



Vaksin Strategy as Enjoyment Chemical Approach for Senior High School Students

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ABSTRACT

Desire to apply knowledge gained in school is the characteristic of high school students. These characteristic actually has been accommodated into 2013 curriculum. However, low interest of high school students to study chemistry was still found. Various learning methods have been developed to improve learning interest in the classroom. The effort to increase students' interest in chemistry can also be done outside the classroom. In this paper will be presented a theoretical study of joyful learning real world chemistry through VAKSIN strategy during school break. The strategy will be given in two ways, through science camps or excursion. Materials to be provided during the science camp are making green chemistry paint, exploration of cat litters, and simulations of waste water purification. Excursion can go into two places, the industry or university. VAKSIN strategy will have positive impact on students, teachers, industries, and universities.

Keywords: high school students, joyful learning, real world chemistry, VAKSIN strategy

INTRODUCTION

High school students in Indonesia as teenager with age range 14-17 years old positioned as middle school students have their own characteristics in studying science. The development of cognitive, affective, and psychomotor of high school students is more mature compared to the previous phase. According to Curtis (2015), the frontal part of the brain (Prefrontal Cortex) of teenager with age range 14-17 years is still growing, that cause abstract and logical thinking is growing as well. At that stage, they have begun to formulate some possibilities, interpret, and draw conclusions

To be able to provide effective learning to high school students, it is necessity to find appropriate method suitable to their character as teenage learner. Teenager aged 14-17 years have some characters that are potentially helpful in the learning process. The characters include high motivation in learning, desire to know benefits, and apply the knowledge. They will become easier to

absorb the knowledge given, if there is help from more expert friends and guidance from teachers. A strong, healthy, and credible closeness relationship with teachers will develop students' cognitive, social, motivational, and emotional abilities.

The Government through Curriculum 2013 has compiled Core Competence (KI) and Basic Competence (KD) Chemistry for high school students. One of the core competencies is by studying chemistry for three years students can try, cultivate, present, and create in both concrete and abstract realms related to the development of the self-study in school independently, act effectively and creatively, also able to use the appropriate method scientific rules. The formulation of competence has been suit to characteristic of 14-17 years old students, with hope that students will absorb the material easier.

However in reality, there is still a low interest of high school students to study chemistry. There are some things that cause less interest in high school students,

towards chemistry lessons. Chemistry for high school is still considered as difficult subject by students, due to many abstract concepts and chemical reactions that is invisible, so that students will have perception that it is uninteresting and do not have exact example in perspective. In addition, less teachers introduce the role of chemistry in daily life in learning process, so that learners are less able to link the existence of chemistry in everyday life. Finally students assume that chemistry is just the subjects as a requirement in the next level. (Subagia, 2014, Ismawati, 2017). Where as, knowledge about chemistry and its role in life are emphasize more in 2013 Curriculum.

In order to make chemistry role can be felt more in students' life, actually 2013 Curriculum has accommodated it through classroom practicum. Meeting hours in class is increased and practicum materials in the classroom is comprehensive enough to support the theoretical that studied by high school students. However, to provide chemistry materials for high school students, 2013 Curriculum provides a real example about the implication in everyday life, the comes from ideas or creative strategies of teachers.

Strategy and teacher innovative method in teaching and learning process has already done. That method is adapted with 2013 curriculum, such as developed inquiry, problem-based practicum, project-based learning, and group investigation. (Rahmawati, 2015; Nirwana, 2016; Ratna, 2017). Teacher has already utilise technology, such as animation in e learning until using media in android-based learning (Na'imah, 2015; Nur, 2017; Putra, 2017).

The development of method and media in teaching and learning in class, as explained above is effective in increasing students learning outcomes. However, chemistry approach in daily life is not limited in learning process in class. Students can learn it by their own will outside classroom.

While waiting for teacher that arranging score, in the end of every

semester high school students usually do not have any activity in classroom, but still asked to come to school. This free time that followed by their holiday can be used to comprehend more about chemistry in daily life. Therefore, this research will discuss about steps of chemistry approach that can be applied to high school students, by plan an activity named VAKSIN (Vakansi Asyik Kimia dalam Kehidupan) or Fun chemistry vacation in everyday life. Hopefully, this activity can create and enhance students understanding, that chemistry is a branch of science that can be useful in life.

METHOD

Method of this research is literature study. The article is written by collecting data, read, note, and preview all conceptual ideas, related to steps of how to increase high school students interest in using their free time by studying vakansi. Important ideas from the information will be processed and arrange well until become an article.

RESULT AND DISCUSSION

Utilizing high school students' spare time

Implantation the concept of chemistry is one fun knowledge of senior high school students that can be done by utilizing spare time afterschool. Holiday is the time that can be utilized maximally, some holiday such as transition semester, either from odd semester to even, or the opposite. Because at holiday time, high school students grade are focusing to prepare their final exam, or college selection, that is why the main target for this are not them, yet students grade X and XI. As early as possible the implantation done, better result are expected.

By take a look at characteristic of students grade X and XI, the concept will be understand easier through some fun practicum. Asyik (English: fun) in learning science for senior high school students shows that the knowledge is delivered well in simple way, easy to do, and close to life.

The learning process will be more fun, if they do together with friends through focus group discussion and accompanied by a competent teacher. Efforts to fill vacation, as well as build the idea that chemistry is a fun science to high school students class X and XI can be done by some activity such as science camp or study excursion.

Science Camp

The output of this camp is high school students will like chemistry more, because actually learning chemistry is fun. The nature of chemistry can be find in every aspect of our life. They are expected to be able to relate between theory and the implementation. The concept of chemistry about practicums are also expected the strengthen concept that already studied or any new concept for students.

Actually, science camp for high school students are not new thing anymore. Ahrenkiel (2014) already did science camp for high school, by theme forensic. The output shows that participant are enjoying the activity in science camp. Not only enjoy, but they also feel that they got a lesson and competence that will be useful for their future.

The concept of science camp is an five-days activity. On the first day, participants will not have any practicum yet, but getting explanation about safety on laboratory, such as the way to dress, take care of any chemical product, and first aid when accidents happened. Then, they also get information about how to use some simple tool in laboratory, such as mortar and beaker.

The practicum will be hold in three days. It is a simple experiment that has direct relation with daily life. Students will be doing the practicum in group, to make them have high intensity discussion. Every group will be helped by a competence teacher as facilitator. In doing the practicum, students will get a modul and logbook, it must be filled with practicum steps, calculation (if it has), and result.

On the last day, there will be evaluation as follow up of the activity. In the

evaluation, teacher will give questionnaire with Likert scale to students. the questions is about material benefit, difficulties, relation of theory with real life, and others. The result will establish what follow up of the activity will be.

The material given in three-days practicum is colourpaint eco-friendly making, chemical characteristic exploration of syntetic sand for cat litter disposal, and wastewater purification simulations, adapted to the 2013 curriculum. Practicum of colorpaint making from natural materials will be done on the second day, exploration of chemical properties of artificial sand component will be done on the third day, and simulation of purification of waste water will be implemented on the fourth day. Before the practicum session, there will be an explanation about the concepts of chemistry associated with the lab. After the practicum session, each group will be collected in one session related to the explanation from one of the supervising teachers about the results of the lab. Then, after the plenary session each group will present the results of the experiments that have been done.

Making eco-friendly colorpaint is chosen as a practicum material, because it raises environmental issues as important in chemistry. In addition, tools and materials used are easy to find in everyday life. Exploration of the chemical properties of the components of artificial sand, is chosen because it is close in life. Artificial sand as a cat litter dump is easily found in both the pet store and the supermarket. The waste water purification simulation material was chosen because water is the key to life. Without water, people and plants can not live. These things become material to be emphasized in science camp activities. Schedule is designed as shown in table 1.

Table 1. Schedule of five-days science camp

Time	Day				
	1	2	3	4	5
07:00- 08:00	Registration	Break-fast	Break-fast	Break-fast	Break fast
08:00 - 08:30	Material introduction	Brief-ing	Brief-ing	Brief-ing	Briefing
08:30 – 12:00	1 st Materi	Practicum	Practicum	Practicum	Evaluation and Follow up
12:00 – 13:00	Lunch	Lunch	Lunch	Lunch	Lunch
13:00 – 14:00	2 nd Materi	Report	Report	Report	Closing Ceremony
14:00 – 14:30	2 nd Materi	Ple-nary session	Ple-nary session	Ple-nary session	Get home
14:30 – 16:00	2 nd Materi	Presen-tation	Pre-sentation	Pre-sentation	
16:00 – 16:30	Break	Break	Break	Break	
16:30 – 17:00	Closing	Closing	Closing	Closing	
17:00 – 18:30	Dinner	Dinner	DInner	Dinner	
18:30 – 19:30	Social activity and extracuriculer				

1) Making eco-friendly colorpaint

The tools required for this experiment are easily obtained. The tools are included non-glass bowls, aluminum molds, filter paper, tablespoons, small fans, paper cups, wooden sticks, and laboratory glasses. Materials needed were easily obtained, namely grapes, ethanol, and eggs (Blatti, 2016).

Grapes of 15 seeds and ethanol of 1 - 2 tablespoons are mixed in a non-glass bowl and then stirred and crushed until crushed enough. The colorless ethanol will dissolve the color pigment of the wine so the mixture will turn red. The wine vines with mixed color pigments are then separated using filter paper. The filter drops are fed into the aluminum mold (Blatti, 2016).

Alcohol will be let to evaporate for approximately 15 minutes, so that only the remaining pigment wine is extracted. Alcohol evaporation process is accelerated with the help of a fan. The solid pigment is then mixed with egg whites to get the sticky structure so it can be used as a color paint (Blatti, 2016). The whole practice process looks like in figure 1.

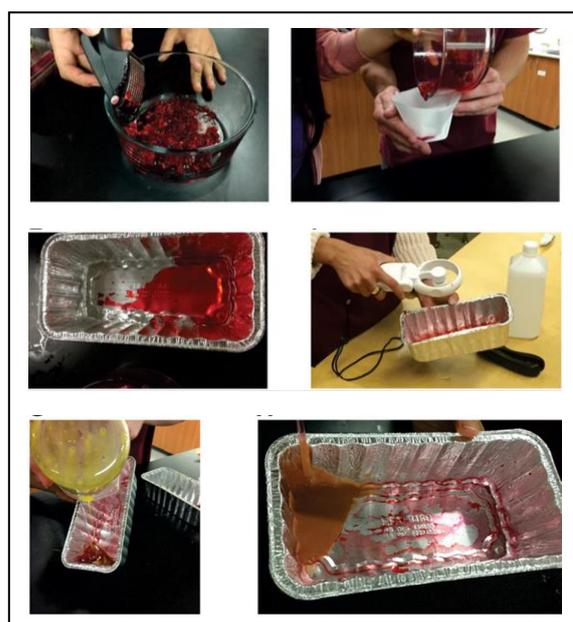


Figure 1. Extraction process of colorpaint until become natural colorpaint (Sources: Blatti, 2016)

2) Exploration chemical element of artificial sand



Figure 2. Samples of artificial sand for cat litter dump (Source: Calestino and Marchetti, 2015)

In a practical simulation of wastewater purification, wastewater samples are prepared by mixing gravel, river water sediments, clay, and water. The required tools are then arranged as shown in Fig. 3. Figure 4 shows the steps to be performed in the wastewater purification process.

The practicum begins with observation of different types of artificial sand samples, ie sand from zeolite, bentonite, crystalline, and biodegradable materials as shown in Figure 2. Participants in groups are asked to note the composition of each artificial sand. Artificial sand is then tested solubility by inserting sand into water, acid solution, or alcohol such as ethanol and then stirred for 15 minutes then ignored. In addition, the sand also tested the metal components through flame test (Celestino and Marchetti, 2015).

3) Simulation of waste water purification

In a practical simulation of wastewater purification, wastewater samples are prepared by mixing gravel, river water sediments, clay, and water. The required tools are then arranged as shown in Fig. 3. Figure 4 shows the steps to be performed in the wastewater purification process.

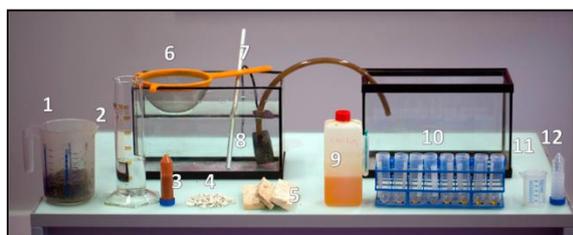


Figure 3. Setting tools and practicum materials: (1) 500 mL cup glass containing sediment; (2) water; (3) clay; (4) gravel; (5) polystyrene sticks; (6) strainers; (7) stirrer; (8) aquarium pumps; (9) FeCl₃ 0.1 M; (10) reaction tube shelf; (11) 50 mL cup glass; (12) electrolyte solution; and two aquariums (Source: Néel et al., 2015)

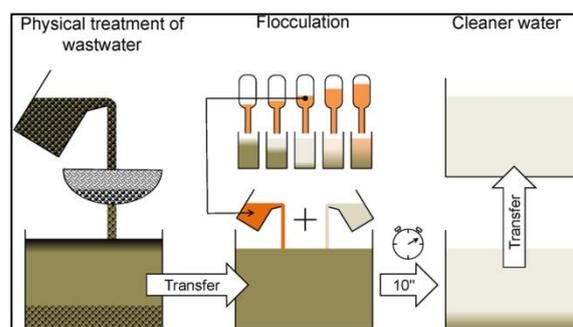


Figure 4. Wastewater purification steps, ie filtration, decantation, and coagulation (Source: Néel et al., 2015)

Wastewater samples are then filtered using a sieve. The filtration product will leave rough solids such as gravel so that water contains only fine solids such as clay and sediment. The sediment and clay in the container will accumulate under the container through the settling process. The rest of the oil like polystyrene will float on the surface of the water. The surface layer of water containing polystyrene is then pumped into another container so that only the remaining suspension of water contains the sediment (Néel et al., 2015).

In the third stage of coagulation, it is necessary to add an aggregate-forming material with colloids to the suspension, for example iron (III) chloride. The iron solid (III) chloride is added to the suspension and then stirred for 30 seconds, then another coagulant is added. The suspension is allowed to settle down until the supernatant is obtained, which is clear water. Clear water is then transferred in other containers and ready to be tested whether or not it is thrown into the environment (Néel et al., 2015).

Excursion Study

The fun chemistry concept-building during school holidays can be done through two things: in-school activities, such as science camps and out-of-school activities, such as excursion studies. Excursion studies deals with chemistry implication in daily life divided into two goals, named industry and university. Each destination has advantages and disadvantages. If participants choose to visit the industry,

participants will find more interactive and applicable chemistry. However, the concepts of chemistry can not be explored more deeply. Conversely, if participants choose to visit the university, participants can deepen any chemistry through the experts. Universities can also provide demonstrations or practicum applicative, but only on a small scale, not as large as the industry.

(1) Visit to industry

During industry visits, participants are grouped into groups to view, note, take photos or process video happened in industry, if it is allowed. Companion teachers and chemistry staff from industry visited explain and facilitate participant questions about the chemistry applied in the industry. Visits are held within one day. At the end of the activity, participants are asked to make a report or infographic of the sciences gained during a visit to the industry.

Chowdhury (2013) states the soap industry can be targeted for high school students to visit. The reasons is among others, fat as the main component of soap must be taught in the high school curriculum. In addition, soap is an object that is often used in everyday life. These two factors can cause an element of closeness to life in the minds of high school students.

Before visiting industry, participants were directed to seek information about soaps, chemical reactions, and the manufacturing process. Searching process can be done by reading books, magazines, newspapers, articles from the internet, and other learning resources. Participants were asked to note some questions to be asked to chemical staff in soap industry, such as: how to make soap, how to separate soap from mixtures, how to separate and purify glycerine, good soap quality parameters, and soap waste industrial disposal procedures (Chowdhury, 2013).

During the visit to the soap industry, participants were directed to see the process of making soap, glycerin separation, and research activities being carried out by the

laboratory or soap industry chemist staff. Questions that have been prepared before the visit to the industry can be asked during the mentoring process. After completing the visit, the companion teacher can discuss to the participants about the experience gained (Chowdhury, 2013).

(2) University Visit

University visit can be done only if there is already cooperation with the intended study program, especially study program of chemistry or chemical education. Schools can submit an appeal to study programs, so that lecturers can help preparing practicum materials, along with modules or demonstrations can be done for one day. Practical or demonstration materials should be close to everyday life, similar with 2013 curriculum, and easily done by high school students.

Aubrecht (2015) proposes three areas of study that can be introduced to high school students by universities, environment, energy, and eco-friendly chemical product. Practical laboratory activities that can be proposed in the three study areas and the chemistry concepts, can be studied are presented in table 2. For practicum activities, participants are divided into groups of three to four.

For about two weeks before university's excursion study was conducted, the university sent the practicum procedure document, the tasks that needed to be given to the participants, and reading materials that supported the practicum to the companion teacher. The companion teacher is expected to guide the participants to read the procedure document first. When the excursion study was conducted, the participants carried out the practicum assisted by the companion teacher and the university. After the lab ends, participants are asked to write a report and discuss the results obtained (Aubrecht, 2015).

Table 2. Study materials at university excursions

Scope	Topic	Concept
Environment	Interaction acid rain with acidic	Acid and base
Energy	Synthesis of biodiesel	Stoichiometry, acid-base, titration
Eco-friendly chemistry	Synthesis of biodegradable	Stoichiometric polymers

(Source: Aubrecht, 2015)

Many results will be obtained after students follow VAKSIN activities (Vakansi Asyik Kimia dalam Kehidupan). Positive impacts are not only felt by students, but also teachers, and third side such as industry and universities. The positive impact for students is that students will not feel that chemistry is a difficult anymore, but looking at chemistry is a fun science that close to everyday life, and can benefit many people so that it has an increased interest in learning. High interest in learning indirectly contributes to the increase in student achievement. In addition, students will have an overview of work related to chemistry.

Positive impact will also be felt by the teacher. Changing mindset to chemistry teacher, who initially assumed that teachers can not relate chemistry to real life examples. After vacation, students can feel directly that teacher as facilitator has the competence to introduce chemistry application in life. Teachers also become more creative and innovative in delivering material to students. Another positive impact that arises is VAKSIN activity has the potential to create cooperation between middle school with industry and university.

CONCLUSION

VAKSIN strategy (Vakansi Asyik Kimia dalam Kehidupan) or Fun chemistry vacation in everyday life as a fun chemistry introduction planning activity for high school students, can be done in two ways, that is through science camp activities and excursion studies. Materials in science camps are eco-friendly colorpaint, exploration of chemical elements in artificial sand for cat litter disposal, and

wastewater purification simulations. Excursion studies can be divided into two purposes, they are industry and university. The positive impact of VACCIN strategy when it has been implemented is not only felt by students, but also teachers and third parties such as industry and universities. The VACCIN strategy is planned for school holidays, both students and teachers will likely focus on non-academic activities. Therefore, in order to run the activity properly and give maximum benefit, it is necessary to have high interest and active participation not only from the students, but also from group of chemistry subject teachers in SMA

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