

# Using STSE-Model Learning to Examine Students' Environmental Awareness of the Risk of Environmental Disaster

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The objective of this work is to study the environmental awareness of students in areas at risk of environmental disaster. STSE-model learning is used, to compare students who are experienced and inexperienced as to the effects of such disasters. Students in year suksa 4 and year 5, under the Office of the Basic Education Commission in Thailand, were studied; in total 134 students. The data was analysed to find mean, standard deviation, and t-test independent. This work found that a high level of in-depth knowledge, appreciation, love and cherishing of the environment, through its examination and evaluation of learning. However, the aspect of anxiety and concern, and being able to act or solving various environmental problems by oneself and working group at the highest level. The data analysis of mean, standard deviation, and t-test independent indicate a difference in the environmental awareness of students, between pre and post learning, with statistical significance, from 41.75% to 89.50%. Students experienced and inexperienced affected to environmental disasters. Awareness toward environmental of students in the area at risk to environmental disaster by using STSE-model learning not different.

**Key words:** *Awareness, Environmental, Area at Risk, STSE-Model.*

## Background and Significance of the Problem

Researchers from the U.S. Global Change Research Program (USGCRP) Institute explain the seriousness of climate change. In 2018, global disasters occurred more often and intensively than previously. That involves heat wave events in both South Korea and Pakistan, floods in India, cold snaps in Europe and a hurricane in the eastern United States at the end of February 2018. Cold air from Siberia blows into Europe, and the "Devil from the East" causes European temperature to drop, which affected Poland in particular. In the USA, Hurricane

Florence blew down in Carolina and is considered the worst storm in 29 years, resulting in heavy rains and flash floods. Heat waves recently made South Korea's summer the hottest in 11 years. Its government warned its people not to stay outdoors for a long time, and managed measures to assist communities in August 2018. In India a large flood affected Kerala state. Three hundred and sixty-one people died and over a hundred thousand people were homeless. India has been hit by severe floods from May to October. Germany suffered an extensive drought and heat wave, severely damaging agricultural products (Greenpeace, 2019). Meanwhile, scientists from the European Commission - Joint Research Centre (EC-JRC) have warned climate change and sea level rise may cause the world to lose half of its beach area within the next 80 years. It has impacted the tourism industry and further intensified damage from storms and floods. Australia will be most affected. There may be nearly 15,000 kilometres of sunken beaches. Other countries at risk of lost beach area include Canada, Chile, United States, Mexico, China, Russia, Argentina, India and Brazil (BBC, 2020). Flooding and avalanches have caused Pakistan and Afghanistan to suffer both rain and snow, after a storm hit the region. Kashmir in particular was most affected (Spring News, 2020). Guoxia, Ma et al. (2020, 8) mentioned that China is experiencing serious environmental and ecological degradation, causing damage to its biosphere and people. C. Fant et al. (2020) found that climate change effects, such as greenhouse gas emissions, damage infrastructure, physical livelihoods and economic systems at a cost of up to 25% per year. Further, Jermittiparsert and Chankoson (2019, 366-372) show that carbon emissions from manufacturing and construction industries impact society, environment, health and the economy as does research by Haseeb, M. et al. (2019, 3598). There is insufficient room here to discuss environmental pollution in ASEAN countries. However, the pollution of the environment results in increased health care expenditure, and pollution in society.

The United Nations Environment Programme (UNEP) has three main functions: (1) Evaluate national and regional environmental conditions and trends; (2) Develop national and international environmental documents; (3) Strengthen the Institute for Smarter Environment Management. There are four climate change goals: adapt by creating the ability to handle climate change, support changes to a low-carbon society, improve scientific understanding of climate change, and communication and awareness raising (UNEP, 2017). Worldwide awareness of the importance this change resulted in agreements to manage common problems, such as creating the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes, a multilateral treaty signed by European countries and the US on October 31, 1988 in Sofia, Bulgaria. The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty established to control, deter and campaign to reduce the production and use of ozone depleting substances, to maintain the ozone layer. The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) set targets for industrial countries to reduce greenhouse gas emissions. For example, the ASEAN

Agreement on Transboundary Haze Pollution is an environmental agreement signed in 2002 between members of the Association of South East Asian Nations with the objective of reducing toxic pollution in Southeast Asia (Wikipedia, 2014). Addison (2016, 5) presents Thai environmental situation by size and intensity of the problems. The first problem is unsanitary recycling of electronic garbage that is incorrectly done, according to academic principles. The second problem is deforestation. The third is water and drought. The fourth problem is coastal erosion which is worsening. Fifth is the problem of greenhouse gas emissions. The principles of the 12th National Economic and Social Development Plan (2017-2021) provide a national development plan, to achieve the goal in five years. The main principle, "People are the centre of development", aims to create quality of life and good health for Thai people. It develops people to be complete, disciplined, knowledgeable, and to have creative skills and a good attitude. Social responsibility involves ethics and morals. It includes creative people using and living in a supportive environment (Conservation: The proper use of natural resources and the environment, Office of the Prime Minister, 2016). Thara (2018, 10) suggested that the environmental problem in Thailand, Southeast Asia, and the world is plastic pollution. Although there are several measures to handle plastic usage, the crisis does not improve.

Learning management based on science, technology, society and environment (STSE-Model) helps students develop concepts about reality in life. It enables action to solve problems appropriately, as a relationship, in terms of promotion and development towards positive organisms and the environment (Positive) and destruction, harmful to living organisms and the environment (Negative), including giving punishment as well (Bencze, J.L., 2011). It has the important aim of: (1) creating social responsibility; (2) enabling decision-making about problems arising from the impact of science on daily life under ethics and morality; and (3) having knowledge, skills and confidence in expressing opinions and showing responsibility to solve science-related problems in the real world (Pedretti, G., 2005). Therefore, the researcher organised the said process for learners to raise awareness of the environment for learning by means of science, technology, society and the environment. Five stages were used: (1) Identification of environmental issue; (2) Identification of environmental potential solution; (3) Need for knowledge; (4) Decision-making; (5) Socialisation (Yörük, N. et al., 2010, 1418) Bar, V. et al., (2016, 327). Learning processes help develop student awareness of the environmental characteristics of internal motivation or the want to do, want to fix, to push, want to learn deeply, to know the truth in that matter, by researching creation with love, taking care and paying attention to various things created by showing behaviours that reflect environmental awareness in all four aspects. The four aspects include (1) In-depth knowledge and appreciation of the environment; (2) loving and cherishing the environment; (3) anxiety and concern for the environment; and (4) being able to act or solve various environmental problems by oneself and the working group. Rungtiwa and Phongsuk (2013, 53) Arba'at, Hassan and Mohd, Zaid Ismail (2011, 3406) considered an important way to change

awareness of the environment, one that is cultivated into habits valuable to oneself and the world. According to the research question that is: “How is awareness toward students’ environmental awareness in the area at risk of environmental disaster, by using STSE-model learning in post- Learning higher than *pre*- Learning, awareness toward environmental of students in the area at risk to environmental disaster by using STSE-model learning according to students experienced and inexperienced affected to environmental disasters”. The objectives of this research are: (1) to study students’ environmental awareness in the area at risk of environmental disaster, by using STSE-model learning; and (2) to compare the outcomes of students’ environmental awareness in the area at risk of environmental disaster, by using STSE-model learning categorised by the students both experienced and inexperienced in being affected by environmental disasters.

### **Science-Technology-Society-Environment Learning and Awareness toward Environment**

Learning management based on the concepts of science, technology, society and the environment, has numerous implications. It means teaching and learning that integrates science, technology, social and environmental dimensions. Therefore science teaching management, according to the concepts of science, technology, society and environment, needs expertise in a wider teaching strategy like open-ended thinking (Divergent thinking), working as a small, student-centred group, in class discussion, problem-solving, simulations, decision-making, criticism, dissent, and argument (Erminia, G. et al., 2008, 941; Yörük, N. et al., 2009, 57). Guidelines for teaching and learning management follow these steps: (1) Creating interest; (2) Searching and research; (3) Explanation; (4) Expanding knowledge; and (5) Evaluation (Teera, et al. (2014, 141)). Learning management can be based on the concepts of science, technology, society and environment (STSE), for the benefit of the science development of learners, with the goal of making students aware of responsibility and finding solutions to problems that arise. This helps relate science, technology, society and the environment.

To apply the knowledge gained in daily life, five steps of learning management are as follows: (1) identify process of expressing opinions and learning ideas; (2) identify and collect social and environmental information; (3) identify knowledge; (4) procedures for inspecting and making decisions; and (5) social action steps and processes (Suriyawadee, et al. (2016, 1326)). Under STSE Education pedagogy, based on constructivist learning principles, for instance, students often have pre-conceived notions about topics teachers intend to teach. Students’ pre-conceived notions can influence how they interpret ideas, perspectives, experiences that teachers provide. With this in mind, teachers might consider using a constructivism-informed pedagogical framework for their STSE Education. Some specific examples of activities based on this three-phase framework are as follows: (1)

*Expressing Ideas* - Teachers may for example, ask students to list several inventions and brainstorm and debate benefits and hazards associated with each one. (2) *Learning Ideas* - Teachers could, for example, use various case methods; that is activities ('methods') that get students to interact with case studies about some STSE issue. (3) *Judging Ideas* - Students can - in various ways – judge which STSE perspectives to believe. “Town-hall debates” in which students role-play different positions on STSE issues, are excellent. They can also form opinions as they act on issues/harms (Bencze, J.L., 2019). Katarin MacLeod (2013, 3) mentioned STSE education is rooted in a “context-based” approach to science teaching, whereby a rich social-cultural context kindle student interest in exploring science. Scientific environmentalists and sociologists who focus on integrating “values” and “social responsibility” in science education have supported STSE education. Over time, STSE has evolved, as Aikenhead, G. S. (2005, 384-397) explained. STSE was formed by amalgamating broad academic fields which included elements of science, scientists, social issues external and internal to these social by relationships. Varda, B. (2010, 328) speaks of our research as based on STSE curricular ideas containing physics, chemistry and technological applications, together with a constructivist approach to science teaching.

The research was based on: (1) investigating students’ previous ideas; (2) exposing these ideas through experiences and class discussion; and (3) attempting to change misconceptions by performing more hands-on experiences and carrying out discussions taken from science. Chanapimuk, K. (2018, 15) referred to science, technology, society, and environment (STSE) approach as focusing on using the result of science and technology that affects society and the environment in the science lesson. It can improve the student’s application of scientific knowledge, to relate what they learn in the classroom to daily life, and also make meaningful scientific learning. In addition, students can practice asking scientifically valid questions, designing experiments, exploring, analysing and interpreting data to find solutions to solve problems. This approach consists of four steps: 1) *motivation*, encourage students to be aware of important environmental issues and contexts; 2) *exploration*, encourage students to examine an issue and to find possible solutions; 3) *brainstorming*, collecting information and ideas, and then interpreting the information; 4) *decision-making*, students had to decide the best solution of the class, from a presentation and discussion.

**Awareness toward Environment.** The environment is the basic livelihood, development condition and material foundation for humans (Saengchai, Sriyakul, & Jernsittiparsert, 2019). Whether students question environmental behaviour highly can be checked, through questions that raise awareness of environmental behaviours, such as “Can you tell what is White Pollution?” “Do you know Three typical kinds of Waste?” “How do you deal with a used battery?” “How do you deal with an abandoned plastic film?” Wang, Nan. et al. (2010, 2624). Environmental education should not be limited, by giving information and establishing consciousness of responsibility. Instead it should also affect people’s behaviours.

As Hakan, Önal and Alaattin, Kızıldağ (2011, 428) mention, teachers' attitudes towards EE (Environmental Education infusion) include six elements. They are: (1) Attending courses; (2) Providing opportunities to students; (3) Teaching the environment as a single subject; (4) Helping students to inculcate their own sensitivity and practice positive attitudes towards the environment; (5) Help students find the best way of problem-solving skills; and (6) Help students find the best way of decision making skills. Arba'at, Hassan and Mohd, Zaid Ismail (2011, 3406) present, teaching and learning, to create awareness of the environment. They do so by cooperative learning, to find environmental problems in their communities and help each other find the cause, and fix the problem together. This focuses on real actions. By surveying or searching for problems that affect life and society, and by the students themselves solving the problems, that will help the students realise the importance of the real environment. Rungtiwa (2019, 27) found out that environmental awareness is clear knowledge of the environment. It is the subconscious mind protecting the environment, because awareness is the knowledge that is constantly under the conscious mind. Whenever there is a problem or a story we have knowledge, and will pull out the subconscious mind to see the picture clearly regardless of any condition; deep and accurate awareness will not change. Clear awareness is divided into four steps as follows: (1) In-depth knowledge and appreciation in the environment means fully understanding it. Knowing what is right, what is wrong, what is good and what is not good, what is beneficial, what is harmful? What causes good and harmful effects on the environment? (2) Loving and cherishing the environment means loving and cherishing the things that are truly understood, for stories of the environment which are the right things, and the good things that have benefits that are good for humanity and the world; (3) anxiety and concern means feeling concerned about things that happen to the environment such as being concerned about selfish habits, not focusing on the common good, taking advantage of nature without sufficiency; (4) able to act or solve various environmental problems by oneself and the working group.

### **Research Methodology**

The case study groups are students in Yearsuksa 4 and Matayomsuksa 5, at Wiang Kaen Witthayakhom School (Chiangrai province), Educational Service Area Office 36, Phayao-Chiang Rai Province, under the Office of the Basic Education Commission; 134 persons in total. The equipment for research consists of an STSE-model, for students to learn improved awareness toward the environment, in an area at risk of environmental disaster. This consists with four activities. The plan is as follows:

<b>Process of learning</b>	<b>Activities</b>
<b>Pre-learning</b>	Pre- assessed learning evaluation with two evaluation forms: 1. Examination form to examine awareness toward the environment 2. Evaluation form to evaluate awareness toward the environment
<p><b>During learning</b> : Organise learning activities using STSE-Model</p> <p><b>Activity 1:</b> Landslide</p> <p><b>Activity 2:</b> Environmental Problems in the Community</p> <p><b>Activity 3:</b> Biology Education</p> <p><b>Activity 4:</b> The pressure and pressure of fluid viscosity</p>	<p><b>1. Identification of environment issue stage</b> - Question "landslide problems that occur in Wiang Kaen district. What causes it? How to fix the problem?" - Question: "In the student community How do students think that there are environmental problems? What are the problems and the causes?" - "What is the cause of the river problems students have seen? How to solve the problem?"</p> <p><b>2. Identification of environment potential solution stage</b> - Divide students into groups to discuss the occurrence of landslides, present drought events, dust, pollution and garbage for students, the river problems in Wiang Kaen district. - Each group discussed, analysed, criticised, exchanged views on causes and impacts on people in the community, Effects and methods or activities that will be used to solve problems.</p> <p><b>3. Need for knowledge stage</b> - Present methods or activities that are used to solve problems to exchange possibilities and add ideas from friends and teachers. - Search for more information, students find more information to make the methods or activities used to solve problems more complete. Criticise, exchange, discuss together for cause. Methods and environmental protection and joint review based on information, accurate scientific evidence giving a summary of solutions to environmental problems in their communities.</p> <p><b>4. Decision making stage and reflect</b> - Practice in solving the problem - Reflecting the results of activities to solve problem. - Present the results of the landslide problem activity.</p> <p><b>5. Socialization stage</b> Present external or related work such as public relations to the family and community, science week Wiang Kaen School, exhibition Lai Ngao Subdistrict Municipality and reports the results of the Ngao River solving activities to the school directors and community leaders.</p>
<b>Post- learning</b> : Assessment after the training	Post- assessed learning with 2 evaluation forms: 1. Examination form to examine awareness toward the environment 2. Evaluation form to evaluate awareness toward the environment

STSE-model learning on the improvement of students' environmental awareness, in an area at risk of environmental disaster, by using STSE-model learning passes, checks from three experts for content validity, language, to find index of Item Objective Congruence: IOC, evaluation of the suitability and conformity of the activities with the conformity index at 0.60 – 1.00. Overall, there is conformity, indexed at 0.87.

Equipment for data collection consists of: An examination form to examine student awareness towards the environment, in an area at risk of environmental disaster, by using STSE-model learning. It is a type of open-ended questions or scenarios, five-part rating scale, posing four environmental issues/problems. Check from expert content by validity, language, to find index of Item Objective Congruence: IOC evaluation of the suitability and conformity of the activities with the conformity index at 0.60 – 1.00. Overall, there is conformity, indexed at 0.92, then came the reliability  $\geq 0.70$  (Panida, 2018) The reliability is rated at 0.97 by its Alpha coefficient.

Equipment for data collection consists of: A form to evaluate students' awareness of the environment in the area at risk to environmental disaster by using STSE-model learning consists of four dimensions: 1) In-depth knowledge and appreciation in environment; 2) love and cherish the environment; 3) anxiety and concern and; 4) able to act or solve various environmental problems by oneself and working group. It is rated into five levels. It is an actual environment situation which requires answers or presentations, according to a Rubric Score. The quality of the equipment passes checks from three experts for content validity, language, to find index of Item Objective Congruence: IOC, evaluation of the suitability and conformity of the activities with the conformity index at 0.60 – 1.00. Overall, there is conformity indexed at 0.91, then came reliability  $\geq 0.70$  (Panida, 2018). Reliability is rated at 0.90 by the Alpha coefficient.

Data Analysis as the following: Student awareness toward environment in the area at risk of environmental disaster, using STSE-model learning, by calculating mean and standard deviation, resulting in the following: 4.51 - 5.00 indicate top awareness; 3.51 – 4.50 indicate high awareness; 2.51 – 3.50 indicate moderate awareness; 1.51 – 2.50 indicate less awareness; and 1.00 – 1.50 indicate least awareness. *Pre* and *post* student awareness toward environment in an area at risk of environmental disaster compared, using STSE-model learning. Comparing *pre* and *post* testing of student awareness towards the environment, in an area at risk of environmental disaster, using STSE-model learning, categorised by students experienced and inexperienced, affected by environmental disasters, by an Independent t-test.

## Research Results

The results of the research on student awareness toward the environment in an area at risk of environmental disaster, by STSE-model learning, are shown in Table 1.

**Table 1:** Shows student awareness toward the environment in the area at risk of environmental disaster, by using STSE-model learning, in four problems or situations.

Awareness toward environmental of students	$\bar{x}$	S.D.	Level
1. In-depth knowledge and appreciation in environment	4.13	0.61	High
2. love and cherish the environment	4.28	0.57	High
3. anxiety and concern	4.57	0.50	Very high
4. able to act or solve various environmental problems by oneself and the working group	4.62	0.49	Very high
<b>Total</b>	4.40	0.06	High

Table 1 indicates that the mean of student awareness toward the environmental in an area at risk of environmental disaster, using STSE-model learning from four problems or situations, is at high level. Environmental awareness was at the highest level with anxiety, concern and able to act or solve various environmental problems by oneself, and the working group in terms of in-depth knowledge and appreciation in environment and loving, cherishing the environment at a high level.

The comparison results of student awareness toward the environment in the area at risk of environmental disaster by using STSE-model learning, in both *pre* and *post* learning, analysing data by mean, standard deviation, and a Paired Samples T-Test.

**Table 2:** Shows student awareness toward the environment in the area at risk of environmental disaster, using STSE-model learning *pre* and *post* learning

Experimental group	<i>n</i>	$\bar{x}$	S.D	<i>t</i>	<i>p</i>
<i>Pre</i> –learning	134	34.95	0.42	76.56*	.000
<i>Post</i> - learning	134	74.84	0.29		

$p^* \leq .05$

Table 2 indicates that the mean of student awareness toward the environment in the area at risk of environmental disaster by using STSE-model learning in *post* learning is 74.84, which is higher than *pre* learning at 34.95. The analysis of the difference between *pre* and *post* learning by T-Test results  $t = 76.56$  and  $p \leq .05$ . The result indicates higher student awareness towards the environment, because of the learning according to the STSE-model learning which results in a significant increase at .05.

**Table 3:** Shows student awareness toward the environment in the area at risk of environmental disaster, by using STSE-model learning in *pre*, *during*, and *post* learning

Awareness toward environmental of students	pre learning %	between learning %	post learning %	Overall %	Level
1. In-depth knowledge and appreciation in environment	35.93	88.36	91.21	71.83	High
2. love and cherish the environment	33.34	89.82	91.5	71.57	High
3. anxiety and concern	47.51	95.45	97.46	80.14	Very high
4. able to act or solve various environmental problems by oneself and working group	47.31	97.36	97.58	80.75	Very high
<b>Total</b>	<b>41.02</b>	<b>92.75</b>	<b>94.45</b>	<b>76.07</b>	<b>High</b>
	<b>Low</b>	<b>Very high</b>	<b>Very high</b>	<b>High</b>	<b>High</b>

The result of comparing student awareness towards the environment in the area at risk of environmental disaster, by STSE-model learning, categorised by students experienced and inexperienced, affected by environmental disasters, in each dimension at the same level, is given in detail in Table 4.

**Table 4:** Compares student awareness towards the environment of students experienced and inexperienced affected by environmental disasters

Awareness toward environmental of students	experienced		inexperienced		<i>t</i>	<i>sig</i>
	$\bar{x}$	<i>S.D.</i>	$\bar{x}$	<i>S.D.</i>		
1. In-depth knowledge and appreciation in environment	3.66	0.67	3.63	0.68	0.28	0.78
2. love and cherish the environment	3.38	0.84	3.35	0.84	0.33	0.74
3. anxiety and concern	3.63	0.71	3.64	0.73	0.08	0.94
4. able to act or solve various environmental problems by oneself and working group	4.44	0.54	4.48	0.55	0.52	0.60
<b>Total</b>	<b>3.78</b>	<b>0.69</b>	<b>3.78</b>	<b>0.70</b>	<b>0.30</b>	<b>0.77</b>

## Discussion and Conclusion

The result of the research into student awareness towards the environment in areas at risk of environmental disaster, by using STSE-model learning, indicates that science students have a high awareness. The factors from STSE-model teaching methodology are principles of knowledge creation based on learning (constructivism), that is to see the truth by learning

from the theories, principles, and evidence that assert credibility such as fluid pressure, physics principles that slow down water flow, diffusion and processes of cell membrane transportation of economic plants, soil acidity with soil acid reactions and carbon compounds and air pollution. It is an integrated learning between science, technology, society and the environment, to describe the truth deeply (D.J., Hess & B.K., Sovacoo. 2020, 101462; Sawitree, et al. 2017, 1083). Reviewing and examining the actual practice by oneself, has been repeatedly proven to produce a body of knowledge. It has been found that step (4), the decision-making stage, and reflection, emphasise practical solutions in which the learners express the desire to own the problem in their decisions. That is so, whether it is an experiment, invention, finding a way to deal with problems or the reflection process; an activity that makes students truly scientists because they have to search for evidence to confirm or prove those works or problems with the greatest clarity (M.A., Jarvis & O.B., Baloyi. 2020, 100195). Step (5) socialisation is to contribute to the benefit of society with confidence, because the matter that is solved is a problem in the global society. It has been screened according to the principles and correct scientific processes; a step that makes students feel ownership and awareness of the value of that matter (Kuniaki Yajma, et al., 2016, 1489 – 1496).

Learning activities based on STSE-Model learning have an important focus on issues related to the real environment, from real life. From real environmental risk experiences, including indirectly effect, students have to search for answers, investigate the cause, find solutions to plan, design, take action, solve problems, or find ways to change in a way appropriate for the community, society or real life context, by oneself (Yager, R.E. & Akcay, H. 2008, 2; Rungtiwa & Phongsuk, 2017, 60; Sudarat, Ahlee-Ae, 2015, 91). In the five steps of the learning activities, there is a feature that emphasises for the learners, that the students have to express their own needs and teaching techniques based on STSE-Model teaching methods which are diverse such as reflection, and are criticised by principles, rules, and scientific theories. Decisions in solving problems requires rational review that has a clear testimony and takes into account both the positive and negative effects on the environment with meaning (Poonam, Sindhu. P & Suman, S. 2014, 4). Socialisation stages and reflecting techniques are the steps that reflect student's awareness of the environment that will lead to true social use which will be reflected through practice. Students are required to perform selected audits, to confirm those principles and then disseminate them in society; in the family or announce them to the community to reduce problems or support those environments. Sakanan and Chokchai (2011, 1469) found that encourages students to search for answers and decide together the opportunity for each student to express their views, to exchange scientific knowledge. The mutual perception of the environment and the opportunity to revisit one's own thoughts will lead to decisions that require dialogue, and interpretation of information through appropriate social processes.

Raising awareness about the environment is a sentiment. Esteem and knowledge, understanding science, technology, and society changes the occurrence of anxiety and makes one cherish concern to think of solutions for oneself and the group together. The method of learning with the STSE-Model is the concept of self-learning. That is a subject being learned. In addition to covering the natural content of science, the environmental problems to be solved must reflect the problems of student's lives, affected directly or indirectly, acted out in practice which raises awareness that the environment, whether in a disaster such as a landslide, or just the familiar water, air, and forest, can really impact positively or negatively on one's social life (D.M. Oliver et al., 2020, 7). Organising learning activities by stimulating or creating learners, encourages one to seek out from real life or real problem situations, ways to solve the problem oneself. Challenges with thought-provoking questions make one face and solve that problem by actually doing, and will create knowledge by oneself. The learning providing according to the STSE-Approach would help the students to know, understand, express the need to reserve environment and natural resources, and participate in taking care of such matters. Students would have care in the problem which is real in their community, bettering their knowledge and understanding (Prisan, 2015: 2; J.C., Dring, 2020, 27-28).

The result of comparisons of student awareness towards environment in the area at risk of environmental disaster, by using STSE-model, by students experienced and inexperienced in the effects of environmental disasters, indicates that there is no difference all across the dimensions. This is because it is learning through problem-solving from real situations which is caused by debating with divergent thinking, to make reliable collaborative decisions based on scientific evidence, and data is a learning method of the STSE Approach (Nadia, Laura Serdenciuc (2012, 754)). The students will choose the problem, which is either a direct environmental disaster or being indirectly affected by environmental risk, such as the erosion of the Ngao River, a landslide, drought in the village, severe runoff of water, bad smells from rubber problems, density, or dust, etc. This resulting in students showing their potential, freedom, and creativity. This is an important motivation that students want to practice, want to edit, want to learn, and want their work to have meaning in life. It is found that effective learning management should be integrated with science content issues and activities, and that they should be challenging to give real practice from the surroundings, as well as stimulate environmental awareness of scientific and environmental responsibility, for more meaningful learning (Tan (2009, 32). Basil, Ahmed Kamel and Mohamed, Said Asar (2012, 674) mention that to achieve sustainability in behaviour, awareness of the environment must change behaviour from within; that is caused by problems of one's own needs and the need for correct knowledge. In terms of anxiety and concern, both groups of students expressed anxiety and concern not different from each other. Learning by doing, according to the techniques or activities of STSE-model, such as bringing news of events such as floods, air pollution, the Greenhouse effect, including issues that affect life, such as health, economy, safety in life, students will see the need the importance of their own environmental problems,



from step 1; in-depth knowledge and appreciation in environment (Latifah, Amin et al., 2012, 83). Therefore, teaching and learning by using STSE-model learning, in understanding the principles of removing issues, activities, as well as teaching techniques according to the teaching process, result in students becoming experienced or inexperienced in the effects of environmental disasters upon them. Moreover, STSE-model learning is a method of teaching to encourage participation in building a sense of belonging in relation to common interests for both the school and the community (The community especially in schools and with other stakeholders) (Siti Mazwin Kamaruddin, Puziah Ahmad, and Norsyamira Alwee, 2016, 729). It resulted in the student's awareness of the environment being common, and not different.



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