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Triple Approach Instruction to Improve Learning Process and Outcome of Integrated Science Subject

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Abstract
The Triple Approach learning is the integrated learning of Chemistry, Physics and Biology using integrated approach of Contextual Teaching and Learning (CTL), Process Skill Approach (PSA) and Science Technology Society (STS). The implementation of Triple Approach to the subject of science in the secondary school uses the integrated approach. The potential models to be implemented are 'connected, webbed, shared and integrated'. The implementation can be conducted by a single teacher or by a team teaching. The steps of the Triple Approach are 1) determining the study area, 2) identifying the basic competence of each study area, 3) creating connection matrix between basic competence and uniting themes/topics, 4) clarifying the topics into the indicators of learning outcomes, 5) deciding the strategies and approaches used from the CTL, PSA, and STS, and 6) creating syllabus and teaching plans.
Keywords: Triple Approach, Integrated Natural Science Subject

1. Introduction

Natural Science Subject, also more commonly referred to as 'Science', is one of the major subjects in the Indonesian national curriculum, especially in primary school. Science is considered as difficult subject by most students from primary to secondary level. Science deals with ways to study about nature in a systematic way, thus it is not merely the understanding of knowledge in the forms of facts, concepts, or principles, but it also is a process of inquiry.

Based on the field observation, students at schools are good in memorizing, but are lacking skills of applying the learned knowledge, despite the fact that Science concepts are very close to daily life. The learning of Science eventually becomes merely memorizing, deviating further away from its main objective to solve problems of life.

Generally, the performance of science subject in the curriculum is simplified. Therefore, Science teachers at schools ought to implement Science instruction using creative and innovative methods and strategies in order to get students to understand science concepts and to be able to implement it in their life. Science teacher should understand science concepts holistically, since Science never asks 'what' is sought after, and instead it asks 'how' something happens, something which can be observed, examined, and heard, and it also asks 'why.' Therefore, teaching science should be conducted by people who are really capable of teaching it correctly.

The study of Science in secondary school, when viewed from the dimensions of object, the hierarchy of object, and its theme of inquiry, which are Physics, Chemistry and Biology, has many types of study. In order to teach secondary school students about science as a whole, the teaching and learning of Science should be integrated, considering that secondary school students are in the transition phase - from the concrete phase to the formal operation phase. In addition, if we consider students existing knowledge, the integrated Science in secondary school level, especially in grade VII, is still relatively simple. However, students can be trained to understand science concepts by integrating various study areas.

The major problem of Science teaching in Indonesia is the lack of qualification of many of its teachers. This is a serious problem because Science should only be taught by scientists who understand the subject considerably. The teaching and learning of science in Indonesia vary with its teachers' specialization ranging from Chemistry, Physics, and Biology, and sometimes even other background of discipline. The teaching and learning of science in secondary schools also vary in accordance with the condition, innovation and ability of the teachers. A survey in 2006 revealed two models of science instruction in secondary schools in the Municipality of Malang., they are: 1) Science instruction with a single teacher, and 2) Science instruction with two teachers. This condition is not far different from that of in the Municipality of Batu in 2012, which showed three approaches in Science instruction; 1) integrated science learning with only one science type of Science subject, 2) science learning with two types of Science subject, and 3) science learning with three types of science subjects: Physics, Chemistry and Biology.

The implementation of curriculum 2013 requires the teaching of Science in secondary schools to be conducted in an integrated manner. The integration is different from that of the curriculum 2006 in which, if illustrated using the analogy of 'mixed-fruit ice', the fruits were sliced in cubes. Although they are mixed and served in one bowl, each fruit brings different color and flavor. In curriculum 2013, the integration is illustrated using the analogy of 'mixed-fruit juice', in which all fruits are crushed and blended together so that the appearance of the fruits is inseparable. Therefore, in curriculum 2006, the integrated Science subject still separated the subjects of Biology, Chemistry and Physics which were packed in different themes. However, not all materials can be packed into similar theme, thus some materials still stand alone.

This condition still shows that the instruction of Science is still far from ideal. The instruction of Science requires the support of various components, such as quality teachers as well as creative and innovative teaching strategies. One of the major problems in schools during the implementation of curriculum 2013 is the human resources, in this case the lack of qualified teachers and insufficient infrastructure. The instruction of Science could be conducted in an integrated manner both in the area of content and strategies, as well as the learning approach. The integrated subjects are Chemistry, Physics and Biology, while the integrated strategies include the contextual instruction using the process skill approach and community technology. This double integration is referred to as the Triple Approach. This Triple Approach is expected to improve students' learning process and learning outcome in order to create the quality learning.

2. Discussion

The Nature of Science and Its Teaching

Science is defined as a set of guided knowledge, as explained in the Curriculum of *KTSP* (*Kurikulum Tingkat Satuan Pendidikan*-Educational Unit Curriculum) which states that Science deals with the ways to systematically learn about the nature; thus it is not merely about knowing a set of facts, concepts or principles, but it also covers empirical knowledge about facts and natural phenomena (Depdiknas, 2006). Therefore, the study of Science is factual and contextual. There are four main essences of Science: attitude, process, product, and application; thus the study of science should be empirical and factual. In addition, Science is a holistic and inseparable unity; accordingly, its teaching is also better done as one. This is in line with Hewit, Paul, et. al.'s (200) argument that integrated Science covers the aspects of Physics, Chemistry, Biology, Geography, astronomy, as well as other aspects of the study of nature. Besides, since Science possesses objects, its teaching should be conducted holistically.

The teaching of Science in junior high school is conducted in an integrated manner, as expressed in the Development Guidance for Curriculum of 2013, because Science is seen as an 'integrative science' and not as a 'discipline.' Integrative science incorporates various aspects, including the domains of attitude, knowledge and skills. The features of Science teaching are: oriented towards application, and focused on building the thinking skills, learning motivation, curiosity and raising students' awareness, concerns and responsibility towards the natural and social life. Substantially, science could be used as a tool to develop the domains of attitude, knowledge and skills. Therefore, integrated learning is one of the suggested models for implementing the curriculum, which can be applied for all education levels from the primary to the secondary levels.

Curriculum of 2013 has stated that the study of science in junior high school is developed as an integrative science, and not as a discipline. This concept is explicitly stated in the 'Main Competence' (*KI-Kompetensi Inti*) and 'Basic Competence' (*KD-Kompetensi Dasar*), in which one KD integrates various concepts from the discipline of Biology, Physics, geography and astronomy. Integrated science allow students to directly experience the science, thus encouraging them to better accept, store and apply the learned concepts. Therefore, students are trained to independently find meaning of various concepts which are taught holistically, meaningfully, authentically and actively. The packaging of the learning experience is designed to influence how students make meaning from the learning activities. The learning experience which shows the connection of various conceptual elements will lead to a more effective learning process. The conceptual relevance learned through the relevant discipline of science will create cognitive scheme, thus students will benefit from the holistic knowledge. What they learn in science class, the holistic view of the real world, and its natural phenomena can only be reflected through integrated learning.

In Curriculum of 2013, the KD of Science subject has integrated various concepts of Physics, Biology, Chemistry, Geography and Astronomy. However, not all aspects can be integrated because they naturally are different. Fogarty (1991) proposed potential model to be implemented in an integrated Science instruction, they are 'connected, webbed, shared and integrated.' The four models are chosen because the concepts in the Science's KD have different characteristics, thus the used model should also be different to optimize their integration. In the curriculum of Science, there are a number of connected concepts in one KD; therefore, its teaching should also be 'connected' to create a unified competence. In this model, the main concept serves as the core teaching material, and the examples or the practical concepts connected to the main concept serve to enrich the main concept.

The KD with connected concepts but with no direct cross-sections should be connected to a certain theme to create a holistic competence, thus it will look like a spider web. This model is referred to as 'webbed', because a connecting theme is always necessary; this model is also commonly called 'thematic.' Meanwhile, KD with cross-sectional concepts requires 'integrated' or 'shared' teaching model, since separating them will result in inefficient learning. In the integrated model, the teaching materials are organized from the cross-sectional concepts contained in the KD; while in the shared model, it is used when not all concepts in the KD are cross-sectional, but its instruction should start from the cross-sectional ones.

3. Triple Approach Instruction

Science instruction is aimed to be inquiry based in order to help students to gain deeper understanding about their surrounding nature (BSNP, 2006). The integrated learning of Science is organized from one theme or topic which is discussed from various points of view, thus it will help students to understand it better. In the integrated Science teaching, one concept or theme is discussed using a number of disciplines of science. The Triple Approach in Science teaching is the development of Science subject through the integration of Physics, Biology and Chemistry concepts as one theme, using triple approach; process skill approach, contextual-constructivist, and community technology. The combination of the three approaches is believed to create a model of instruction which allows students to be deeply involved and to be more active, and thus more student-centered. This model is schematically presented in Figure 1.

Triple Approach consists of double integration; content integration and approach integration. The content integration involves Chemistry, Physics and Biology, while the approach integration consists of contextual teaching and learning approach, science of community technology, and process skill approach. In designing the integrated approach, the main principle to be taken into account is the substance of the contents/materials which are going to be integrated. These are obtained from the key concepts contained in the development aspects related to meaning and functions, which, if combined in certain context (events, issue, topic and theme), still show their original meaning in addition to the developed meaning specific to the context.

Each model of instruction possesses specific feature as any other integrated instruction. Hilda Karli and Margareta (2002:15) suggest several features of integrated instruction: 1) holistic, an event becoming a center point of the instruction is discussed from several disciplines at the same time to understand a phenomenon from all possible points of view; 2) meaningful, the connections of concepts will improve the meaningfulness of the learned concept, and thus is expected to help students to implement their learned knowledge to solve real problems in their life; 3) active, integrated learning is developed through a discovery-inquiry approach, thus students are actively involved in the learning process, which will eventually motivate them to learn more and more.

The three features-holistic, meaningful and active-are the main features of integrated instruction. The holistic integration reflects the formation of a complete concept consisting of a number of contents/materials, phenomena and disciplines. The integration also forms a wider meaning and provides an active instruction with various teaching and learning models. Triple approach also has several unique features: 1) it is based on student-centered learning which requires students to be active; 2) it applies the concept of 'learning how to learn', or in other words, learning science like scientist; 3) it combines the disciplines of Chemistry, Physics and Biology, as well as geography and astronomy as one integrated science subject; 4) it integrates contextual teaching and learning, science of community technology, and process skill approach; 5) it is contextual-it presents subject contents which are related to real life situations and which motivates students to connect their knowledge and the application of the knowledge into the real life; 6) it implements scientific methods by using process skill approach for both basic and integrated skills; 7) it is meaningful, as it connects science teaching and learning and human daily technology with the current issues faced by the society; and 8) it uses authentic assessment-a procedure to measure students' learning of a subject through simple regurgitation of the knowledge.

Triple Approach develops the principles of science instruction. According to Herlen (1985, in Sholahudin, 2005), the instruction of science should develop scientific attitude, curiosity, respect for evidence, flexibility, critical reflection, and sensitivity to living things and environment.

The process skill approach views science as a scientific process and science instruction as scientific process skill training which scientists usually used to teach. Therefore, students should experience science to obtain scientific products such as concepts, principles and laws. Learning using process skill approach is learning about how scientists learn science, or in other words 'learning how to learn.' In learning about science, scientists employs a skill called 'science process skill,' which are divided into basic process skills and integrated process skills (Barba, 1995). The development of the skills are addressed and improved using the inquiry based instruction since it is believed to support students' creativity (Hardini, 2011). The basic process skills include observation, classification, measurement, communication, conclusion, prediction, the use of place and time causality, numerical employment, and variable identification; while the integrated process skills involves: creating hypothesis, variable control, investigation, operational definition making, and experiment (Barba, 1995).

The detailed phases are presented in Table 1.

The constructivist theory requires students' deep involvement in the instruction process, and suggests students' active participation in the learning process. The constructivist strategy is often referred to as the student centered instruction and the teacher's role is to assist students in finding concepts, facts or principles for themselves. In constructivist approach, the teachers' roles and the instruction strategies are improved (La Yoon Fah, 2004). According to Johnson (1999), constructivist class requires teachers to act as learning facilitator and the students decide what and how to learn. The constructivist theory should make the information theirs (Brooks, 1990; Leinhardt, 1992; Brown et al, 1999).

Martin (1997) divides the constructivist strategies into 4 phases; they are exploration, explanation, expansion and evaluation. In the exploration phase, students are involved in the instruction process by exploring all their knowledge and understanding; this idea is represented in Table 2. Students are also encouraged to work in groups and to ask questions during the exploration process. In the explanation phase, students interact with each other in order to develop their ideas further. Teachers help students to use their ideas and explore the ideas further to develop the science concepts and knowledge. In the explanation phase, students are expected to develop their ideas further through physical and mental activities, to widen their ideas and to develop their scientific process skills. Teachers support students' communication through group works and real experience of nature and technology.

Contextual teaching and learning (CTL) is a concept that helps teacher to connect subject contents with the real world situation and that motivates students to make connection between knowledge and its application in their life as a family member, citizen and workforce (US Department of Education and the National School to Work Office quoted by Blanchard, 2001). According to Nurhadi and Agus (2003), contextual instruction is an instruction concept where teachers bring the real world into the class and encourage students to make connections between their knowledge and their daily life. The emphasis of CTL is in the thinking process, inter-discipline knowledge transfer, as well as collection, analysis and synthesis of information and data from various sources and points of view (Nur, 2001). The Center for Occupational Research (COR) in America gives the Contextual Teaching and Learning principles the term REACT (Relating, Experiencing, Applying, Cooperating, and Transferring) of which explanation is as follows. 1) 'Relating' is the most influential contextual instruction strategy at the heart of constructivism. 2) 'Experiencing', this activity involves learning by doing, which includes exploration, discovery and innovation. The direct activity includes manipulation of simple forms of objects, problem solving activities, laboratory activities or projects, 3) 'Applying' is the application of concepts in other contexts, learning by transferring the learned knowledge into application. 4) In 'cooperating', students obtain the knowledge and experience through cooperation among students which will result in meaningful learning because students learn in context by interacting in groups. 5) 'Transferring' is the use of knowledge in a new context. This idea is presented in Table 3.

The implementation of contextual instruction using REACT is more practical and more directed and is organized into phases. Students learn from a problem that they observe which will serve as an experience for them. This initial knowledge will become the stimulus for students to develop their curiosity further by conducting observation, discovery, learning in laboratory, and creating problem solving projects. Solving a problem requires concepts and theories, thus students are expected to implement their knowledge supported by their understanding of concept and theories. In addition, problem solving also needs a team work, thus cooperative learning in the forms that are appropriate with the problems and the topics is encouraged. Students' findings should be applicable to their daily life in order to bring their learned knowledge outside the classroom/laboratory into the society.

The implementation of knowledge in the daily life could use the Science Technology Society (STS) instruction approach, which is an approach to study science and technology in daily life based on the issues currently faced by the community. STS fits the multi-dimension of students' learning, such as conceptual mastery, scientific process, creativity, attitude, implementation, values and their connection to each other (Ghozali, 2002). Iskandar (1996, in Rumansyah 2005) states that STS is based on its close connection to science, technology and community, and is also based on constructivism, and contains five areas of instruction, they are 1) cognitive area, 2) affective area, 3) scientific process area, 4) creativity area, and 5) connection and application area.

Other findings show that students who learn through the STS approach have the opportunity to identify the problems related to things that students already know, which is different from the conventional classroom learning. Robert E. Yager (1992) suggests that STS instruction model is as follows. 1) The first phase is the invitation phase, which includes inviting students to be active in the learning process by first exploring students' issues and problems. Teachers help students to connect the new knowledge that they are going to learn to the previous learning, which then will be followed by the main learning materials which have practical values. 2) The second phase is the exploration phase, in which students, under the teachers' guidance as facilitator, will work in groups and try to design and conduct experiments to collect data. Here, students are trained to use their

scientific process skill. 3) The third phase is explanation and solution phase. In accordance with the constructivism theory, students will develop their own learning by solving the problems by themselves using the information obtained from the exploration phase (second phase). 4) The fourth phase is follow up phase, in which teachers assist students to explain about the natural phenomena based on the newly developed concepts. Teachers also explain various real applications to add meaning to the newly learned information, and conduct reflection towards the understanding of concept. The STS model is presented in Table 4.

Therefore, there are two important issues that need to be developed in the science instruction using the Triple Approach; appropriate science materials and suitable approach. This developmental phase requires the development of syllabus which also contains the instruction strategy. The developed syllabus will be more practical if it is organized into matrix, so that the relations and connections of each component are better understood, as displayed in Table 5.

The success of integrated instruction is determined by how far the instruction is planned and organized based on students' situation; their interests, talents, needs and abilities. The topics and concepts in the curriculum are arranged in advance, thus teachers only need to study the topics/ concepts so that they can be integrated using a unifying theme.

The integration of Biology, Chemistry and Physics will allow students to learn about them in an integrated way, either individually or in groups. Students can actively explore, elaborate, confirm and communicate the results as designed in the 5 principles of Curriculum 2013: to observe, to inquire, to reason, to experiment, and to communicate. Integration means weaving the connections of various aspects and materials expressed in the basic competence of science subject to create one or two learning themes. Integrated learning can also be considered as an instruction which combines a number of materials in one theme.

The science integrated approach "Triple Approach" as an integrated learning applies scientific approach using some phases, they are as follows:

Step 1:

Determining the study areas that are adequately appropriate to be integrated into one topic by first judiciously thinking of what the factors are to base on in selecting these study areas to be taught as the starting point for the selection of the Basic Competence (KD).

Step 2:

Identifying and learning the KD in each study area would be helpful prior to the mapping process since this process is for the purpose of being able to determine the appropriate Standard Competence (SK) and Basic competence (KD) that function as unification. Some determinations of mapping the KD in the development of teaching Science using an integrated model are elaborated as follows:

a. Identifying some KDs that are potential to be integrated in tandem
b. Do not compel to do the integration of the study areas of some KDs which are not potential to be integrated. The KD that cannot be integrated is supposed to be taught by its own.
c. The KDs are not to be derived from the whole SK that exist on the subjects of science in the same classes excluding only two or three that may be plausible to use from the SK into the KD.
d. The KDs that have been mapped into one topic/theme can also be mapped in tandem with the other ones.

After having a good understanding on the SK, KD and the study areas that would be integrated, this phase also requires the choosing and the defining of the themes and the topics of the study area in order that the process of defining the unifying themes would be easier. The selected themes must be relevant to the KDs that have been mapped and been formulated by having a closer look to the latest issues and its connections to the KD from various study area of science. In determining the topics/themes on the process of integrated Teaching Science, there are some aspects that need to be capitalized as follows:

a. Theme, which in the process of integrated Teaching Science functions as unifier among the KDs in the study area of science.
b. The selected themes are not only expected to be relevant to the KDs in one level of class, but be relevant to the students' personal experience in a contextual meaning and are suitable for their local environment as well.
c. In determining the topics, the newest developing central issues can be of the biggest priority, without disregarding the correlation among the KDs with the study areas that have been mapped.

Step 3:

Designing connection matrix between the KDs and the unifying topics/themes is aimed at arriving at a goal to point out the connection between them.

Step 4:

The KDs that have been determined will be divided into some indicators of the learning outcomes as references in arranging syllabus. This syllabus is further developed from various indicators on the study areas of science into some teaching activities in which the concepts of integration and connection can be unified among some study areas of science. The components of the syllabus arrangement involve the Standard Competence of

Science, Basic Competence, Indicators, Teaching Activities, Time allocation, Assessments, and the Learning Sources.

Step 5:

Defining the strategies and the approaches which are chosen from the three phases of CTL, PSA, and STS then, each of the selected phases is unified into one teaching and learning package. After that, each of the phases is integrated to build a "Triple Approach". Besides, there are still other components of teaching that are also essential to be taken into account such as: time, assessments, media, and the students' condition.

Step 6:

The last step is making Syllabus and Lesson Plan as a realization of the students' learning experience. Arranging the lesson plan requires learning and investigating once again or even more frequently since this teaching model uses an integration approach that consists of contextual-constructivist teaching and learning process, community science-technology, and process-based skill approach. The characteristics of these three approaches can be seen in details in the table 0.5. It is shown that Triple Approach unifies the three stages into single instructional activity. The flow chart is shown in picture 2.

4. Conclusion

Triple Approach is a teaching and learning process designed by integrating the subjects of Chemistry, Physics and Biology that are unified by means of three approaches namely; contextual approach, process-based skill approach, and community science-technology. This approach serves as an alternative way in implementing the integrated teaching of science subject in Junior High School.

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Appendix

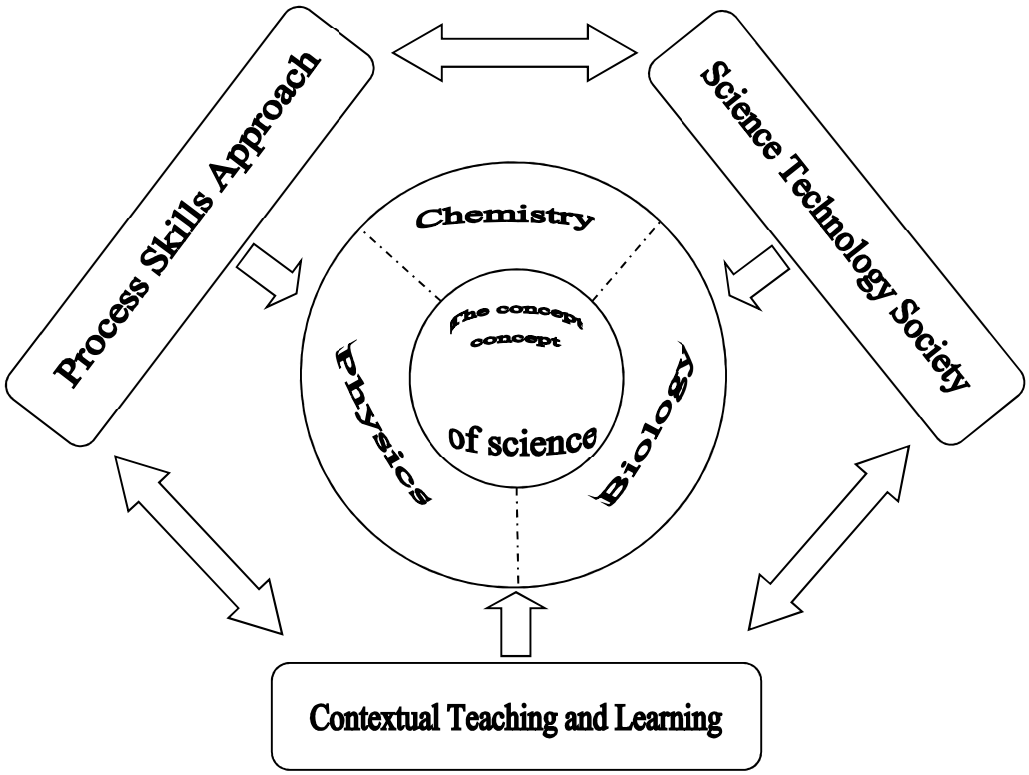

Figure 2 Triple Approach Model

Table 1 Description of Science Process Skill

Process Skill	Definition
BASES Observation	The process of identifying and naming the characteristics of certain things and of some phenomena in a physical world
Classification	Organizing the things, events or information using a certain method or system
Measurement	Comparing an object based on the unknown dimension with the known dimension
Communication	Conveying ideas by means of social relationship/contact
Decision Making	Making a conclusion based on reasoning to explain a set of observations
Prediction	Predicting events in the future in accordance with the obvious fact
The utilization of the connection between time and place	Utilizing a geometrical form to conduct the observation
The utilization of numbers	Applying laws or formulas of Math to calculate numbers
The identification of variable **BEING INTEGRATED**	Distinguishing the characteristics of the constant and dynamic objects.
Hypothesis arrangement	Creating credible statements about one event
Variable control	Modifying an object or a temporary condition while letting the others be constant
Investigation	Learning to discover data in a situation
Creating operational definition	Creating definitions or terminologies that are appropriate with the context
Experimentation	Planning and implementing the experimentation by engaging the integrated process skills

Source: Adapted from Barba, 1995

Table 2 Constructivist Model of Teaching and Learning

Phases	Teacher Activities
Exploration	Providing a chance for the students to be involved in the teaching and learning process and doing exploration using all of their knowledge and understanding. Encouraging a good cooperation of each group during conducting the research and asking question
Explanation	Interacting with the students for the purpose of stimulating their ideas. Giving questions to be able to lead students to do reflection on materials they have learned. Assisting the students to make use of the existing ideas and doing exploration to build concepts and understanding that they are able to comprehend.
Expansion	Assisting the students to develop their ideas deeper through physical activities and mentality. Helping students to sharpen their ideas and developing scientific process skill. Encouraging students to build good communication through group cooperation and more experiences in relation to the nature, world and technology
Evaluation	Evaluating conception by testing the changes on thought and scientific process skill mastery of the students. Using *hands-on assessment, pictorial problem solving,* and *reflective questioning*. Encouraging and attracting the students' interest on ideas opinions, and thoughts of their friends

Source: Adapted from Martin, 1997

Table 3 Contextual Model of Teaching and Learning (REACT)

Phases	Activities
Relating	1. Learning in a context of living experience or one's initial knowledge that is used when the teacher is relating the new concepts with the ideas that are closely related to the students' life
Experiencing	*2.* This activity involves learning by doing that is done through exploration, discovery and creation. Direct activity could engage manipulation that includes simple forms of an object, problem solving activity, laboratorial activity or project.
Applying	3. It is the implementation of concepts to other contexts by way of learning by carrying the knowledge in tandem with the usefulness.
Cooperating	4. It is when the students are obtaining knowledge and experiences through their cooperation one another that leads to the meaningful learning since they are learning in the context of group interaction.
Transferring	5. It is the use of knowledge on the new context.

Source: Adaptep from Blanchard, 2001)

Table 4 Syntax Model of Teaching STS

Phases	Teaching Activities
Phase 1 (Invitation) Exploring issues or problems deriving from the students in early meeting	Teacher gives effective questions to motivate students.
Correlating a new teaching and learning process with the previous one	Teacher has to be respectful to the students who are trying to give their answers and opinions.
Identifying issues or problems in the society related to the topic being discussed	
Phase 2 (Exploration) Designing and doing experimental activities to collect data	Teacher explains the core materials and the practical benefits that will be obtained by the students.
Practicing science process skills	Teacher divides the students into groups.
Sharpening scientific attitude and activities	Teacher gives the students chances to do an experiment to find out the solution and the explanation of the problem and then report their result of observation to be concluded.
Using group discussions that leads to the final conclusion	Teacher directly asks the students to discuss their result of observation to be applied in another situation.
Phase 3 (The Proposal of Explanation and Solution)	Teacher observes and pays special attention to the result of the whole groups.
Students are to construct their own concepts.	Teacher reassures the students' activities if there are some groups coming up with a biased conclusion
Students conduct an effective discussion while learning.	Teacher gives a summary or a review on the right concepts proposed by the students.
Solution of the problems being faced by the society in relation to the materials which are obtained by the students are truly based on the information from exploration activity.	Teacher directs conceptual questions.
Phase 4 (Follow Up) Explaining the natural phenomenon based on the arranged concepts	
Explaining application variously in order to give deeper meaning	
Reflecting concept of understanding	

Source: Adapted from Yager, 1992

Table 5 Characteristic Matrix of Triple Approach

Constructivist	Contextual Approach	Process Skill Approach	Science Community Technology
Exploration Explanation Expansion Evaluation	**REACT** Relating Experiencing Applying Cooperating Transferring	**BASES** Observation Classification Measurement Communication Conclusion Prediction The utilization of the connection between time and place The utilization of number Identification of variable **INTEGRATED** Hypothesis arrangement Variable control Investigation Operational definition Experimentation	**DOMAIN** Concept Process Creativity Values and Attitude Implementation and connection or interconnectivity.

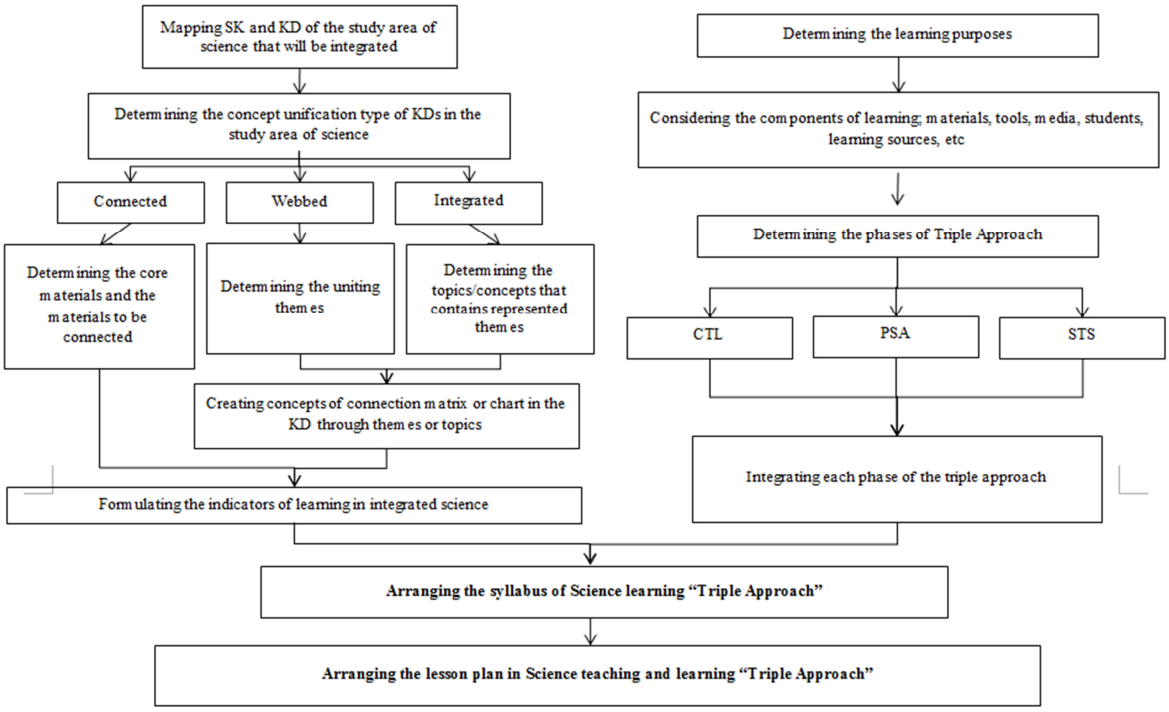

Figure 3 The Flow Chart of an Integrated Teaching and Learning Design

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