda. In fact, this natural phenomenon is more real than people could possibly imagine. Its existence and threats to mankind have been scientifically documented with concrete evidence, statistical data, and occurrences that should be sufficient to keep world citizens from ignoring the reality while also urging them to reflect on their actions. Though global warming and climate change are not entirely man-made, its negative repercussions have indeed become more accelerated and amplified due to overexploitation of natural resources and economic activities driven by mankind. Excessive greenhouse gases in the earth's atmosphere, species extinction, revival of wiped-out diseases, fluctuating lengths of seasons, coastal flooding, rapid sea level rise, unpredictable changes in meteorological conditions, and more severe and frequent storms are all clear indicators that should remind people that the threat from global warming is real and imminent. Over the past decade, Thailand has witnessed and suffered from a variety of natural disasters that were quite extreme in both dimension and consequence.

Besides the 2007 Asian tsunami, the nation has also been plagued by recurring inundation caused by lengthy and heavy rainfalls, intense drought, severe cold weather, and declining quality and production of agricultural crops, etc. Thus, the Thai government has to seriously take these matters into account, either by implementing health and environmental policies or by cooperating with other nations and/or organizations in a mutual effort to confront global warming. The city of Bangkok, on the other hand, also has been tackling the effects of global warming through specific approaches that would eventually become the most challenging task for both provincial and state authorities in the future (National News Bureau of Thailand, 2012).

The 2013 monsoon season (August 2013 - December 2013) is seeing large-scale flooding return to Indochina after a calmer 2012. Poverty-stricken Cambodia has been hardest hit, with some 83 deaths so far. Also hit include Vietnam, Thailand, Laos, and Myanmar. The Philippines has seen the annual typhoon-related occurrences, which often pummel Indochina. Flooding and/or related typhoon damage is an annual occurrence in all of Southeast Asia. However, deforestation, land subsidence, and poor drainage have exacerbated existing problems, while infrastructure development, such as dams, drainage, and pumps have lessened it elsewhere. Despite a long history of devastation and little spread of news outside the region, more global attention has been paid to Southeast Asian flooding as it has become a manufacturing hub in the global supply chain and a major tourist destination (*Bangkok Post*, 2013).

From July 2011 to January 2012, Thailand had the worst flooding in five decades. The floods killed over 800 people and left millions homeless or displaced. Over three quarters of Thailand's provinces were declared flood disaster zones, and the World Bank estimated that the economic loss exceeded \$45 billion. Thailand's government was unprepared for the longevity and severity of the floods, and many communities felt that the Flood Response Operation Center (FROC), which was established to coordinate emergency response and provide regular communications to the public, was inadequate (Nindang & Allen, 2012). While Thais are accustomed and well adapted to the annual flood season, the 2011 flooding crisis was the worst in five decades and caught the entire nation off guard. The floods actually began in northern Thailand in May and continued through mid-January, ultimately submerging 65 of Thailand's 77 provinces, including seven major industrial estates north of Bangkok, and left 815 dead and 13.6 million affected. The World Bank ranked the flood emergency as the world's fourth most severe national disaster in terms of economic consequences (Winijkulchai, 2012)

One of the major problems in Thailand is drought. Drought has the most profound effect on the environment and socio-economic levels at the local, regional, and national levels. Drought has lowered the

water resources for drinking and irrigation, as well as stressed vegetation, including rice and other crops. There are also serious issues of mental health due to prolonged dry and hot weather periods. For drought monitoring and planning, improved knowledge of landscape temporal variations and inter-annual behavior on local and regional scales is needed. Drought is one of the most serious problems in Thailand with far-reaching environmental and socio-economic impacts on the whole country. It is important to improve knowledge of landscape temporal variations and inter-annual vegetation response to precipitation on local and regional scales for drought monitoring and planning.

Overall, temporal profiles of rice, crops, and deciduous forests depicted dry-wet seasonal contrasts strongly coupled with rainfall and a pronounced dry season from November to April and a wet season from May to October. In contrast, the evergreen forest showed the lowest seasonal contrast and relationship with rainfall with green-up occurring during the dry season (Jan-Feb). Significant decreasing trends were found in 2001-2006. However, the dominant land cover type, dry paddy rice, exhibited seasonal profiles with large spatial variations due to land use management practices, which resulted in a more complex rainfall-vegetation relationship. Therefore, it is suggested that land use practices be taken into account for drought assessment and that the use of other land cover types, i.e. dry land crops, be considered (Ratana, 2012).

Heavy flooding occurred in Eastern Thailand, especially in Sa Kaeo, Prachin Buri, Chon Buri Provinces. Despite government assurances after the 2011 disaster, flooding has shutdown two factories at an Amata estate. As of Oct 9th, 28 out of 77 Thai provinces have been affected, and 39 people have been killed, but the Health Ministry said 51 have died, and more than 3 million people have been affected since July (*Asia News*, 2013). Sa Kaeo is a province of Thailand. It is located in the east of Thailand, neighboring provinces of Cambodia. Sa Kaeo became a province in 1993, when the six districts Sa Kaeo, Khlong Hat, Wang Nam Yen, Aranya Prathet, Ta Phraya and Watthana Nakhon of Prajin Buri were elevated to provincial status. It is, thus, one of the four youngest provinces of Thailand; in 1979, the Sa Kaeo Refugee Camp was established in the northwest of Sa Kaeo. The north of the province is covered with the forested mountains of the Sankamphaeng range and the Dangrek Mountains. To the south are foothill plains and foothills of the Cardamorn Mountains, which are mostly deforested. Sa Kaeo is subdivided into 9 districts. The districts are further subdivided into 59 sub-districts and 619 villages; the 9 districts are Mueng Sakaeo, Khlong Hat, Ta Phraya, Wang Nam Yen, Wattananakorn, Aranyaprathet, Khao Chakan, Khok Sung, and Wang Sombun. Weather in Sa Kaeo is heavy rain and about 28+ degrees, average per year. SA KAEO - Aranyaprathet district has been devastated by floods, and water levels in the Cambodia border town look set to rise after a fresh alert from the Natural Disaster (Wikipedia, 2014).

Development may refer to work aiming to increase knowledge for the practices and academic disciplines to improve various aspects of local communities (Wikipedia, 2014). Development is the systematic use of scientific and technical knowledge to meet specific objectives or requirements; an extension of the theoretical or practical aspects of a concept, design, discovery or invention; the process of economic and social transformation that is based on complex cultural and environmental factors and their interactions (*Business Dictionary*, 2014). In this study, development is a significant event, occurrence, or change; a group of dwellings built by the same contractor, and determination of the best techniques for applying a new device or process to the production of goods or services. These were all used for developing the mixed media process to investigate the rural household perceptions about their understanding, knowledge, and attitudes toward global warming in the Sa Kaeo province in Thailand.

A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts and that exceeds the ability of the affected community or society to cope using its own resources. In contemporary academia, disasters are seen as the consequence of inappropriately managed risk. These risks are the product of a combination of both hazards of flood/drought and vulnerability. Hazards that strike in areas with low vulnerability will never become disasters, as is the case in uninhabited regions.

Developing countries suffer the greatest costs when a disaster hits – more than 95 percent of all deaths caused by hazards occur in developing countries, and losses due to natural hazards are 20 times greater in developing countries than in industrialized countries, Focusing on Sa Kaeo province in Thailand, the Thai Meteorological Department has reported that rainfall in the last five years has decreased continually; on the

other hand, the temperature has been higher than in each previous year. This affects the people and others (see Table 1).

Table 1. Shows antecedent rainfall in last 5 years ago in Sa Kaeo Province

Years	Antecedent rainfall (mm.)	Average rainfall means (mm.)
2008	133.53	4.38
2009	108.34	3.55
2010	123.25	4.03
2011	159.30	5.24
2012	132.39	4.35

Source: Thai Meteorological Department (2013).

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes and variations in solar radiation received by earth. Certain human activities have also been identified as significant causes of recent climate change, often referred to as “global warming” (IPCC, 2013: pp 21). Climatologically, temperatures substantially affect precipitation. For instance, during the last five years, thermal-driven evaporation from the Sa Kaeo region onto landmasses was low, causing large areas of extreme temperature and drought. In contrast, Sa Kaew's climate was wetter than today's near the start of the warm flexibility. This is shown in Table 2.

Table 2. Affecting Drought Natural Disaster in Sa Kaeo Province Region in 2011.

Sequence Number	Drought Areas			Household families' disaster	
	District	Number of Sub districts	Number of Villages	Number of households	Number of population
1	Mueng Sa Kaeo	8	129	11,967	42,817
2	Aranyaprophet	12	114	19,000	65,000
3	Ta Praya	5	64	9,703	41,435
4	Wattana Nakorn	11	115	20,785	74,300
5	Wang Nam Yen	4	48	14,313	51,729
6	Klong Hat	7	71	1,178	3,480
7	Khoachakan	4	71	3,486	12,908
8	Khoksung	4	41	8,349	25,877
9	Wangsombun	3	48	11,713	35,578
	Total	58	701	100,494	353,124

Source: The National Disaster Warning Centre (2013)

On the other hand, The National Disaster Warning Center has warned the people in Chanthaburi, Prajinburi, Sa Kaeo, and Trat provinces of eastern Thailand to prepare for heavy rains over the next few days. The Disaster Warning Center expects flash floods and mudslides from July 17-19, 2013, in the mentioned regions. People near hillsides and waterways are said to be more vulnerable to the coming natural calamities. The Thai Meteorological Department has predicted scattered to fairly widespread thundershowers and isolated heavy rain from July 16, 2013, to July 22, 2013. Below are 7-day weather

forecast charts for Chanthaburi, Prajinburi, Sa Kaeo, and Trad (Thai Meteorological Department, 2013).

This issue highlights the importance of risk management for water security, not only in Rayong, Chantaburi, Trat, Sa Kaeo, and Chonburi, but also in the greater region. By conducting a risk assessment for the East Coast - Gulf Basin using the water balance and scenario analysis (HAII, 2008-b), flood and drought risk maps (Figure 1) have been created. In this case, the Mab Ta Phut area typically has a risk of drought, whereas two out of three areas (areas 3, 4 and 5 in Figure 1) supplying water to Mab Ta Phut have a severe drought risk, and one of them also has a risk of flooding and exploring to the eastern region. Therefore, policy makers are advised that area 4, which has both flood and drought issues, should have the highest priority for management. Thus, the potential severity of drought and flood threats in individual sub-basins can be determined and local measures suggested based on the magnitude of the severity in eastern region, especially in Sa Kaeo.

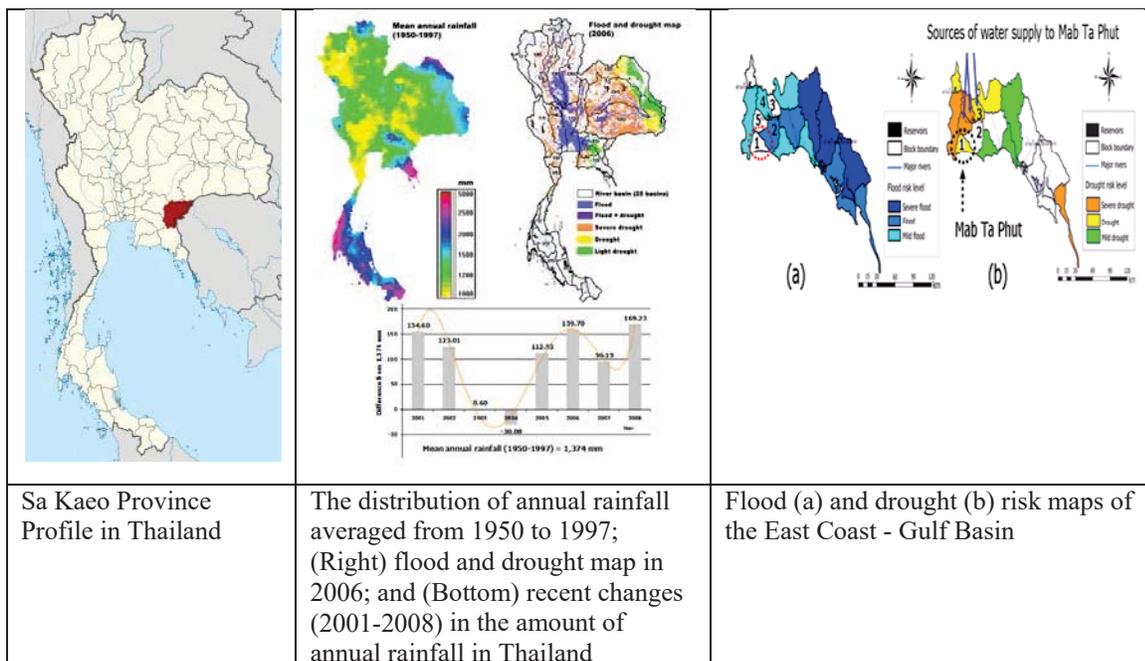


Figure 1. Flood and drought risk maps
 Source: Chitradon, Boonya-aroonnet, & Thanapakpawin (2013).

This research has been seeking the natural disaster effects on different aspects of people's living conditions. There are multiple effects of natural disasters. They affect almost every part of people's lives, such as social, emotional, economic, physical, environmental, and many others. Natural disasters strike suddenly and leave behind lives shattered by physical injury or the loss of home and job. These conditions may severely affect the emotions of the people. Natural disasters, like floods, droughts, tsunamis, and landslides, may cause huge losses of wealth and bring financial problems. Likewise, the natural disaster may lead to catastrophic effects on the environment, as many toxic materials, such as paint, pesticide and gasoline, can be released into the rivers. Moreover, this study describes the effects of natural disasters on various ways, such as physical destruction, economic loss, environmental problems, and emotional concerns. The effects of natural disasters, also, vary from immediate to long-term. Some of the effects are immediate, whereas other effects have persistence long-term impacts. If people who have gotten the understanding, knowledge, and learning about disaster effects from the mixed-based media learning environment, and if there is a unit of association to manage the knowledge, they will be able to know how to prepare for protecting their lives and others' immediately. This research has been for them.

Normally, mixed media in visual art refers to artwork in the making of which more than one medium has been employed. There is an important distinction between "mixed-media" artworks and "multimedia art." Mixed media tends to refer to a work of visual art that combines various traditionally distinct visual art media. For example, a work on canvas that combines paint, ink, and collage could properly be called a "mixed media" work, but not a work of "multimedia art." The term multimedia art implies a broader scope than mixed media, combining visual art with non-visual elements (such as recorded sound) or with elements of the other arts (such as literature, drama, dance, motion graphics, music, or interactivity).

When creating a painted or photographed work using mixed media, it is important to choose the layers carefully and allow enough drying time between the layers to ensure the final work will have structural integrity. If many different media are used, it is equally important to choose a sturdy foundation upon which the different layers are imposed. A phrase sometimes used in relationship to mixed media is "Fat over lean." In other words: "Don't start with oil paints. Plan to make them the final layer." Many effects can be achieved by using mixed media. Found objects can be used in conjunction with traditional artist media to attain a wide range of self-expression.

In this study, seeking to guide successful introduction of technology into non-school systems, scholars of education have computer design principles for engaging learners' interest and supporting content learning. This research study focuses on designs that enhance rural households' understanding, knowledge, attitudes, and durability of perceptions about global warming. Further, it studies the educational learning system that uses technology, media, and materials to create artifacts of the global warming situation to emphasize what they are taught and acknowledge in their daily life. The system uses data (it is data-based), numbers, graphic designs, soundtrack visuals, and video tape to mix media with computer technology programs. The term "mixed-media" is intended to be distinct from "multimedia," (which has come to mean audiovisual artifacts, such as presentations, interactive CD-ROMs, or websites) and is intended to develop this program format and content about global warming for rural household families' study, completely in terms of a non-educational system; the information education is being built with modern technology for study by those who are able to learn on their own in their free time.

The mixed-media curriculum for global warming lessons in rural household families in the Sa Kaeo province in Thailand have been designed. Learners are interested and understand that it has changed the attitudes, understanding, and knowledge of their behaviors and has enhanced them. In collaborative and interactive situations, learners in non-classrooms could gradually develop the ability to look at background events from various viewpoints. Through experiments, researchers have demonstrated that learners could think about day-to-day situations to discover, to understand, to reconstruct, and, finally, to create new relationships between daily events and the global warming situation.

Methodology

Research Objectives

1. To develop the mixed-media to support the learning environment on global warming for rural households with information and education in Sa Kaeo province in Thailand.
2. To investigate the pre- and post- rural households' perceptions of their understanding and knowledge about global warming effects with information education.
3. To assess the pre- and post- rural households' attitudes of their global warming effects with information and education.
4. To describe the pre- and post- rural households' durability of their attitudes and understanding and knowledge about global warming effects with information education.

Research Limitations

This research is limited by the frame of study: the research on environmental education principles, content about the global warming situation and its effects, Bloom's taxonomy, advertising media, learning about the environmental education processes, the theory of communication by Berlo, type data passing to mixed media, the description of global warming by Albert Arnold "Al" Gore, Jr., former Vice President of U.S.A., which he used in his campaign, and the senior professional environment, which exemplifies the

development of mixed-media techniques to manage the environment in terms of educating rural households in the Sa Kaew province in Thailand; this has four major points: the fundamental knowledge of global warming, problems of global warming effects, the affecting global warming, and the protecting and relieving effects from global warming in 12 months by subsequent planning.

Sample Sizes

This study was administered to a randomly selected sample of 400 rural households using the Krejcie and Morgan sampling technique for planning the new mixed-media learning environment; the sample was taken from 101,725 people aged 15 – 60 years old and living in the Wang Nam Yen, Klong Hat and Ta Praya districts within the Sa Kaeo Province in Thailand.

Research Instruments

The researcher has designed the research instruments detailed in Figure 2.

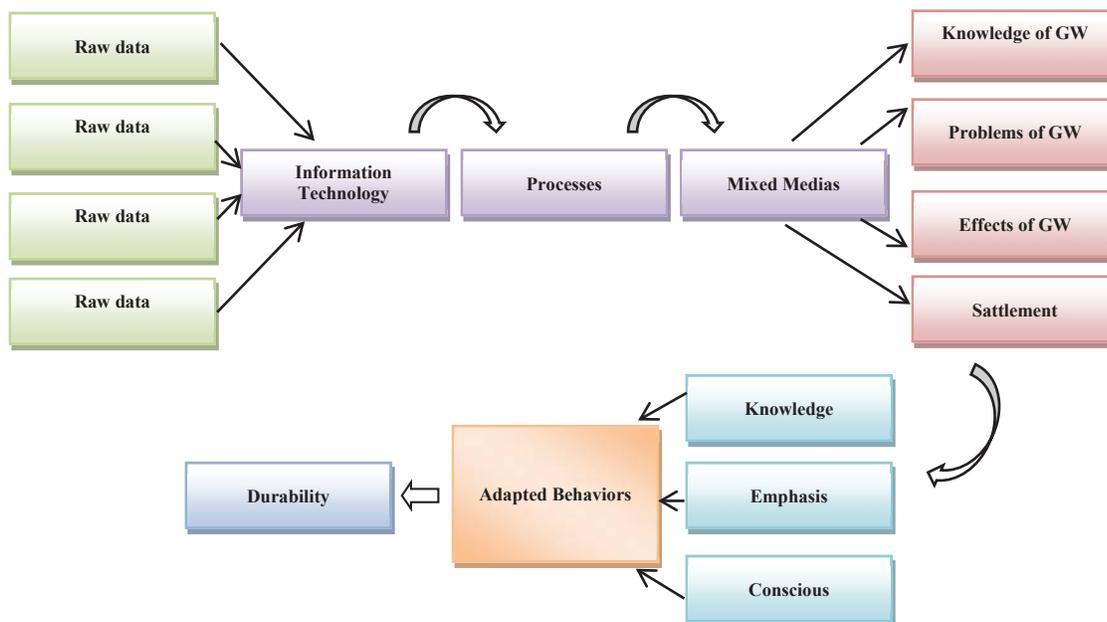


Figure 2. Shows the model planning steps of the research instruments

1. Mixed Medias Information Technology model for supporting learners' understanding and knowledge.
2. Environmental education lesson plans on global warming with the education information.
3. Assessing the quality of the mixed media questionnaire using four scales: the utility standard, the feasibility standard, the propriety standard, and the accuracy standard; these use a 5-rating scale (Almost,..., Never).
4. The questionnaires for rural households' perceptions of their understanding and knowledge of their attitudes and their durability on global warming situations and effects using a 5-rating scale (Almost,..., Never).

Results

The objectives of this study are to investigate the development of the mixed media learning environment about global warming's effects and problems. The four phases of this research will help people protect themselves and their homes through understanding of the next natural disaster that could be caused by global warming.

Phase I: The Quality of the Mixed-Media Learning Environment about Global Warming for Rural Household Memberships

In terms of the quality of the mixed-media learning environment's impact on global warming for rural household memberships, the content is recorded on CD-ROMs using the four scales: the content and administration of this curriculum; pictures, language, and sound; mixed-media, and overall use of this mixed media for information and educational. The seven scales of this section (confirmation of content, the research purposes, content accuracy, content satisfaction, clarity of content, quality of content, and the suitability of content for the sample size) shows that, overall, the seven scales are at their highest levels; content satisfaction with the sample size, content accuracy ($\bar{X}=5.00$, S. D.=.00), content suitability, content and administration ($\bar{X}=4.80$, S. D.=.44), and content explanation cleanness have the lowest means score ($\bar{X}=4.60$, S. D.=.44), .

The research focuses on the quality of the pictures, language, and sound, which were assessed using 10 scales of language accuracy, picture confirmation with soundstages, meaning cleanness and suitability, confirmation between pictures and content quality, the number of pictures composed of the contents, suitability composed of graphic designs, suitability composed of picture movement, the quality of sound, music accompaniment, and attractive mixed media. It has found that, overall, these ten scales are at the highest level of rural households' responses ($\bar{X} > 4.60$). Interestingly, the quality of the mixed media on the four scales of the suitability of monitoring design for simplicity of use, the alphabet size and color suitability for learners, the suitability and cleanness of graphic pictures, and the creative design on inventing pictures scales results indicate that, overall, the four scales of the quality of the mixed media are at the highest levels ($\bar{X} > 4.60$).

Phase II: Background of Rural Households' Volunteers

Rural households' perceptions of their understanding and knowledge and their attitudes toward their durability about global warming effects and problems in the four scales clearly demonstrate the outcomes of their understanding and knowledge, their attitudes, and their durability of these learning environments. However, this paper is reporting on the background of the volunteers of the rural household leaders and membership; the of sample size includes 195 males and 205 females; the average age mean score is 36 years old; 40% of the sample has secondary education, and 41% of the sample are agriculturists.

Phase III: Pre- and Post- Assessment Tests of Rural Households' Perceptions of their Understanding and Knowledge of Global Warming

Rural households' perceptions were analyzed with pre- and post- assessments that tested their understanding and knowledge, their attitudes, and their durability of the global warming learning environment from the CD-ROMs used in the educational system. Rural households responded with their assessments on the four scales using a 40-item assessment test: the foundational understanding and knowledge about global warming, the problems with their understanding and knowledge about global warming, the effects of their understanding and knowledge about global warming, and the protections and relief from the effects of global warming; each scale is composed of 10 items.

Table 3.

Scales, Means, and Standard Deviations for the Rural Households' Responses to Correctly Using the Assessing Test to Determine Their Understanding and Knowledge about Global Warming.

Testing Scales on Global Warming	Means		Standard Deviation		Mean Diff.	t-value
	Pre-test	Post-test	Pre-test	Post-test		
The foundational understanding and knowledge	43.37	82.17	0.77	0.58	38.80*	1.57*
The problems of their understanding and knowledge	43.87	78.72	0.67	0.25	34.85*	1.62*
The effects of their understanding knowledge	47.30	75.82	0.67	0.55	28.52*	1.87*
The protections and relief on the effects	53.38	80.72	0.77	0.57	27.34*	1.69*
Mean score average (100%)	46.98	79.35	0.77	0.56	32.37*	1.66*

N = 400, $\rho < 0.05$

Statistical analyses, including information about each scale's mean scores, standard deviations, mean differences, and comparisons of means by T-tests are presented. The results in this study are detailed in Table 3. The pre- and post- assessment tests of the 400 people of their mixed media learning environments on their understanding and knowledge about global warming also used assessment tests for each scale: the learning environments of information education of rural household mean scores, correctness, the standard deviations, and the T-test results for statistical significance. The scale means ranged from 43.37 to 53.38 (total score is 100) on the pre-assessment test and from 75.82 to 82.17 on the post-assessment test. Standard deviations for the pre-assessment test ranged from 0.67 to 0.77 and 0.52 to 0.58 for the post-assessment test. Rural households' responses tended to be greater on their post-assessment tests than the pre-assessment test. The T-values indicated that the post- and pre-assessment tests were differentiated at the statistically significant level of 0.05.

Phase IV: Pre- and Post- Attitude Questionnaire to Assess Rural Households' Perceptions to their Understanding Knowledge on Global Warming

This section presents a comparison between pre- and post-testing volunteers about rural households' perceptions of their attitudes about mixed media technology learning environments that included information and education about the global warming curriculum, which was invented by the researcher. The researcher used 20 items on the pre- and post- attitude questionnaire to assess of the rural households' perceptions, a sample size of 400 volunteers using four scales; each scale was composed of 5 questions: the foundational understanding and knowledge, the problems, the effects, and the protections and relief from the effects of global warming. The understanding and knowledge about global warming in information and educational systems asked volunteers about their attitudes toward their learning environments and is also discussed. Statistical analyses, including information about each scale's mean scores, standard deviations, mean differences, and comparisons of means by T-tests, are presented. The results in this study are detailed in Table 4.

Table 4

Scales, Means, Standard Deviations, and T-test Values for Rural Households' Perceptions of their Pre- and Post-Attitude Questionnaire about their Understanding and Knowledge about Global Warming

Attitude Scales on Global Warming	Means		Standard Deviation		Mean Diff.	t-value
	Pre-test	Post-test	Pre-test	Post-test		
The foundational understanding and knowledge	2.69	3.58	0.65	0.60	0.89*	1.57*
The problems of their understanding and knowledge	2.90	3.99	0.69	0.50	1.09*	1.71*
The effects of their understanding and knowledge	2.86	4.40	0.85	0.59	1.54*	1.82*
The protections and relief from the effects	2.89	4.61	0.82	0.50	1.72*	1.97*
Mean score average (1.00-5.00)	2.83	4.14	0.75	0.55	1.31*	1.76*

N = 400, $\rho < 0.05$

The pre- and post- attitude questionnaires of the 400 volunteers from the rural households using the mixed media learning environments were compared to their attitudes of their understanding and knowledge about global warming also used the four-attitude scales; each scale in the learning environment had information and education about the attitude mean scores (minimum 1 and maximum 5), the standard deviations, and the T-test results for statistical significance. The scale means ranged from 2.69 to 2.90 on the pre- attitude assessment and from 3.58 to 4.61 on the post- attitude assessment. Standard deviations for the pre-assessment test ranged from 0.65 to 0.85 and 0.50 to 0.60 for the post- attitude assessment. Rural households' perceptions tended to be greater than their post-assessment tests compared to the pre-assessment test. The T-values were indicated that the post- and pre- attitude assessments were differentiated as statistically significant at the level of 0.05.

Overall, this study, in Table 1 and Table 2, reveals the mean differences between the rural households' responses to the pre- and post- assessment tests about their understanding and knowledge and their attitudes about their pre- and post- attitude assessments of their learning environment; the environment included information and education dealing with use of the mixed media, which was invented and recorded on CD-ROMs that discussed their fundamental knowledge about global warming. In most cases, the findings indicate that rural households would prefer the post assessments, and the perceptions have higher scores than the pre- assessments and attitudes scores, which reveals that the differences between the pre- and post-assessments of their testing; their perceptions of their attitudes toward the mixed medias about their understanding and knowledge based on their information and education about global warming were statistically significant at the 0.05 level for all of the four scales.

Discussions

The results of this study showed statistically significant differences between the 400-volunteers learners who represented rural households' testing and perceptions in the Karasin province in Thailand using four scales of the pre- and post- foundational understanding and knowledge about their attitudes on the effects of global warming, problems of their knowledge, and the protection and relief from the effects using the mixed media of the global warming CDROMs were assessed. However, there are a number of widely held misconceptions about climate change, and, unfortunately, these are reflected in some of the educational materials available on the mixed media. It is, therefore, crucial for researchers to educate

themselves and learners with accurate information, being careful not to reinforce common but incorrect notions. The following primer is a good place to begin. Normally, everybody understands that global warming is caused primarily by carbon dioxide from burning coal, oil, and gas.

Certain gases that trap heat are building up in the earth's atmosphere. The primary culprit is carbon dioxide, released from burning coal, oil, and natural gas in power plants, cars, factories, etc. (and to a lesser extent when forests are cleared). The second is methane, released from rice paddies, both ends of cows, rotting garbage in landfills, mining operations, and gas pipelines. Third are chlorofluorocarbons (CFCs) and similar chemicals, which are also implicated in the separate problem of ozone depletion. Nitrous oxide (from fertilizers and other chemicals) is fourth. These causes changed understanding of this knowledge for the volunteers after they studied with the CD-ROMs in the mixed-media learning environment on global warming.

There are the promotions and campaigns in the past that show the media from a scientific consensus that global warming is real, is caused by human activities, and presents serious challenges. Research has tried to indicate that scientists working on this issue report that the observed global warming cannot be explained by natural variations, such as changes in the sun's output or volcanic eruptions for volunteers' understanding and knowledge. Therefore, the most authoritative source of information is the UN Intergovernmental Panel on Climate Change (IPCC, 2013), which draws upon the collective wisdom of many hundreds of scientists from around the world. The IPCC projects global temperature will increase 3 to 10 degrees F in the next 100 years and say that human activity is the cause of most of the observed and projected warming (National Science Teachers Association, 2013); these situations are contained knowledge and people's attitudes toward global warming effects and determines their daily life, as detailed in Tables 1 and 2.

Interestingly, this field study on environment education is an essential element of the global response to climate change. It helps people (especially people who live in the third-world countries) understand and address the impact of global warming, encourages changes in their attitudes and behaviors, and helps them adapt to climate change-related trends that this study has found and reported through the Climate Change Education for sustainable Development Program. UNESCO aims to make climate change education a more central and visible part of the international response to climate change. The program aims to help people understand the impact of global warming today and increase "climate literacy" among people. It does this by strengthening the capacity of its member states to provide quality climate change education, encouraging innovative teaching approaches to integrate climate change education in school or non-school systems, and by raising awareness about climate change, as well as enhancing non-formal education program through mixed media, networking, and partnerships (UNESCO Office in Kathmandu, 2013) to enhance understanding and knowledge for people on global warming effects; furthermore, people ought to study this information and education according to their own abilities and needs.

Suggestions

The results in this study, the development of mixed-media learning about environmental education about global warming, using a curriculum for volunteers who are in rural households and can use the information education system on the CD-ROMs in the Sa Kaeo province, their pre- and post- understanding and knowledge about global warming was tested, and their pre- and post-attitudes' perceptions about global warming were assessed. It was found that the indications of their understanding and knowledge and their attitudes were greater from post-actual than pre-actual, significantly. The modern lifestyle age propelled the economies of the present-day developed countries forward and gave rise to unprecedented improvements in the standard of living for much of mankind. It also gave birth to environmental pollution as they know it today, beginning a slow but accelerating transformation of the earth's surface and atmosphere. Meeting the ever-increasing appetite for goods and services of the modern lifestyle continues to require extensive use of a seemingly infinite natural resource base. The challenge imposed on the earth to provide the necessary raw materials, energy, and waste disposal processes for mankind's production and consumption has had many consequences for the health of ecosystems around the globe.

The shelter, in precipitation patterns leading to extended droughts or flooding, and more frequent extreme weather events are just some of the effects of global warming and changes to the global climate. The human toll in lost lives and livelihoods is mounting; particularly in Northeastern and the Eastern regions in Thailand and other countries, it will remain affected, thus making it clear that climate change mitigation and adaptation is necessary to address one of the greatest challenges faced by the world today. People ought to learn in this situation, clothing, nourishment, mobility and other lifestyle components that make up humanity's basic needs, and increasing "Western-style" consumption impose a significant impact on the environment, particularly as the earth's population increases. Of the many problems generated by the economic and global energy progress, climate change is one that dominates media headlines. The current warming trend due to the effects of atmosphere that started with the global energy revolution has given scientists, politicians, and individuals around the world cause for great concern. This research study has indicated the process for enhancing people's learning about and their understanding and knowledge and have a good attitude towards durability and sustainable development based on their education about global warming.

References

- America's Climate Choices, Washington, D.C. (2011). *The National Academies Press*. The average temperature of the Earth's surface increased by about 1.4 °F (0.8 °C) over the past 100 years, with about 1.0 °F (0.6 °C) of this warming occurring over just the past three decades. Retrieved from http://en.wikipedia.org/wiki/Global_warming.
- Asia News. (2013). *South East Asia news: AsiaOne*. News.asiaone.com. Retrieved from http://en.wikipedia.org/wiki/2013_Southeast_Asian_floods.
- Bangkok Post. (2013). *Death toll from floods rises to 73*. Bangkok Post. -10-19. Retrieved from http://en.wikipedia.org/wiki/2013_Southeast_Asian_floods.
- Battisti, D., & Naylor, N. (2009). Historical warnings of future food insecurity with unprecedented seasonal heat. *Science* 323 (5911), 240–4.
- Business Dictionary. (2014). *What is development?* Retrieved from <http://www.businessdictionary.com/definition/development.html>.
- Chitradon, R., Boonya-aroonnet, S., & Thanapakpawin, P. (2013). *Risk management of water resources in Thailand in the face of climate change*. Retrieved from http://www.haii.or.th/wiki/index.php/Risk_Management_of_Water_Resources_in_Thailand_in_the_Face_of_Climate_Change
- HAI (Hydro and Agro Informatics Institute), 2008-b: Study of the National Water Policy Framework, Parliament House, Thailand. Retrieved from http://www.haii.or.th/haiiweb/index.php?option=com_content&task=view&id=94&Itemid=95&lang=th_TH#
- IPCC. (2013). *Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010*. IPCC, Climate Change 2013: The Physical Science Basis - Summary for Policymakers, Observed Changes in the Climate System. In IPCC WG1 2013. Retrieved from http://en.wikipedia.org/wiki/Global_warming.
- Kirby, A. (2001). Science academies back Kyoto. *BBC News*. Retrieved 27 July 2011 from http://en.wikipedia.org/wiki/Global_warming
- Lu, J., Vechhi, G. A., & Reichler, T. (2007). Expansion of the Hadley cell under global warming (PDF). *Geophysical Research Letters*, 34(6), L06805.
- Meehl, G. A., & Stocker, T. F. (2007). *Chapter 10: Global climate projections. Selection 10.5: Quantifying the range of climate change in IPCC AR4 WG4 WG1 2007*. Retrieved from http://en.wikipedia.org/wiki/Global_warming
- National News Bureau of Thailand. (2012). *Global warming in Thailand*. Retrieved from <http://nntworld.prd.go.th/newsenglish/global/index.html>

- National Science Teachers Association. (2013). *Teachers' guide to high quality educational materials on climate change and global warming*. Retrieved from <http://hdgc.epp.cmu.edu/teachersguide/teachersguide.htm>
- Nindang, S., & Allen, T. (2012). *Ahead of flood season, Thailand's communities demand greater preparedness*. Retrieved from <http://asiafoundation.org/in-asia/tag/thailand-floods/>
- Parry, M. L., & Palutikof, J. P. (2007). *Technical summary*. Box TS. 6. The main projected impacts for regions missing or empty title in IPCC AR4 WG2 2007: pp. 59 – 63. Retrieved from http://en.wikipedia.org/wiki/Global_warming.
- Rattana, P. (2012). Recent drought in Northeast Thailand: Case study using model time series. Retrieved from http://gecnet.kku.ac.th/research/i_proceed/2550/2_Recent_Drought.pdf.
- Riebeek, H. (2010). *Global warming: Feature articles*. Earth Observatory, part of the EOS Project Science Office located at NASA Goddard Space Flight Center. “Global warming is the unusually rapid increase in Earth's average surface temperature over the past century primarily due to the greenhouse gases released as people burn fossil fuels.” Retrieved from http://en.wikipedia.org/wiki/Global_warming.
- Schneider, von, D, T., & Held, G, R. (2006). Climate sensitivity estimated from ensemble simulations of glacial climate. *Climate Dynamics*, 27(2–3), 149.
- Solomon, S., Qin, D., & Manning, M. (2007). *Technical summary*. Section TS. 5.3: Regional-scale projections in IPCC AR4 WG1 2007: pp. 49 – 58.
- Stocker, T. F., Qin, D., Plattner, G. K., & Alexander, L. V. (2013). *Technical summary* in IPCC AR5 WG1 2013. National Aeronautics and Space Administration Goddard Institute for Space Studies. Retrieved from http://en.wikipedia.org/wiki/Global_warming
- Thai Meteorological Department. (2013). *Natural disaster in Thailand 2013*. Retrieved from <http://www.disaster-report.com/2013/02/natural-disasters-in-thailand-2013.html>
- The National Disaster Warning Centre. (2013). *Natural disaster in Thailand*. Retrieved from http://www.ldeo.columbia.edu/chrr/research/profiles/pdfs/thailand_profile1.pdf.
- UNESCO Office in Kathmandu, (2013). *Workshop for Climate Change Education stakeholders: mapping report indicates the need for improved coordination*. Retrieved from http://www.unesco.org/new/en/kathmandu/about-this-office/singleview/news/workshop_for_climate_change_education_stakeholders_mapping_report_indicates_the_need_for_improved_coordination-1/#.U9DA87HFIZ9
- Wikipedia, the free encyclopedia. (2014). *Development*. Retrieved from <http://en.wikipedia.org/wiki/Development>.
- Wikipedia, the free encyclopedia. (2014). *Sa Kaeo province*. Retrieved from http://en.wikipedia.org/wiki/Sa_Kaeo_Province
- Winijkulchai, A. (2012). Thailand's 2011: Flood crisis reveals potential of technology and social media in disaster response. <http://asiafoundation.org/in-asia/tag/thailand-floods/>.