HOW TO ENHANCE LEARNERS' MOTIVATION FOR SCIENCE STUDIES

－Application of activity based science lesson in Sri Lankan and Japanese high schools－

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Qualitative science education enhances the learners' motivation for learning improving knowledge, competence and skills for a successful evolvement of individuals, and that indicates the technological empowerment of a nation for better development. Students' interest in science education is significantly decreasing in all over the world due to the various reasons. Enhancement of learners' involvement for science education was focused in this activity by introducing a learner centered outcome based science lesson for Sri Lankan and Japanese high school students. The paper reveals a significant enhancement of learners' motivation for science education by the application of proper teaching strategies and teaching skills towards the improvement of scientific knowledge, competence and different skills among high school science students. An activity based teaching material was developed in Naruto University of Education - Japan, to persuade students' eagerness for the science education using Japanese teaching skills and strategies and applied in some Sri Lankan high schools and Jonan high school in Tokushima-Japan.

Key Words：Science Education, Learners' eagerness, Water Chemistry, Learner centered activity, Sri Lankan and Japanese high schools.

理科学習者のための意欲高揚法

－スリランカと日本の高校における理科授業への応用－

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自分の能力を向上させたいと願っている個人の学習意欲を高めるのは，質の高い理科教育であると考えられる。つまり質の高い理科教育が，よりよい発展を望む国の技術強化をもたらしてくれる。しかし諸々の理由により，理科の学習に対する生徒の魅力が，世界的に非常に減少しつつある。発展途上国の理科学習意欲の向上に対して，スリランカでは理科教育を改善するために適切な教授法と技能の熟達を考慮しながら，学習者中心の理科授業を導入している。この論文では日本の教授技能と教育方針に基づいて鳴門教育大学で開発・発展させた理科学習者の意欲高揚の方法を，スリランカの高校と日本の徳島県城南高校へ適用した成果について報告する。

キーワード：理科教育，学習者の意欲，水の化学，学習者中心の授業，スリランカと日本の高校

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1. INTRODUCTION

Education is the foundation of peace and development of a country empowering the development. High quality of the science education indicates the technological development of a country and school science education towards the basic path for the improvement of technological skills and knowledge. Sri Lanka holds a top level of the education among developing countries by centralizing the system under public state providing free education for all citizens till the end of the university level.

Sri Lankan education system has undergone many reforms; though the examination oriented teaching procedure is practiced imitating the British system rather than understandings and applications. Students' involvement for the science education is decreasing in most of the countries including Sri Lanka due to the lack of favor to the subject under certain faults of the science education system and social problems. The quality of the science education is mainly regarded to minimize the learners' attraction for science education in most of the developing countries. How to enhance students' favor for learning is the hidden secret behind the quality of the science education.

2. RESEARCH STRUCTURE

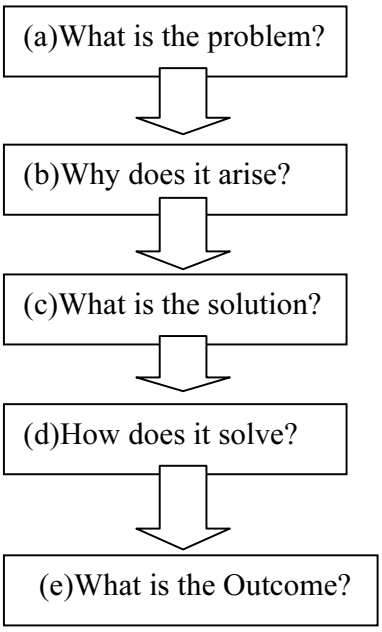

Figure 1. Research structure

The research structure was designed according to the Figure 1 considering five steps such as（a）What is the problem in Sri Lankan science educational system?（b）Why does it arise?（c）What is the solution?（d）How does it solve? and（e）What is the outcome? The problem was investigated by the experience as a high school teacher in Sri Lanka and by the discussion with the teachers.

The problem is observed as the lack of favor to the science education among high school students, as well as the science education does not involve to the personal evolvement and student strength for a better revolution. Specially, students' low pass rates for science subjects relatively to the other subjects in the national examinations disclose the poor quality of science education. Certain faults were observed to raise the problem as follows.

Outcomes of the activity were investigated according to the observations in the teaching- learning cycle, students' performance in the assessments and students impressions on the entire activity.

2.1 What are the reasons that reduce Sri Lankan learners' motivation for science education?

1. Psychological barrier that science is a difficult subject.

2. Lack of skillful teachers to teach science subject properly.（Most of the teachers are trained and knowledgeable though very poor in teaching skills）.

3. Text books are very heavy and big containing compact, complex and advanced concepts and theories. Colorful photographs are not included to enrich the learners' eagerness.

4. Learner centered and outcome based science education is inapplicable due to the compact theories and concepts, lack of resources for complex experiments, exam orientation and over crowded class rooms. Teacher centered science lessons including fewer activities and experiments minimize learners' interest.

5. High school teachers（Advanced level teachers）are very poor in the subject knowledge and teaching skills due to the unavailability of proper pre-service teacher training programs.

6. Sri Lankan science Education is influenced by the examination oriented system. The contents of examinations are emphasized by teaching process rather than understandings and applications.

7. In-service teacher training programs are not proceeding continuously due to the economical problems.

8. Lack of experience is observed among high school teachers to simplify the complex subject contents and to prepare proper lesson plans for leaner centered, activity based science lesson applying proper teaching skills.

9. Teachers are not satisfied with the motivation to dedicate their duty.

10. 'Lesson study' programs are not available to share the professional teaching strategies and skills among teachers.

11. Science education has undergone many transitions and reforms by the professionals without observing the reality in classrooms.

12. Examination papers do not tally with the class room applications due to the lack of classroom experiences by the educators who prepare the national exam papers.

13. Inter-personal relationship between the teacher and learner is very poor due to the cultural aspect minimizing the learners' activeness in the classroom.

14. Well performing students in mathematics and science in the junior high school level are quickly attracted by easily understandable, occupational oriented, interesting subjects like 'information technology' and are deviated from the science stream in the high school level.

15. Learners' involvement for science education is discouraged by the equal motivation of arts and science graduates in the state level.

16. The educational system has undergone many transitions though British system is adopted, which is unsuitable for a developing country. The curricula do not expose agricultural and technological activities using readily available resources and materials in the country for a creative science education.

2.2 What is the solution?

A successful reform is essential for science education in Sri Lanka by adopting such method as learner centered, activity based and outcome based science education considering the own cultural, econonomical and social back ground. As a developing, agricultural country, Sri Lankan science curricula should contain the activities- based contents enhancing learners' eagerness on readily available resources in the country focusing technological and agricultural development and sustainable development. Hence, proper teaching strategies and teaching skills are significant to attract students for science education without creating cognitive conflict on science.

Suggestions would be made for predictable challenges in the activity for effectiveness and success of the entire process. Application of proper teaching strategies and teaching skills are recognized as a main challenge in this activity.

2.3 How does it solve?

The valuable facts to solve the problem would be extracted from the technologically empowered nations in the world by the deep investigation of their undergone transitions of the science education, as a result of the globalization. Suitable solutions are proposed accordingly. The following steps have followed in the activity.

1. Investigation of Japanese curriculum development process, progress of the science education, teaching strategies and teaching skills and teaching -learning cycle etc. to understand the successes of the entire process.
2. Comparison of the high school chemistry curricula in both countries to design an activity based chemistry lesson for high school students in both countries considering current chemistry knowledge.
3. Formulation of the lesson 'water chemistry' for both countries considering Japanese teaching strategies and teaching skills.
4. Enhancement of the teacher's quality by improving teaching skills and teaching strategies. Pre-lesson study, pre-teaching practices and pre-preparations etc. are applied observing demonstration lessons by educators.
5. Evaluation of the teaching process by considering the suggestions on the above step and improvement of the whole process upon it.
6. Application of the developed teaching process in high schools of both countries.
7. Investigation of the outcomes of the entire process according to the students' performances, impression and responses on the activity.
8. Recommendation of the activity would be done upon the research findings for both Sri Lanka and Japan to be considered if possible for implementation.

The curricula 'water chemistry' was developed for high school students in Naruto University of Education - Japan aiming to overcome the certain problems in Sri Lankan science education system, according to the successful Japanese teaching and curriculum-development strategies . The lesson was successfully applied in Jonan high school- Tokushima and some Sri Lankan High schools.

2.4. Development of educational system and explicit teaching strategies in Japan

Japan had followed American, British and European styles to extract contents and the teaching patterns of the science education in early 18^{th} centaury. Also the system has undergone many transitions creating own educational system which is suitable for the strength of the nation, considering own cultural and economical background empowering the development, without depending on the foreign styles.

A huge difference was observed in the current Japanese science education system relatively to the other countries.

Most of the Asian, European and most of the African countries follow very advance, compact and complex contents in the school science education though Japan follows very simple and adequately arranged fewer amount of contents which make more understandable for the students. Most of the African countries and Asian countries including Sri Lanka have undergone many reforms of the educational system creating own systems though the systems are prevailing the western systems containing very advanced and complex contents as a result of the colonization. Developments of the developing countries are negatively affected by the western educational styles neglecting current economical backgrounds and available resources. The science syllabi of the above mentioned countries are rich in compact theories and concepts rather than hands-on activities and daily life applications. Specially most of the theories and concepts are impossible to understand practically due to the lack of resources. Agricultural and environmental activities are not considered in their syllabi which is essential for the nations' strength and development.

Concepts and theories are not compact in the Japanese science syllabi and text books of the each level is thin containing clear, simple explanations and colorful photographs inducing learners' eagerness.

Learner centered, activity based teaching process is undergoing on understandings and applications of the subject matters linking to the daily life in Japanese science education.

Extra teaching and learning materials are available in each level relevant to the agriculture, technology and readily available resources regionally.（Example- Extra reading material of the junior high school science subject in Hokkaido-Northern part of Japan contains cultivation of Soba and production of Soba noodles.）

Japanese University professors regularly visit schools to improve the quality of the education in the class room level. All Japanese reforms have undergone by considering the applicability and capability in the classroom.

Respectively, less amount of subject contents are taught in each grade applying more activities and experiments. Teaching process is punctual due to the adequately arranged subject matters for a subject period in Japanese schools.

Teaching and learning is a relax work in Japanese schools making high percentage of the student（50% or more）properly understanding the subject maters. The situation is completely different in Sri Lankan schools, teaching large amount of subject maters within one period quickly, applying fewer hands-on activities. Teaching and learning is not a relax work due to the compact subject contents and examination oriented teaching pattern. About 5% or less of the student in a class room only acquires the subject matters properly.

'Lesson study' in Japan efforts to an evolution of teaching techniques among the educators overcoming individual weaknesses by improving educating skills on suggestions.

Team teaching is proceeding in Japanese education system for difficult subjects such as science and mathematics to overcome the misunderstandings by providing more learning opportunities.

Japanese teachers are highly motivated and well committed to their duty. It is crucial to the progress of the entire educational process.

Continues in-service teacher training programs are going on in Japan towards the improvement of the quality of the education in primary, junior high and high school teachers under the guidance of university professors.

Some educators express the Japanese education system as a substandard one due to the loosely-compact and uncomplicated subject maters in each grade, though the deep investigations expose as, it is a highly advanced system due to the high qualitative science education than the quantitative education providing more learner centered, useful daily life activities making high percentage of the student understanding the subject matters.

Japan holds a successful science education system which is suitable to promote the agricultural, technological and economical background of the country providing effective and qualitative education empowering the strength of the nation.

3. METHODOLOGY

3.1 Curriculum development

The curriculum *'WATER CHEMISTRY'* was developed as Figure 2. connecting one step to another. Introduction of adequately arranged subject matters including more activities and daily life applications were emphasized in the curriculum.

3.2 How to arrange an active based lesson?

3.2.1-Teaching cycle

A curriculum would be taught in different ways by different teachers in the class room though, how to formulate an active based lesson for a curriculum to attract students for science education. Consequently, the lesson was planned suggesting a 'Teaching cycle' as shown in figure3.

Teacher should be well knowledgeable and skillful person in the field. A proper lesson plan should be formulated considering students' engagement and progress through the teaching cycle improving different skills, competence and

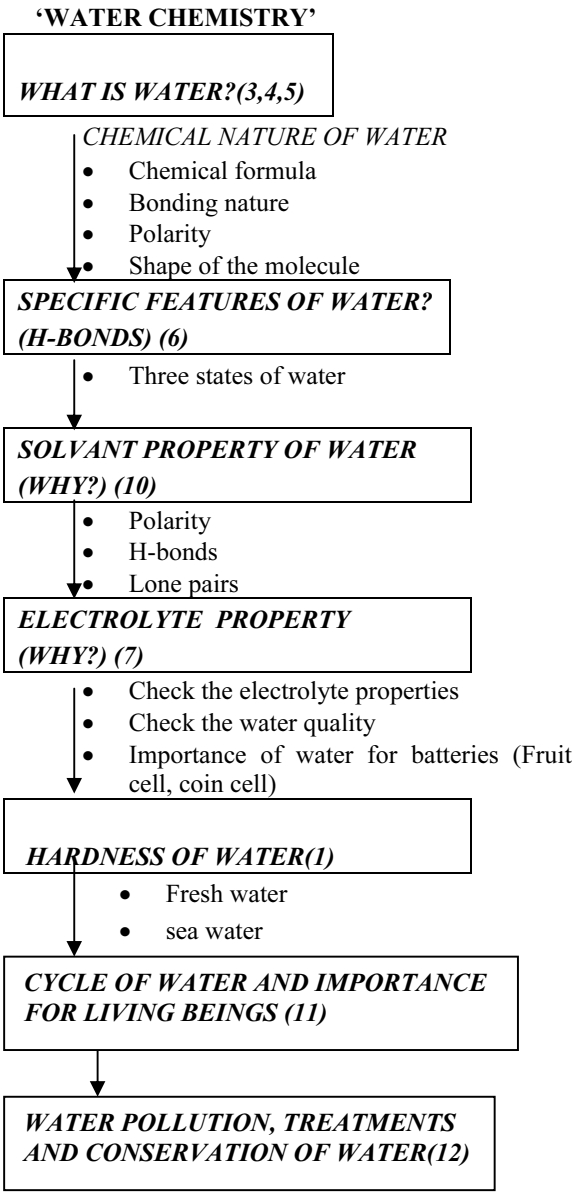

Figure 2. Curricula

knowledge of the individuals for better evolution.[8]

Engagement reflects how to act on the lesson plan. Hence, the following strategies were applied to enrich the teaching process such as pre-preparations by confirming the expectations of the chemical experiments, arrangement of attractive teaching material such as colorful posters, models and pre-lesson study etc.

Educator evaluation process including critical suggestions on the pre-lesson study is significant upwards a perfect educational activity in the classroom.

Interpersonal relationship reflects the achievement of objectives in the entire teaching process and teacher should be benefited upon it onwards the improvement of own teaching skills and strategies.

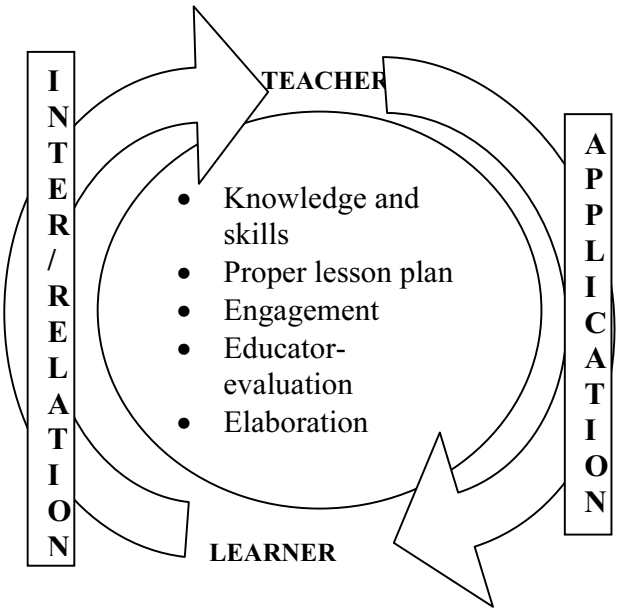

Figure 3. Teaching cycle

3.2.2 Science learning cycle

Especially, explanation of theories and concepts according to the observations of activities and experimental results make a successful lesson enhancing 'finding ability' and 'problem solving ability' of the learners[9]. Hence, a 'Science learning cycle' was developed as Figure 4 to enhance students' interest and favor on science.

Students were aware upon the Science-learning cycle, before start of the teaching process. Learners were trained to make perfect conclusions on predicts and hypothesis according to the activity results by observing, measuring and manipulating variables, analyzing and interpreting results to evaluate scientific evidence.

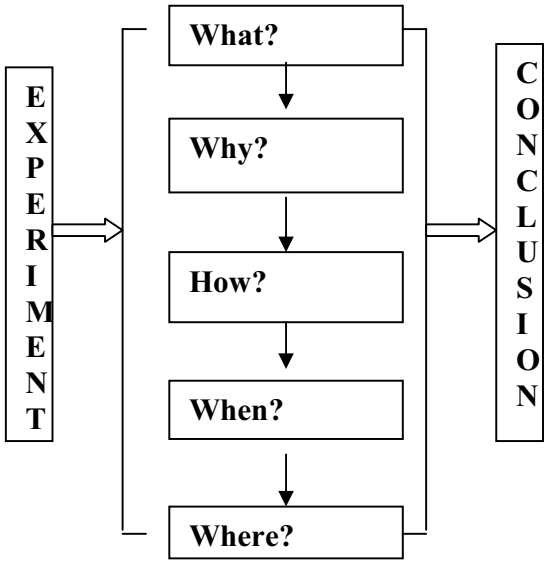

Figure 4. Science-learning cycle

3.3 Explicit teaching strategies

The following teaching strategies and skills are significant for a successful learner centered, outcome based science lessons.

1. Simple explanation of subject matters by simplifying complex and advanced subject matters as much as possible.
2. Arrangement of subject matters from known to unknown (bottom-up method).
3. Linkage of the contents step wise making an interesting story.
4. Activity based explanations of concepts and theories, arranging more experiments and activities using readily available resources[(2)] and materials. Relationship between the subject matters and daily life practices were emphasized.
5. Discussion based explanation of subject matters improving teacher learner interaction and friendship for an active class room. Individual attention was paid as much as possible regarding the problems on the subject contents and language barriers.
6. Application of loosely compact and uncomplicated subject matters applying relax teaching-learning process.
7. Arrangement of lessons by considering the current background of the country, educational system, class room situations, prior chemistry knowledge and resources available.
8. Application of *'lesson study'* by pre-practicing the lesson to overcome weakness and faults of the entire process.
9. Class room arrangements, pre-preparations for activities and experiments, demonstrations and attractive teaching materials were emphasized.
10. Application of *'team teaching'* process for an effective and punctual duty facilitating more learning opportunities.
11. Improvement of different skills among students was considered as much as possible. English practicing ability is poor in Japanese high schools as well as English was introduced as the instructional medium for Sri Lankan educational system recently. Hence, English was selected as the instructional medium for both countries, for better involvement of globalization.
12. Application of very simple, slow and clear English explanations and Japanese translations of the scientific words. Japanese explanations were used if necessary to overcome the language barrier in Japanese high school.
13. Encouragement of students to record, report and present their activities in English.
14. Feed back by summarizing the lesson connecting the acquired knowledge to the daily life.
15. Assessment of students considering their active participation to the experiments, recording, reporting and presentation of the activities in English.
16. Evaluation of students in the assessments by highlighting talents and skills providing suggestions for weak points.

4. APPLICATION

The whole curriculum was taught applying above mentioned teaching strategies and skills in Jonan high school-Tokushima-Japan for 41 high school science students during one academic year (from May-2005 to Feb. 2006) and for some Sri Lankan high schools students (122) at Anula College in Colombo on 5th Jan. 2006, Devi Balika Vidyalaya in Colombo on 6th Jan. 2006 and Darmaraja College in Kandy on 9th Jan. 2006. Some of the selected topics were practiced in Sri Lankan schools due to the time barrier.

The discussion based teaching process was arranged probing prior knowledge facilitating the students' active participation.

Stimulant questions are significant to motivate students' eagerness to find the secrets behind the science. Hence, at the beginning following questions were used to stimulate students on the lesson.

1. *Do you know the electric conductivity of water?*
2. *Do you know the presence of very strong bonds in water?*
3. *Do you know how to separate soluble ions in water?*
4. *Can you make batteries using fruits, vegetables and coins etc. at home?*

The stimulation question should expose a new story of science exciting students on it. This enhances learning interest to find the truth behind the secrets. The following examples briefly explain the teachers' role in active based lessons.

4.1. What is the shape of the water molecule?

Paper balls in two sizes (representing H and O atoms) and sticks (representing O-H bonds) were provided to make the model of the water molecule probing the prior knowledge. Different shapes of water molecules were made by students and linear models were made by most of the students. Reasons for the shapes of the models were explained by the students on predicts and hypothesis.

Teacher introduced the lesson using students' made models of water molecule explaining chemical nature of water. chemical formula of water, electronic configuration of H and O atoms, bonding nature of a water molecule and electronic repulsion forces were explained under 'chemical nature of water' providing correct knowledge.

Early made 'models' were corrected by the students acquiring the correct knowledge on the shape of the water

molecule as it is 'angular' and is not as linear.

4.2. What is 'polarity of water'?

An activity was arranged to detect the deviation of 'thin water flow' which come down from a burette by different static electric appliances. Own findings were presented by the students upon predicts and hypothesis based on activity results. Theoretical background of 'water polarity' was explained by the teacher clarifying doubts and providing correct knowledge. Students enjoyed well understanding the polarity by the activity.

H-bonds in water were explained using the polarity of water. The arrangement of water molecules in *'liquid water'* and *'ice'* structures was made using paper balls and sticks.

4.3 Why does the water act as a universal solvent?

Solubility of different compounds in water was observed experimentally. Water and benzene were used as solvents and solubility of different compounds（$KMnO_4$, $K_2Cr_2O_7$, I_2, acetone, ethanol, $CuSO_4$, $CoCl_2$ etc）in the above solvents were observed, recorded and presented the results by the students. Solvent property of water was explained under polarity, H-bonds and lone pairs of water using the students' results categorizing the solutes as ionic, organic compounds and transition elements.

4.4. What is the importance of water in batteries?

Electrolyte property of water was linked to batteries such as Voltaic cell and Daniell cell. Ionization tendency series and reactions on the electrodes were explained upon it. Then the knowledge was applied in the daily life material to make fruit cell and coin cell. Improvement of technological skills was focused in this activity using readily available resources and materials.

All the theories and concepts were explained according to experimental and activity results. Students were motivated to find the secrets behind the activity results according to the science-learning cycle（Figure 3）and it made an enjoyable and active class room overcoming sleepiness and laziness for science education.

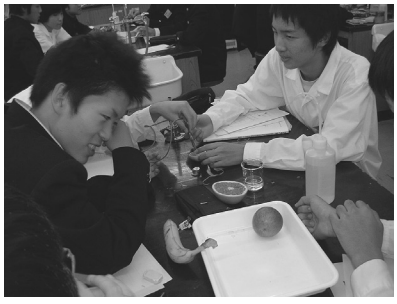

Figure 5. Preparation of fruit cells by Jonan high school students in Japan.

Figure 6. Preparations of fruit cell by Anula College students in Sri Lanka.

Experimental procedures and students work sheets were provided for each student as learning guides.

5. ASSESSMENT

The students' performance in the assessments indicates the quality, success and achievements of the entire process. Hence, assessments and evaluations are emphasized as critical events in the teaching process. Three kinds of assessment methodologies were used in this event to assess the students.

5.1. Continuous assessment

In this case, students were assessed in each experiment for their active participation, recording, reporting and presentation of the results in English.

5.2. Written test

A written test also used to assess the scientific knowledge among the students after completing the whole teaching process. A questionnaire was used in this step providing 20-questions with 4-multiple choices for each. The contents of whole curriculum were assessed by this. Students' scientific knowledge, problem solving skills, processing skills and attitudes on the environment were assessed by the test paper. The same questioner was used to assess Sri Lankan and Japanese high school students.

5.2.1. Students' performance for written test

According to the Figure 7, pre-test results reveal that, 10% of the Sri Lankan students only obtained above 40% marks and none of the students obtained above 60% marks. Ninety percent of the students obtained less than 40% marks. However, 75% of the students obtained above 60% marks for the post-test and 25% only obtained between 21-60 marks. The results indicate a significant statistical

increase in their mean score from pre-test（mean-M=34.2, standard deviation-SD=14.8）to post-test（M=70.75, SD= 11.86）, t value from t-test- t=8.6814, probability- p<0.0001. According to the Figure 8, 89% of the Japanese students obtained less than 40% marks for pre-test exposing the lack of knowledge and skills on 'water chemistry' before the lesson. However, students have improved their knowledge and skills after the lesson obtaining more than 60% marks by 76% of the students in the class. A significant statistical increase is indicated in their mean score from pre-test（M=33.7, SD= 13.94）to post-test（M=76.2, SD=12.27）, t=9.1772, p< 0.0001.

Pre-test results for both countries reveal that lack of knowledge and skills on the contents of 'water chemistry' among the high school students. The efficiency of teaching process is considered to be extremely statistically significant.

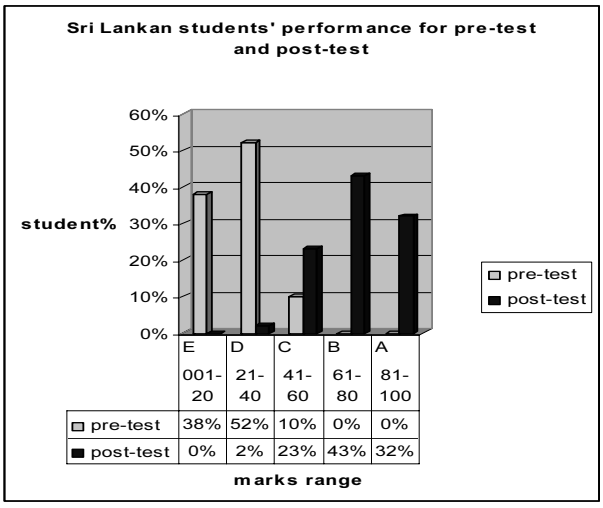

Figure 7. Sri Lankan students' performance for pre-test and post-test

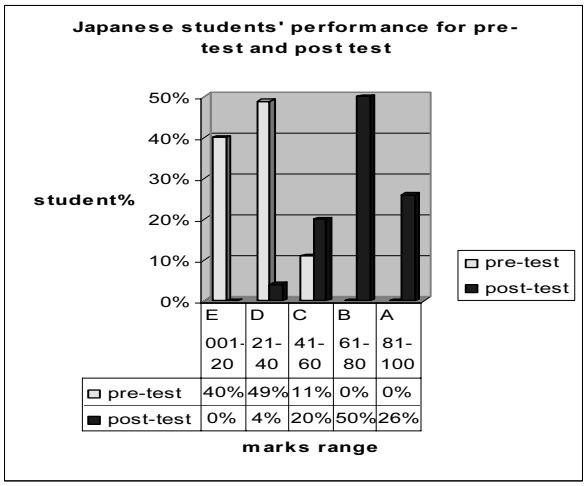

Figure 8. Japanese students' performance for pre-test and post test

5.3. Presentation competition

High school science students are poor in presentation and English practicing skills due to the deep concentration of complex theories and concepts. Hence, the final assessment was designed as a 'presentation competition' among the groups of students to improve different skills other than the scientific knowledge.

Time was a barrier to hold a 'presentation assessment' in Sri Lankan high schools though it was successfully applied in Jonan high school- Japan. Different topics of the lessons were divided into 8 groups（5 students in one group）and students had to present the concepts and theories according to the experiments and activity results. Students were aware on the conditions of the competition for better preparation in the assessment. Greetings, Introduction, Titles and Contents, Relevancy and Order of contents, Presentation skills, Preparations（posters, models etc）, Group co-operation, Conclusions and Ending were emphasized as assessment criteria in the evaluation process.

Most of the students performed well than the expected level in the assessment as shown in Figure 9. Five groups obtained（A, C, D, E and F）above 70% marks well performing English practicing skills as well as improving scientific knowledge. Some reasons were observed for the weaknesses among the students who have poorly performed in the assessment as lack of experience for presentation assessment. Group activities are emphasized to provide experiences for accept, share, tolerate and respect others' ideas. Especially they practiced to organize a best presentation by taking correct and clear decisions overcoming own faults by sharing various talents and skills.

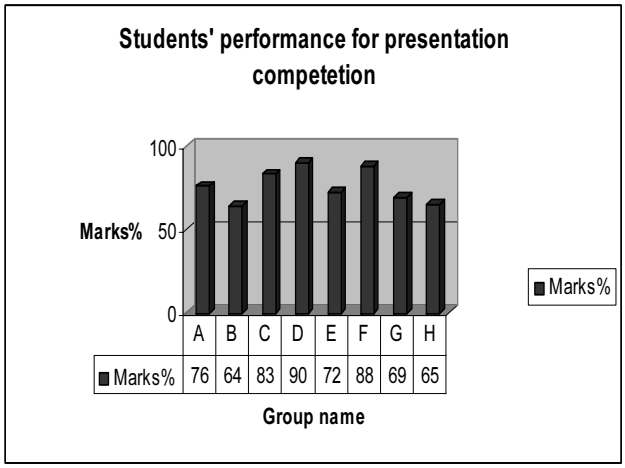

Figure 9. Jonan high school students' performance for presentation competition

6. STUDENTS' IMPRESSION

Sri Lankan students' impression was obtained using a questionnaire as given in the Figure 10. Students' responses for question no. 2. and 5. show the improvement of techno-logical skills using readily available resources and materials by the lesson. Students' responses for question no. 5 reveal the motivation of students to apply the knowledge in the daily life. Fruit-cell and coin cell were not exposed in Sri Lankan science syllabi according to their response for question no.2. Students' impression on question no.6 shows their interest on the lesson and such a lesson may cause to attract learners for learning science.

Underline the most suitable answer on your experience.

1. Did you know the importance of 'Water' in batteries before this? a. Yes b. No
2. Did you know 'how to make batteries using fruits and coins' before this? a. Yes b. No
3. Did you know the chemistry of water before this? a. Yes b. No
4. Did you know the importance of water in the nature before this? a. Yes b. No
5. Can you make 'fruit cells' and 'coin cells' at home? a. Yes b. No
6. What is your impression on the lesson 'Battery Chemistry'?
   a. Learnt the technology of battery on Fruits and Coins, applicable at home and enjoyed well.
   b. Never learnt the technology of battery and not enjoyed at all.

Figure 10. Questionnaire

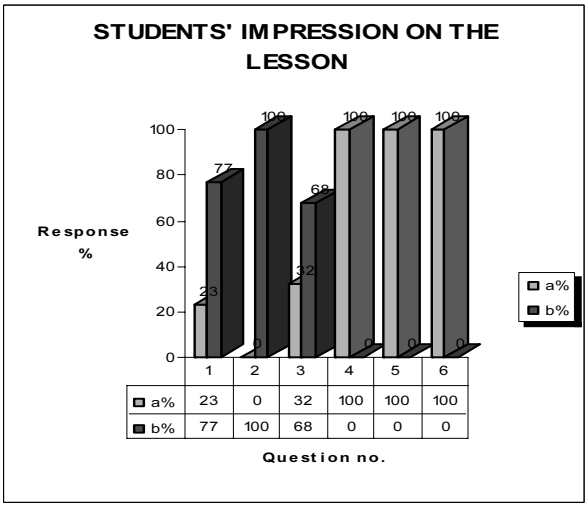

Figure 11. Students' impression

Some of the Jonan high school Students' impressions on the lesson were given below.

Students' impression as shown in Figure 12 proves the enhancement of learner attraction for science education according to the activity based teaching-learning process. Unfamiliar instructional medium was a big challenge in the entire process though the challenge could be easily overcome by clear and simple explanations and by application of proper teaching skills. Students' motivation to enter to the science university by the lesson is a great achievement of the activity proving success and the effectiveness of the duty.

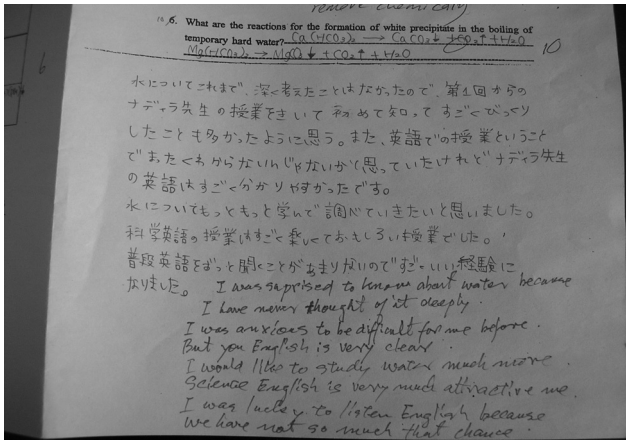

Figure 12. A student's impression.

One of the student mentioned that *'I was surprised to learn about water because I have never thought of it so deeply. It was anxious to be difficult for me before. But your English explanations were very clear. I would like to study under 'water' more because Science-English is very much attractive for me. I am lucky to hear such a lesson because we have not so much that chance'.*

Another student expressed that *'It was pleasant. I worried about Science-English at the beginning. But it was getting understandable. I would like to go to a university of science. So it was a good experience for me.*
Thank you.'

Another student said that, *'I could think of water through experiments. I am surprised to find new features of things which I use in daily life. I could understand them in detail by the chemical experiments. I was not familiar for English lessons, but I understood almost by your slow talking. It was attractive for me'.*

7. EVALUATION

Students' evaluation procedure plays a vital role changing learners' mind correlatively to enhance learning eagerness or not. Intellectual application of teaching skills acts to analyze the student performance and weakness cultivating positive

attitudes on learning process. Students' talents and performance should be highlighted to encourage them enhancing learning favor though suggestions should be provided smoothly to overcome the weaknesses in the assessment minimizing negative attitudes on learning process. Application of appropriate teaching skills in an evaluation process cognitively persuade learners' eagerness for learning.

Well performed Students were evaluated in this activity highlighting their talents and skills and the others were encouraged giving suggestions to overcome the weaknesses at the final assessment in Jonan high school- Japan. The 'stimulation phrases' were used by the teacher to motivate weak students indirectly such as *'Shall we do better next time'* rather than sharply and directly exposing the weak points such as *'You are very poor in ----'* etc.

8. CONCLUSION

The lesson was formulated to achieve short term as well as the long term outcomes. Short term outcomes are obvious in the entire process by the careful observations of teaching-learning cycle though long term outcomes are predictable. 'Enhancement of learners' eagerness for science education' and 'improvement of knowledge and different skills by a science lesson' are the expected major outcomes. Learners' reactivity, participation, impression and performance indicate the evidence for the success of the process.

The entire teaching process on 'water chemistry' was successfully applied to enhance learners' eagerness on the science among Sri Lankan and Japanese high school students according to their performance and impression. The main outcome of the activity seems to be achieved by the analysis of final data.

Teacher, syllabi and resources are focused as significant keys for a qualitative science education. Suitable reform is required for Sri Lankan science education by improving teacher's quality, reducing the contents of syllabi and exposing agricultural and technological activities using readily available resources and materials.

Teacher has to play a vital role in the activity to get the success of the entire process applying proper teaching skills and strategies to create a good quality lesson.

Application of proper teaching skills and teaching strategies, well dedication and scarification to the duty proceeded to the success and progress of the entire process.

According to the above explanations, teacher should be a knowledgeable and skillful person on the subject. Teacher should be able to create an accurate interpretation on the contents. The lesson should be planed to support personal understandings, improve skills and knowledge and make perceptive and well developed connection among concepts and daily life. Adequately arranged, activity based lesson plan designs and conveys information accurately for learner attraction.

Pre-lesson studies and pre-teaching practices support to improve teaching process by the 'educator evaluation'. A perfect activity is made by elaboration and acceptance to the suggestions at the 'educator evaluation'[8].

Discussion based teaching procedure encourages students to express own ideas probing prior knowledge in the class room enhancing learners' expressing skills minimizing the laziness for learning. Also that helps to escape the 'teacher centered' teaching process. Teacher-learner inter-relationship is improved by discussion based lesson overcoming teacher learner gap. A proper teaching -learning cycle creates a good quality lesson.

Investigational skills are enhanced by the 'Science learning cycle' involving to observe, measure and manipulate variables, compare and contrast, analyze, interpret results and evaluate scientific evidence making perfect conclusions on predicts and hypothesis[2]. Activity based explanations of concepts and theories cause to improve and motivate students' self-findings behind the secrets in science. Science is very relevance to the daily life applications than the other subjects. Therefore a science lesson containing more experiments and activities linking to the daily life encourage students' eagerness for learning than the other subjects.

Proper in-services and pre-service science-teacher training programs are recommended to enrich the teacher's quality on new and broad vision of science teaching process improving the quality of the science education to enhance learners' eagerness for science education.

Assessment strategies can be used to improve different skills among the students overcoming the problems arises by the exam oriented educational patterns.

'Group presentation' supports to enhance the social skills improving strength and flexibility of the students to respect and accept other ideas, discuss the faults of the irrelevant ideas investigating real information. Especially they practiced to organize a best presentation by taking correct and clear decisions overcoming own faults by sharing various talents and skills. However, enjoyable group activities cause to enhance learners' interest on learning since improving essential competence, knowledge and skills.

Understanding and concentration ability of the students in a classroom differs to each other and misunderstandings are taken place regarding the subject matters. The group

activities help them to overcome the individual misunderstandings of the subject matters as well as to widen the knowledge from their colleagues other than the teacher[9].

Japan is practicing a high quality school science education though students' favor on science education is significantly decreasing due to the various reasons. Availability of occupational oriented easily understandable and interesting subjects is observed as a one reason for this problem. Students are willing to study those subjects rather than science subjects by spending less energy for concentration. The similar situation is observed among Sri Lankan high school students due to the equal occupational motivation for arts and science graduates. Learners' eagerness for science education would be persuaded by providing a suitable motivation concerning the value of the science graduates.

Different reasons would be observed to the problem among developed and developing countries though the quality of the science education seems to be improved in developing countries to solve the main problems attracting learners for science education. Students' attraction for science education is a national issue in all over the world and science educators have to play a vital role to persuade learners' attraction for science education concerning the national strength and empowerment.

Notes

1. Science Education and Development (Francoise Caillods and Gabriele Gottelmann 1997) says 'The Cognitive Acceleration in Science education (CASE) studies from the United Kingdom provide some support for the importance of practical activity, albeit that associated with simple and cheap experimentations and 'thought experiments' at the lower secondary level. It appears that the cognitive conflict created in students' minds when observation contradicts prediction may be an advantage in developing cognitive strategies for problem solving.'
2. Teaching and learning 'Secondary science' (Jerry Wellington 2000) says that 'At the heart of good teaching lies good planning and good management.' Individual lessons need to be well planed and structured and to some extent be self-contained. But they must relate to previous lessons, previous knowledge and previous understanding - and connect to future lesson and future learning.
3. 'New science literacy' (Marlene Their and Bannette Daviss 2002) says that 'The strategies for explicit teaching are examples of practical methods you can use to incorporate literacy into your science program. Many of the strategies, such as reciprocal teaching, being with the teacher modeling the techniques for students'
4. 'New science literacy' (Marlene Their and Bannette Daviss 2002) says that 'Self assessment has been shown to be a powerful tool for students to use in groups; it can help them set realistic, yet positive, personal goals based upon feedback from the group'.

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