EXPLORING IN-SERVICE TEACHERS' PERCEPTIONS ON VALUES-BASED WATER EDUCATION VIA INTERACTIVE INSTRUCTIONAL STRATEGIES THAT ENHANCE MEANINGFUL LEARNING

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Instructional strategies determine the approaches an educator may take to achieve learning objectives. Research has shown that sets of strategies or instructional models anchored on social constructivist learning theories were found to be effective in enhancing active participation. It is particularly influential and meaningful in many areas of learning and teaching especially in the field of continuing professional development (CPD). This article reports on the experience in organising an in-service training course as part of the CPD programme for teachers from Southeast Asian countries to introduce the concept of Values-Based Water Education (VBWE). It aims at exploring the participants' understanding of values-based water education via interactive instructional strategies introduced in the course. Strategies/approaches to enhance conceptual understanding via interactive instruction included grouping the participants into four expert groups to explore various issues of water related to environmentally sustainable development; health, sanitation and recreation; social equity and human dignity; culture, traditions and religious practices. Strategies/ approaches to stimulate knowing in action via experiential learning included using field studies to explore various issues related to polluted and non-polluted water. Survey

questionnaires were administered to 23 course participants from 8 Southeast Asian countries to evaluate their perceived levels of knowledge/skills on 12 selected items related to the focus of this study. Data analysis was also reported via descriptive and inferential statistics. The findings revealed that the participants showed significant improvements (p<0.01, with t-values ranging from 6.64 to 12.46) in all items related to their perceived levels of knowledge and skills towards the topics introduced in the training course. Method triangulation was also made with report of findings from observation, interviews and output of learning as observed from their preparation of group presentation including fieldwork reports. In conclusion the implication of the study was elaborated on how teachers' CPD could be redefined for meaningful learner-centred learning incorporating values-based education.

Introduction

Instructional strategies determine the approaches an educator may take to help learners achieve learning objectives. Instructional methods and teaching methods mean the same thing. Instructional methods are used by educators to create learning environments and to specify the nature of the activity in which the educator and learner will be involved during the lesson. Direct and indirect instruction are two main categories that many educators find useful for classifying teaching methods. While particular methods are often associated with certain strategies, some methods may be found within a variety of strategies (Adprima, 2007; Saskatoon Public Schools, 2007).

One of the essential professional roles of teachers is to upgrade teaching skills through Continuing Professional Development

(CPD) programmes including attending in-service training courses. Values-based water education (VBWE) or water and values education (WAVE) (SEAMEO Secretariat, 2007) is an innovative approach that not only seeks to impart information on water, sanitation and hygiene but also inspire and motivate learners to change their behaviour with a view to promote wise and sustainable water-use ethics to conserve or preserve water. Though governments of the region have put in efforts with various technical and regulatory measures aiming at improving quality water management, the implementation of such measures cannot be accomplished without advocacy, awareness and educational initiatives.

This article reports the experience of the author in organising the regional Training-of-Trainers (TOT) course that was held to introduce the concept of VBWE via various interactive instructional strategies/approaches involving 23 participants. These participants were science, mathematics and social science primary/secondary teachers or education officers. The participants were from Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Thailand and Vietnam with diverse socio-cultural and educational backgrounds. The implications of the findings will be elaborated as part of the capacity building exercise and CPD towards achieving the goals of training teachers on integration of *human values-based water, sanitation and hygiene education* (HVWSHE) in the curriculum of the Southeast Asian countries.

Objectives and Focus of the Study

This research is conducted with the following objectives:

1. To explore ways of introducing HVWSHE curriculum in a regional TOT course as an in-service CPD programme via constructivist teaching pedagogies with learner-centred approaches;

2. To evaluate the participants' or in-service teachers' perceived understanding of the concept of values-based education incorporated in water and its related four thematic strands namely (i) environmentally sustainable development; (ii) health, sanitation, recreation; (iii) social equity, human dignity; (iv) culture, traditions and religious practices;

3. To measure the learning performances of the participants from documentary analysis of their output of learning with report on the impact of training curriculum focusing on selected aspects of this study. The triangulated findings were extracted from their qualitative feedback, group discussions and enhanced perceived levels of knowledge/skills in the pre- and post-test evaluation questionnaire being administered before and after the course.

More specifically at the end of the course input, the participants should be able to:

1. show improved conceptual understanding and appreciation of the philosophy of HVWSHE;

2. demonstrate enhanced levels of knowledge/skills in lesson integration incorporating assessment/ evaluation techniques and strategies/approaches introduced in the course that:

    (a) promote conceptual understanding via interactive instruction, particularly Cooperative Learning expert groups integrating cross-curricular approaches, e.g. use of thinking tools; and

    (b) stimulate interest and knowing in action via experiential learning, particularly issues-based contextual learning and fieldwork approaches.

The indicators of learning performance for the in-service teachers will be measured from their:

1.   change of perception on the various topics introduced with evidence of improvement in understanding the concept and rationale of integrating HVWSHE, and the four thematic strands;

2.   enhanced levels of perception on various instructional pedagogies and assessment techniques that promote conceptual understanding via interactive instruction as well as stimulate interest and knowing in action via experiential learning with evidences of output of learning.

Literature Review

Effective sets of strategies or guidelines (often being referred to as instructional models) are based on learning theories that describe the ways that theorists believe people learn new ideas or concepts. Often they explain the relationship between information which was already known and the new information to be learned (EduTech Wiki, 2007; Saskatoon Public Schools, 2007). Research showed that sets of strategies anchored on social constructivist learning theories were found to be effective to enhance active participation. It is influential and meaningful in many areas of learning and teaching especially in the field of Continuing Professional Development (CPD), whereby:

> Knowledge is seen as something that is constructed in social groups. Meaning is arrived at by negotiation.

> (Greeno, 1997 in McConnell, 2000, p.9).

In fact, research into CPD has suggested that traditional methods i.e. lecture by experts or instructor-centred approaches do not influence practice (Waddell, D.L., 1991; Wood, I., 1998). These factors combined with the recognition of the need to promote learner-

centred approaches have led to calls for reform of traditional professional education. It is believed that an integrated approach to teaching (e.g. cross-curricular science teaching) based on influential learning theory such as constructivism is particularly appropriate for activities that have a real-life application in formal or non-formal education (Burns & Glen, 2000; Ramsden, 1992).

Social Constructivist Learning Theories as Research Framework

The key principles of constructivism proposes that learners build personal interpretation of the world based on experiences and interactions with knowledge that is embedded in the learning context in which it is used. Learning which is viewed from social constructivism or social learning theories of situated cognition focuses on learners' prior knowledge and how they construct their understanding based on their contexts or learning culture (Vygotsky, 1978). Social learning theories advocate that students master new learning approaches through interacting with others (Doise, 1990) as knowledge and understanding develop in relationship with the social context (Fickel, 2002). The theories support learning as a social and cultural activity mediated by the social and environmental factors around the learners that stimulate their learning so that growth occurs in the cognitive, psychomotor and affective domains.

The instructional or learning strategies that are proposed under constructivism include constructivist teaching, collaborative learning and problem-based learning. In research reported by Helgeson (1994), most but not all, cases using inquiry-oriented curricula resulted in significant gains in problem-solving skills, and gains in achievement or attitudes towards science.

Exploring Constructivist Teaching Pedagogies to Redefine Teacher CPD in the HVWSHE Course

Two areas of concern in pedagogical approaches introduced in the HVWSHE course are discussed in this section with review of literature related to strategies to promote conceptual understanding and the practical aspects of knowledge or knowing in action (Ng, 2007). Table 1 compares these strategies with the expository approach.

Strategies/approaches to enhance conceptual understanding via interactive instruction. The interactive instruction strategy allows for interactive teaching and learning methods that rely heavily on discussion and sharing among participants. The success of this strategy and its many methods is very much dependent upon the expertise of the educator in structuring and developing the dynamics of the group. It is important for the educator to outline the topic, the discussion time allocated, the size and composition of the groups with the sharing or reporting techniques. This is to ensure learners can learn from peers and educators to organise their thoughts and to develop rational arguments, e.g. through peer partner learning, panel discussion or conferencing, debates, exploratory concept learning and tutorial or experimental group strategies.

Interactive instruction requires the refinement of scientific and social skills or abilities, e.g. observation, listening, interpersonal and intervention skills by both the facilitators and learners. Apart from these commonly used strategies, the lesson plans developed using these strategies may include brainstorming, interviewing, active teaching and learning approaches (e.g. games, simulation, role play, active reading and active writing including sequencing activity with Question and Answer (Q&A) based on text), problem solving, cooperative learning, for example cooperative learning structure 'Think-pair-share' as suggested by Kagan (1995) and 'Jigsaw expert

group' (Slavin, 1991; 1995), active group learning involving graphic organizers to brainstorm ideas in solving problems and promote critical/creative thinking or research skills, pair work and presentation to enhance scientific skills, whole class discussion and quiz.

Strategies/approaches to stimulate interest and knowing in action via experiential learning. The emphasis in experiential learning is on the process of learning and not on the product. It is activity oriented, inductive and learner-centered. This type of learning can be viewed as a cycle consisting of the following five essential phases:

1. Experiencing activity and investigative work.

2. Sharing reflections and/or publishing observations.

3. Determining patterns and dynamics through analysing or processing.

4. Deriving principles through inferring or generalising.

5. Applying plans that are made to transfer learning to other new situations.

Table 1

Learner-Centred Interactive Approaches Used in This Study as Compared with the Expository Mode

Teacher-oriented expository mode experiential approaches in this study *Learners as passive receiver*: Teacher defines terms or concepts and provides explanation directly.	Learner-centred interactive and *Enhancing conceptual understanding via interactive instruction:* Problem-posing: Topics to be exposed and the questions or problems might require learners to investigate. For example, exploring the biological/chemical/physical characteristics of water (refer Appendix A).

Learners are viewed as a reservoir of knowledge, subject-centred. Instruction is made by the educator. Teacher/educator covers more materials in the class and they think the more they cover, the better they are.	Instruction is conducted in a way that helps the learners become conscious of their own knowledge structures and helps them nourish, refine, modify, or replace those knowledge structures. More holistic views of the learner could be achieved, thus more is retained and trans-ferred. Educators are more interested in cognitive and creative growth. The development of multi-talents was taught in helping learners to develop their self-concepts and understanding. For example, using graphic organizer *fishbone diagram* to show cause-and-effect of water pollu-tion (refer Appendix B**)**.
Teacher/educator gives examples and provides explanation on various concepts.	Proposing explanations and solutions: The concepts are discovered or constructed illustrating how findings are communicated or discussed via various mode including ICT-based learning activities (E.g. HVWSHE web-based learning, http://www.srecsam.edu.my/elearn/) and computer graphics.
Guided experimentation and recipe science emphasising product of learning: Examples are given orally or in writing with step-by-step guide (e.g.for experiments).	*Stimulating knowing in action via experiential learning and action taking emphasising process of learning*: The applications of what learners construct or discover through investigation, experien-tial learning activities and field

	studies (refer Appendix A**)**. Mostly less structured guided, non-guided discovery or problem-based learning activities will be encouraged.
Teaching concept without involving e.g. science processes.	*Explorations, discoveries*: The science processes are involved with the method used to carry out field studies activities, individually or in group.

(Adapted from Carin,1993; Saskatoon Public Schools,2007; Ng,2007; Ng, Azian, Cheah & Peter, 2007).

The critical factors in effective experiential learning include the formulation of plans to apply learning to other contexts about an experience. The approaches may include group literature research, institutional visits, group experimentation, survey research or investigative project work, conducting scientific investigation or environmental/field studies on water pollution, group discovery activities or experiential learning involving processes.

Methodology

This section reports on the administration of research instruments and data collection activities.

Administration of Research Instruments

The research design involved a one-group pre/posttest study using an evaluation questionnaire based on the objectives to identify the prior knowledge or learning needs of course participants and their change of perceived levels of knowledge/skills after the course activities. The pretest questionnaire was administered on the first day of the course and the posttest questionnaire with the same content was administered at the end of the course. The participant

respondents were requested to indicate in the column that depicts their levels of perception using the Likert scales of '1=very low, 2=low, 3=moderate, 4=high, 5=very high' on the following twelve statements as the focus areas related to the objectives of this study (also depicted in Figure 1):

1.   Concept, philosophy and exemplary practices of HVWSHE (items numbers 1 and 2) with elaboration on various values-based issues in the four thematic strands (items numbers 3 to 6):

    (i)   Water and Environmentally Sustainable Development (item 3);

    (ii)   Water for Health, Sanitation and Recreation (item 4);

    (iii)   Water, Social Equity and Human Dignity (item 5) and

    (iv)   Water in Culture, Traditions and Religious Practices (item 6).

2.   Incorporating knowledge, skills or techniques in lesson integration via various contemporary teaching approaches and assessment/evaluation techniques that:

    (i)   enhance conceptual understanding via interactive instruction (items numbers 7 and 8), i.e. cooperative learning expert groups using cross-curricular approaches via thinking tools [e.g.fish-bone diagram, refer Appendix B], and assessment/evaluation tools (e.g.Yeap, 2007);

    (ii)   stimulate interest and knowing in action via experiential learning (items 9 to 12), i.e.

        (a)   Issues-based contextual learning incorporating constructivist approaches;

        (b)   Project-based learning via web-portal with exchange of findings from field studies;

(c)   Water sampling activities with testing of sample polluted and non-polluted water;

(d)   HVWSHE related visits to Water Treatment Plant and various water catchments areas.

If their choices of responses were 3 and above, they were requested to explain the meaning of HVWSHE and the related strategies as listed above with elaboration of examples. They were also requested to list the examples of multimedia resources useful to promote HVWSHE, such as on-line web-based resource (e.g. http://www.scienceacross.org/) and e-Learning Management System.

Research Process and Data Collection

The research process involved the social constructivist framework by first identifying the participants' prior knowledge on various pre-test items constructed to assess their knowledge and skills (that were used to inform curriculum planning or revise the plan of lesson activities). It was followed by the implementation of HVWSHE curriculum designed to incorporate appropriate teaching strategies/approaches (Ng, 2007; Ng, et al., 2007); delivery of intervention activities during the training course and finally evaluation of the outcomes of learning (Yeap & Ng, 2007). Report was made on the quantitative findings using descriptive and inferential statistics as well as qualitative findings extracted from their open-answers in the post-test questionnaire and learning output.

Strategies/approaches to enhance conceptual understanding via interactive instruction included grouping the participants into four expert groups (i.e. they were given roles as 'Biologist, Chemist, Physicist and Mathematician') to explore various issues of water related to environmentally sustainable development; health, sanitation and recreation; social equity and human dignity; culture, traditions and religious practices. For example, the 'Chemists' expert group was requested to respond to questions raised in an article

entitled "Many Causes of River Pollution" to give examples of pollutants. They were also tasked to summarise the content of the articles into concept maps illustrating the water cycle and related environmental phenomena (Ng, et al., 2007). The 'Biologists' expert group was requested to record findings on the biological characteristics of water sampling activity by presenting the cause-and-effect of water pollution using the fishbone diagram (refer Appendix B) (Isma, Kaur, Wee, Zahari & Savuth, 2007). Strategies/ approaches to stimulate knowing in action via experiential learning included exploring various environmental issues related to water though field studies in polluted and non-polluted water catchments areas (refer Appendix A) (Tan, et al., 2007).

Survey questionnaires were administered to 23 participants to evaluate their perceived levels of knowledge/skills on the 12 selected items related to the focus of this study (i.e. interactive instructional strategies to promote understanding of values-based water education). Findings from pre/posttests and interviews including their responses for open-ended questions were used as triangulated data to evaluate the output of learning. Observation was also made on the group activities during cooperative expert group discussions with their learning output presented via graphic tools e.g. fishbone diagram. The indicators of their performance were measured from the change of their perceived levels of knowledge/ skills on the topics, Concept/philosophy of HVWSHE, their deepened understanding on the four thematic strands as well as approaches for lesson integration including cross-curricular approaches, constructivist project-based learning, issues-based contextual learning and assessment/evaluation tools.

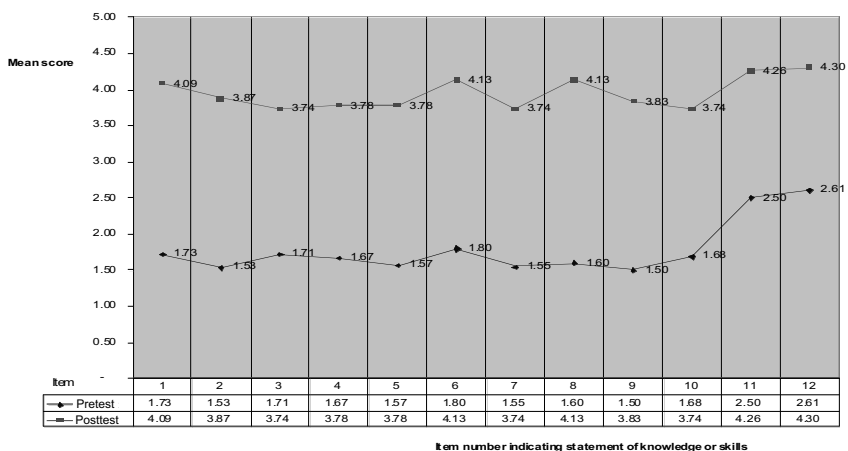## Data Analysis and Discussions of Findings

This section presents the analysis of both quantitative and qualitative data from pre and posttest evaluation questionnaires on knowledge and skills with analysis of quantitative data via descriptive and

inferential statistics. Discussions via method triangulation with findings from observation, interviews or open-ended responses from survey questionnaires will also be reported.

Analysis of Quantitative Data from the Evaluation Questionnaire on Knowledge and Skills

As illustrated in *Figure 1*, there was an increase of the average scores in the participants' perception (N=23) on their levels of knowledge and skills in the 3 main areas with a total of 12 subtopics selected as the focus of this study.

Item	1	2	3	4	5	6	7	8	9	10	11	12
Pretest	1.73	1.53	1.71	1.67	1.57	1.80	1.55	1.60	1.50	1.68	2.50	2.61
Posttest	4.09	3.87	3.74	3.78	3.78	4.13	3.74	4.13	3.83	3.74	4.26	4.30

Item number indicating statement of knowledge or skills

Figure 1. Graphical presentation of HVWSHE participants' overall perceptions on their knowledge on 12 sub-topics before (pre-) and after (post-) course input.

Figure 2 also shows an increase of the average scores in the participants' perception on their levels of knowledge and skills related to HVWSHE course content. Reliability analysis on the questionnaire yielded high Cronbach's alpha value of 0.97. Data analysis via paired-sample t-test also revealed that there was significant increase of participants' perceived levels of knowledge / skills. Table 2 to Table 4 presents the summary of findings from the t-test, a robust tool for statistical analysis (Phillips, 2007).

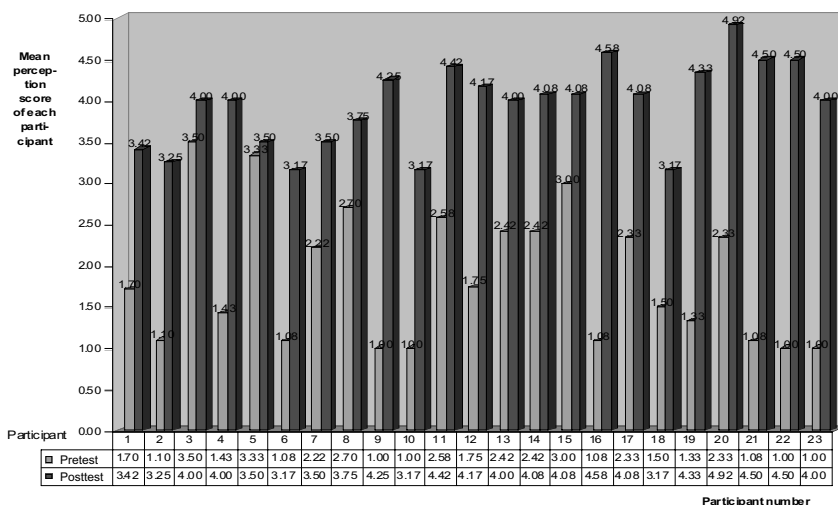| Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Pretest	1.70	1.10	3.50	1.43	3.33	1.08	2.22	2.70	1.00	1.00	2.58	1.75	2.42	2.42	3.00	1.08	2.33	1.50	1.33	2.33	1.08	1.00	1.00
Posttest	3.42	3.25	4.00	4.00	3.50	3.17	3.50	3.75	4.25	3.17	4.42	4.17	4.00	4.08	4.08	4.58	4.08	3.17	4.33	4.92	4.50	4.50	4.00

Figure 2. Column chart illustrating the average pre and posttests scores of HVWSHE participants' perceived levels of knowledge and skills in 12 sub-topics.

Evaluation of Participants' Knowledge/Skills

The quantitative findings from the participants' feedback on their perceived levels of knowledge / skills were also triangulated with observation and interviews including summary of their responses extracted from questionnaire with open-ended questions.

As shown in Table 2, there were significant increases in the participants' perceived levels of knowledge/skills on two items about concept/exemplars and the four items on the thematic strands of HVWSHE respectively. To triangulate the quantitative finding showing high perception of their understanding, they were also requested to respond qualitatively by writing. The following selected verbatim responses were extracted from posttests in response to item 'Illustrate your understanding of HVWSHE integrating human values with exemplary practices...'

> …HVWSHE is an approach that give knowledge and motivates learners to change their behaviour towards wise and sustainable use of water,...Social Science for Strand 1: e.g. Sathya Sai School- Self-sustaining with paddy and agricultural cultivation, reusing used water and initiative of making a retention pond, Science for Strand 1: Cloud seeding and innovation of using 'rockets' to spray chemicals into clouds;…Water ration to elicit mathematical thinking and 5 core human values;… Need to make the more affluent countries to work together to help those in need also;… Teach Maths in Strand 2: 70% of the body is water, how much if the body weight is 60?…Strand 3: Know the role of governmental organisation and NGO in water management. Human rights are the fundamental of human existence;…Strand 1: Sustainable…future…- a fair chance at living a productive and meaningful life in harmony with nature;…In social science, we, human have to deal with social activity in natural environment with scientific approach.…

> (Posttest questionnaire feedback by participants from Malaysia, Brunei, Indonesia, Lao PDR, Myanmar).

Table 2

Mean Score, Standard Deviation and t-Score of Pre/post-Tests Scores in Partici-pants' Perceived Levels of Knowledge/Competency on Concept/Exemplars and Thematic Strands of HVWSHE (N=23)

	Pre-test		Post-test		t-value
	Mean	S.D.	Mean	S.D.	
Pair 1 Philosophical overview, rationale and conceptual knowledge of HVWSHE covering the four thematic strands	1.65	.93	4.09	.67	-8.93**
Pair 2 Understanding HVWSHE and significant HVWSHE experiences in the region.	1.26	.92	3.87	.69	-10.14**
Pair 3 Thematic Strand 1: Water and environmentally sustainable development	1.56	.89	3.74	.69	-8.74**
Pair 5 Thematic Strand 2: Water for health, sanitation and recreation	1.52	1.04	3.78	.52	-8.67**
Pair 7 Thematic Strand 3: Water, human dignity and social equity	1.43	.84	3.78	.67	-12.05**
Pair 9 Thematic Strand 4: Water in culture, traditions and religious practices	1.56	1.08	4.13	.69	-11.39**

**significant at $p<0.01$ or 99% confidence interval of the difference

Although the participants had some basic knowledge on thematic strand 1 (mean pretest was 1.56) prior to the course, they showed significant improvement ($p<0.01$) with mean posttest of 3.74 after

the input was given. Further elaborations on their understanding of this strand were as follows:

> **Strand 1**: Provide environmental facts as eye-openers: Coincide teaching these facts with human values, especially right-conduct to create awareness that it is every inhabitant's duty on earth; When the source of water is polluted, more kinds of living things will die;…Felling/cutting down of trees-> erosion and eroded soil->mud slide->siltation->over flow of rivers->increase the risk of floods downstream-> Pollution of rivers (x3);…Global warming and melting of glaciers of ice and threat to communities along river by sea,e.g…would be flooded. Water as source of drinking and agriculture reduced, e.g. lake Chad drying up, no water for survival, agriculture, migration of people; Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature;…Water should not be taken for granted. As we aim for development, we should sustain environment dealing with water…
>
> (Posttest questionnaire feedback by participants from Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar).

There were also significant improvement (p<0.01, from mean pre-test of 1.52 to mean post-test of 3.78) of the participants' understanding of thematic strand 2 with the following qualitative feedback:

> **Strand 2**: To keep environment clean, e.g. river, lake, mountain, housing (x2); Water is needed for consumption, cooking, personal hygiene, social interaction with nature (x3); Clean water for drinking

and daily use such as bathing, cooking (preparation of food), sanitation and hygiene (x2);…Hygiene is needed in washing, bathing, sanitation, cleaning of body (x3);…Contaminated water poor health, affect agriculture use (x3);….Water-health-long life-happy life, cleaning, active-recreational;... Clean water for daily cleaning; clean and unpolluted for drinking; Clean water for the kids to play around.…

(Posttest questionnaire feedback by participants from Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar).

From a rather low prior knowledge about thematic strand 3 (i.e. mean pretest of 1.43), the participants had shown significant improvement (p<0.01) after the course with mean posttest of 3.78. Further elaborations on their understanding of this thematic strand are illustrated as below:

Strand 3: Social equity is defined as the fair and equitable access to apportunities, livelihood, education and recreation;….Water management (x2);…Need water to survive,…e.g. Maslow hierarchy of needs (5 levels, basic need including water) (x2); Water is life…Water is connected to everything, no water means no life. No life exists without water (x4); Without water all the human beings will die. All human beings cannot live without water;…Water is needed (x2) for all activities;…Respecting water;…girls in some countries drop out because of common washroom; Everyone is entitled to clean water irrespective of social status/ urban or rural;…All living thing is made up of water;..Water is basic needs for human as 70% of our body is water….all human beings are 75% to 80% of water (x4), fruits and vegetables also 75% water;…The

quality of water means the quality of life. It is human dignity and social equity (x2);…

(Posttest questionnaire feedback by participants from Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar).

Culture includes values and institution-based practices in living contexts that are close to the heart of everyone and has a pervasive effect on how people think and act. So it was not surprising that their mean perception had increased a lot significantly with mean score from 1.56 in pretest to 4.13 in posttest. Further elaborations on their understanding in this thematic strand are illustrated as below:

Strand 4: Islam-> ablution requires clean/pure water (x2); Wudhu, spiritual cleanliness. Air Zam-zam for New Year; Water festival (water for agriculture); Water for (prayer)-wudhu-> Islamic(x4). Water to clean old thing (Keris)-> Javanese (x2). Bride-> bathing with water and flower, etc.(x2);…Give us hydropower, drinking, washing;…Cleansing body before prayers/ praying (x3), for medicinal and health;…Blessings in wedding (bath ritual)(for blessing of newly wed husband and wife)(x2) and in birth;…Water for washing before prayers, LoyKratong festival;…The same pool of water can be used for many people…in some culture;…Christian-water baptism;… The monk will spring the water onto our head as blessing;…Water is an offerable thing to the Buddha and it has to be clean and saved….

(Posttest questionnaire feedback by participants from Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar).

Table 3

Mean Score, Standard Deviation and T-Score of Pre-/post-Tests Scores in Perceived Levels of Knowledge/Competency on 'Enhancing Conceptual Understanding via Interactive Instructions' (N=23)

		Pre-test		Post-test		t-value
		Mean	S.D.	Mean	S.D.	
Pair 6	Cross-curricular approaches to HVWSHE incorporating recreational and active learning strategies to enhance multiple intelligences	1.48	0.90	3.74	.86	-8.67**
Pair 13	Assessment/evaluation skills using appropriate tools	1.39	0.94	4.13	.63	-12.46**

**significant at p<0.01 or 99% confidence interval of the difference

In responding to the question on strategies/approaches to enhance conceptual understanding via 'interactive instruction' using cooperative learning expert group discussions and cross-curricular approaches, participants had also shown significant improvement (see Table 3) with the following qualitative responses on how could HVWSHE topics be incorporated with various approaches:

> …In the mathematics, we can always relate it to water consumptions, water management, etc.; …Silent sitting, imagination, learn from nature (recreation) (x2);…Song about water, poems, choral speaking, drama;…'This is the way we save water…Water, precious water. Water is life. Water is more precious than silver'; We can relate the subject to HVWSHE;…Water-boxing, passing the water (representing people) over obstacles; …Simula-

tion of water crisis. Through math calculation to fore-
cast the outcome;…

 (Posttest questionnaire feedback by participants from
Indonesia, Brunei, Lao PDR, Malaysia, Myanmar).

The participants had also gained a general overview of various
alternative assessment techniques to evaluate students' learning
with the following assessment tools given as feedback of examples,

…Portfolio (x2), surveys (x4) to elementary schools for
drinking water used (x2) and questionnaire (x4),
interviews (x3); Self-reflection (x2), evaluation (x2), pre-
test, posttest (x6), rubric, group presentation, action
based research, paper and pencil test; Attitude scale
test/observation (on human behaviour)(x2)/
behavioural checklist; the attitude scales test to evaluate
attitudinal change if there is any, before (pretest) and
after (posttest);…

(Posttest questionnaire feedback by participants from
Indonesia, Brunei, Lao PDR, Malaysia, Myanmar).

As indicated in Table 4, the HVWSHE course participants had shown
significant increase (p<0.01) in perceived levels of knowledge/
competency in the four 'experiential learning' approaches to
stimulate interest and knowledge in action including issues-based
contextual learning, project-based learning via ICT, field studies and
HVWSHE related visits. The following are their verbatim responses
extracted from their open answers elaborating on their
understanding of these approaches.

…Visit to Water Treatment Plant (x3) by analysing water
quality of several water samples; Field studies create
ideas on how to integrate HVWSHE;…Very good (x2)

and educational, we realise how important to have clean water (x2) especially for good health;…While learning, we manage to have sightseeing around the island;…Discussion in plant (x2), detail observation. Touch actual situation, good experience; … "http://www.scienceacross.org"   http://www.scienceacross.org(x3): Science Across the World-'Drinking   water'   topic;…http://www.srecsam.edu.my/elearning(x5);… The fishbone (x3) organiser, mind map/concept map, venn diagram;… Flow diagram: dumping waste→ dirty water;…Flow diagram: water pollution→ plants die → animals die→ humans die (x2);… Field studies: Experience is the best teacher and the best way to learn;….Through educational visit and field study, we realise how important to have clean water;…URL about clean water, safe water and respect water,…Fieldwork comparing clean water and dirty water;…

(Posttest questionnaire feedback by participants from Brunei, Indonesia, Malaysia, Myanmar).

Table 4

Mean Score, Standard Deviation and T-Score of Pre/post-Tests Scores in Perceived Levels of Knowledge/ Competency on 'Stimulating Interest and Knowledge in Action via Experiential Learning' (N=23)

		Pre-test		Post-test		t-value
		Mean	S.D.	Mean	S.D.	
Pair 4	Contextual teaching and learning (CTL) approaches with exemplary constructivist PBL via ICT	1.61	.89	3.74	.62	-9.29**

Pair 10	Understanding various sociocultural issues, societal and environmental problems related to water	1.30	.82	3.83	.78	-10.07**
Pair 24	Institutional visit to Water Treatment Plant.	1.96	1.61	4.26	.75	-6.64**
Pair 25	Round island trip with field studies via *water sampling* activities	2.00	1.60	4.30	.70	-7.13**

**significant at p<0.01 or 99% confidence interval of the difference

Conclusion and Recommendation

Teachers' Continuing Professional Development (CPD) is considered an important factor in raising students' interests and motivation in learning. Teachers should be equipped with a plethora of pedagogies to understand students better and teach more effectively. In fact the study by Harris, Buchanan and Walker (2002) revealed that a positive impact on students' attitudes/motivation and willingness to learn with effort will result when teachers change pedagogical practices in secondary classrooms incorporating factors that are related to their expression of personal interests. Thus effective instructional pedagogies should be incorporated in teachers' in-service training to promote CPD and facilitate their change of paradigms in teaching.

It is hoped that this study will initiate discussions towards redefining teacher's CPD for meaningful learning. The research findings could serve as guidelines for future planning of CPD programmes to promote lifelong learning in values-based education. This study outlines selected areas from the questionnaire to evaluate

teachers' perceived levels of knowledge and skills on the topics introduced in training course. The findings revealed that the participants showed significant improvement in all the following areas that were identified in this study:

- Understanding of the concepts and exemplary practices of HVWSHE with its thematic strands.

- Conceptual understanding of HVWSHE incorporating knowledge/skills in lesson integration via teaching approaches and assessment techniques with:

    (a) interactive instruction incorporating cross-curricular approaches incorporating graphic tool.

    (b) knowing in action via experiential learning e.g. issues-based contextual learning or fieldwork.

In the study the participants showed enhanced values/attitudes towards various water-based issues when they prepared fieldwork reports and devised instructional materials using numerous alternative assessment techniques during school tryout (Ng, et al., 2007) which can be viewed from an elearning system (http:// www.srecsam.edu.my/elearn) that includes their school tryout reports and various learning outputs. The experiences gained from school tryout were also disseminated by participants (Ch'ng, Tan & Ng, 2007; Toh, Yeap, Ng & Isma, 2007).

Recommendations

The findings of this study support the various recommended practices for in-service training to promote CPD as advocated in the literature. In fact a CPD programme which follows work-based learning [an example of contextual learning (CTL) approach] is an aspect of professional development that assists teachers in building strong pedagogical content knowledge (PCK). In designing the models of CPD, two of the design principles proposed for quality

professional development are to:

- involve teachers in identifying their learning needs and the development of learning processes;

- provide learning opportunities that relate to individual needs organised around collaborative problem solving. (Hawley & Valli, 1999, p.138).

These were reflected in this study with pre-/post-test administered to identify learning needs. Learning opportunities were also provided through interactive instruction and experiential learning. Participants were requested to collaboratively solve problems raised in various assignments involving contextual learning activities such as issues-based learning and fieldwork. Assessing/evaluating the enhanced knowledge/skills and learning output of in-service teachers is also another avenue for expanding the in-service teachers' PCK. The findings of this study have brought about the following pertinent points which should be considered in the educational settings or as suggestions for future research:

1. There is a need to identify various niche areas and learning needs of in-service teachers towards redefining a more comprehensive programme for their CPD.

2. Teachers should be provided with CPD opportunities considering the integration of process-knowledge based learning incorporating values-based learner-centred approaches rather than placing much emphasis on content-based learning with instructor-centred approaches.

3. More research studies should be conducted to explore the paradigm shifts of teachers towards implementation of values-based curriculum with exemplary practices to be reported for sharing.

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Appendix A

Summary of Field Study Reported By 'Mathematicians', 'Physicists', 'Chemists' and 'Biologists' Expert Groups

Parameter	Upstream Sungai A (*Eg of non-polluted water catchment area*)	Downstream Sungai P (*Eg of polluted water catchment area*)
(1) PHYSICAL CHARACTERISTICS		
Turbidity	1.90 NTU	16.16 NTU
Colour	Clear	Black
Smell	No smell	Bad smell
Temperature	27.5°C	30°C
Flow rate (ping pong ball & meter rule)	12 sec /meter	45 sec /meter
Substrate/garbage	Clean	Full of rubbish
Land use nearby	Open space	Houses, busy road, factories
Contamination (oil, drainage..)	No	Oily and water stagnant
Type and aquatic life	Many guppies and small fishes	A few small fish inside the river
(2) CHEMICAL CHARACTERISTICS		
pH	5.5	8
Dissolved Oxygen (DO)	92%	13%
Salinity (salt in the water)	0	8.4

(3) BIOLOGICAL CHARACTERISTICS (Bio-indicator)		
Fauna (plants)	Healthy elodea and hydrilla	No sign of plants in the water
Flora (animals)	Guppies, dragon flies and its nymph	No sign of living things except a few fishes
(4) FISH AS INDICATOR		
Type of fish	Guppies and others	Only a few small fish
Other observation	A man was catching fish using a net	Fishermen complaint no fish in the river.

Appendix B

Sample Fishbone Diagram by 'Biologists' Expert Group Illustrating Cause-and-Effects of 'Water Pollution'