The Flipped Classroom: Using Thematic Teaching to Develop Critical Thinking for High School Students

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Abstract The 21st century education tends to train comprehensive human with a range of capacities and working skills in a collaborative environment and towards global citizens, with a particular emphasis on developing critical thinking for learners. People with high level of critical thinking can develop skills, abilities and core values that help them succeed in life. In education, however, critical thinking is not the only goal separate from other important components and it is seen as one of the most important competencies of learner to develop. There has been various ways, methods and techniques to develop critical thinking for students so far. One of those is the flipped classroom model which is used successfully in universities in US, Australia.... This paper aims to introduce such flipped classroom model and its use in the thematic teaching to develop critical thinking for students as well as provide an example for the use of this model in teaching the topic "The use of cosmetics in school - Risks to be learned" for grade 11 students.

Keywords: *flipped classroom, model, thematic teaching, critical thinking, high school*

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1. Introduction

The 21st century school requires the training of a comprehensive human being, a global citizen with lifelong self-study skills, critical thinking, and working skills in a collaborative environment [1]. Vietnam is undertaking education reforms oriented towards the development of learner capacity [2], however, in the process of international integration, it is also necessary to train comprehensive learners with learning and innovation skills; ICT skills; life-skills, especially critical thinking. Accordingly, innovations in teaching and learning methods are being considered the first priority. Instead of having to sit down for hours listening to lectures in a one-way transmission, why not take advantage of the time spent on interactive activities in the classroom? These activities bring more value and benefits to learners. For that reason, teachers always try to explore, apply information technology and flexibly use active teaching methods in classroom. However, do the teachers easily use modern and active learning methods in the classroom while they are accustomed to traditional learning? This question has been addressed by many researchers who offer teaching models that can be applied to positive learning methods including the "flipped classroom" model.

In 2000, the concept of the flipped classroom model that was proposed to meet the different learning needs of learners. Inverting classroom means moving in-class activities out and vice versa [3]. The "flipped classroom"

model can be considered a combined teaching model [4], which uses information technology to support instruction to promote learning "outside the classroom". This is an increasingly popular model applied in universities, because of the learning benefits it brings (Ark, 2012, Berrett, 2012; Blake, 2011) [5,6,7]. A recent study by Means, Toyama, Murphy, Bakia, Jones (2010) evaluates the effectiveness of the "flipped class" model based on 46 empirical studies in the general context and US universities and concludes that this model is effective in learning compared to traditional teaching methods; the study also shows a significant difference in learning outcomes of learners [8]. It can be seen that the "flipped classroom" model has created a deep learning environment, meaningful learning as well as the development of critical thinking and advanced learning. Theoretically, the "flipped classroom" model is based on the theory of active learning, the teaching method of actively exploring, approaching knowledge through interactive process (Vygotsky, 1978) [9]. This model also helps to create an environment that promotes learning autonomy, as learners have the opportunity to learn at their own pace and become responsible for building knowledge rather than waiting for communication from their teachers (passive learning). From the perspective of Bloom's perception level, this mode of learning helps learners develop perceptions through multiple level: remembering, comprehending (access to material), and then applying, analyzing and synthesizing (information processing stage, knowledge building through learning activities conducted by lecturers in class) [10]. Thus,

according to the above analysis, if the model is applied in thematic teaching with appropriately designed content, the student's critical thinking can be developed.

The article presents and analyzes the application of the flipped classroom model in thematic teaching to develop critical thinking for high school students; use this model in teaching the topic of "The use of Cosmetics in School - The Risks to be learned" to develop critical thinking for grade 11 students.

2. Content

2.1. The Essential 21st Century Skills for Students

Education in general and schools in particular are an essential part of human social life and it occupies a particularly important place in today's society. Social civilization and educational level are mixed and closely linked. Dewey once said, "The duty of the community to education is to be the supreme moral duty". The more civilized the society is, the more social organizations, individuals and families pay attention to education. The world in the knowledge age is exposing the unmanageable forces and enormous risks that are demanding the wisdom of development strategy in general and educational development in particular. Some of the hallmarks of school practice that require good attention in the 21st century are: (1) diversity of students; (2) central learning of the school; (3) career development research; (3) global education. What kind of skills do students need in the context of 21st century school? This question can be answered by a survey of 400 employers who claim that graduates should have skills such as: speaking and writing skills, professionalism and professional ethics; team work and cooperation; working in diverse groups; application of technology; leadership and management of the project; critical thinking and problem solving. These are the special abilities that they need to develop to prepare for the challenges of work and life in the 21st century.

According to a study, the 21st century requires to offer major subjects; skills in learning and innovation; skills in information, communication and technology; life and career skills [1]. In which, critical thinking is one of the skills of learning and innovation; many studies have proven that this is a necessary skill to prepare learners for their future life. In this paper, we have applied the flipped classroom model in teaching the topic "The use of cosmetics in school - risks to be learned" in order to develop critical thinking for grade 11 students.

2.2. What is Critical Thinking?

Critical thinking has been formed and developed for a long time but not until the twentieth century was the concept of critical thinking studied thoroughly and the initial theoretical foundations have been developed with a clearer approach and expression. In general, according to studies [11,12,13], there are three main concepts.

- *Firstly*, critical thinking is the process of reviewing every aspect of the problem and coming to a conclusion to solve it.

- *Secondly*, critical thinking is thinking about your own thinking product.

- *Thirdly*, critical thinking is thinking about other people's thinking products, including: (1) reviewing, verifying accuracy to recognize or object to the information provided; (2) evaluating the object.

In this study, by synthesizing of perceptions above, we suggest that critical thinking is a positive process of thinking about a subject or problem in which the thinker improves his or her own thinking quality based on personal development. Accordingly, critical thinking has the following characteristics:

- Proactivity: People, who think critically consistently attempt to identify problems, actively seek information relevant to the problem, raise and ask questions about given information the results of the previous thinking process. Expressions of proactivity in the critical thinking process are to: (1) Aware of the problem; (2) Ask questions around issues to be resolved; (3) Collect information from a variety of sources, in various aspects, ways, methods; (4) Expresses views, makes arguments based on existing knowledge and synthesized information; (5) Arrives to personal conclusion.

- Comprehensiveness: Critical thinking requires linking all aspects of the problem, gathering all the relevant information to the problem to be solved in order to make a careful assessment. In addition, critical thinking also poses the need to consider and analyze thoroughly the elements, characteristics, nature, laws of motion of the object under consideration.

- Insight: The arguments of the critical thinking process must be based on reasonable grounds, complementing and assisting each other to help the subject make the right conclusions. When thinking critically, people use a lot of operations such as analysis, synthesis, generalization, abstraction, comparison, etc.

- Honesty: The consideration, evaluation or reversal of the problem in the process of critical thinking requires the subject to be honest with science and himself. This characteristic is expressed in the fact that the subject is not afraid to express his opinion, although that opinion is against the truth.

A student at high level of critical thinking can: (1) Give important problems and problematic questions; develop clear and accurate questions and problems. (2) Collect and evaluate relevant information; use ideas to explain effectively to make conclusions and solutions rational; Examine questions and issues based on relevant criteria and standards; be open minded, recognize and appreciate if needed; The result is highly practical. (3) Communicate effectively with friends and teachers in finding solutions to complex problems. And when students have critical thinking skills they can develop their other skills, abilities and core values to help them succeed in life.

2.3. Flipped Classroom Model: The Ability to Develop Critical Thinking for Students through Thematic Teaching

Flipped classroom is a teaching strategy in which students have first contact with new lecture materials outside the classroom, usually through readings and video lectures that can be provided online; then in class time the

students will address more difficult problems through problem solving, discussion and discussion strategies. The teaching methods used in the flipped classrooms are quite different from those in the traditional classes. In the traditional classrooms, teachers deliver homework assignments to the students. In the flipped classrooms, the teachers assign lessons in advance to the student through pre-designed lecture provided online, then in classroom teachers support individuals and groups to solve assignments [14,15].

So the question is, why should we apply flipped classroom model?

In a lecture, the attention of most students begins to drop in ten or fifteen minutes; Flipped classroom can help to keep students focused and learning during the lesson.

The implementation of the flipped classroom model is significant. This model gives students time to process, reflect on concepts and learn to increase knowledge before class to apply for study. In addition, students can control the time, pace, location of learning with online materials. Many students think they find it helpful to repeat parts of an online presentation when having difficulty with a particular concept or while studying revision for exams. For teachers, by applying model, they can see difficulty that students may have in materials or questions or misconceptions about the concepts (perhaps through online assessment or discussion forum) before class. Teachers can then adjust the works covered during the classroom through these responses to meet the learner's requirements without being over-time in class. However, this model should only be used in some lectures with topics that satisfy certain requirements rather than all lessons of one subject to develop critical thinking for learners.

2.3.1. Planning Model for Flipped Classroom

When teachers plan for a flipped classroom, they often focus on planning activities to differentiate which activities shall be provided online to prepare for active learning and which activities will be done in the classroom. However, there are two other aspects of a flipped classroom that require detailed planning: (i) how the activities will be introduced to students; (ii) How teachers make sure that students are well prepared for their classroom experience.

The following flipped classroom model can be referred:

a) Introduce Task

The goal of this phase is to optimize the student's willingness to participate in the activities they will work online and in the classroom. The teacher introduces the tasks and clearly explains the achievement that the student will have to make and prepare for the learning activities that take place in the classroom.

b) Out-of-class Task

Teachers may develop learning materials including PowerPoint presentations, screencasts and podcasts, or use online content such as websites, articles, and videos. There should be questions that lead or suggest students to identify the main goal for preparation. If the teachers allow the student to use online method to ask questions related to difficult concepts or other issues, students may use class time to discuss these issues.

c) Assess Learning

Before conducting classroom learning activities, teachers and students are both aware that whether students are fully prepared for the lesson or not through the online question-and-answer system for self-assessment. Self-assessment questions are often designed for students to use what they have learned rather than simply to test their knowledge. Teachers may also provide opportunities for the student to ask questions and provide regular feedback on the student's assessment questions. Teachers can also assess student preparation through a short assignment or review from the beginning of the flipped classroom.

d) In-class activities

The design of classroom activities promotes teamwork and student-to-student and student-teacher dialogue that foster collaborative learning and student learning. The goals of classroom activities are clearly related to the overall goal and the course assessment. In-class learning encourages students to create, discover, and detect errors in a relaxed and risk-taking learning environment.

e) Motivation

Student motivation is the key to the success of the learning process. This motivation may be influenced by the activities designed by the teacher. Challenging but fulfilled designed activities can motivate students. In addition, students will be more motivated if they are exposed to or find meaningful resources for their personal life and find the lessons to be highly practical to help learners find their values and future directions. Another motivation is that the teachers work enthusiastically, have good relationships with students, create an open and positive atmosphere in the classroom, and encourage involvement effectively. The teacher's regular feedback to students after they complete the assignment or ask questions also helps to motivate students in learning.
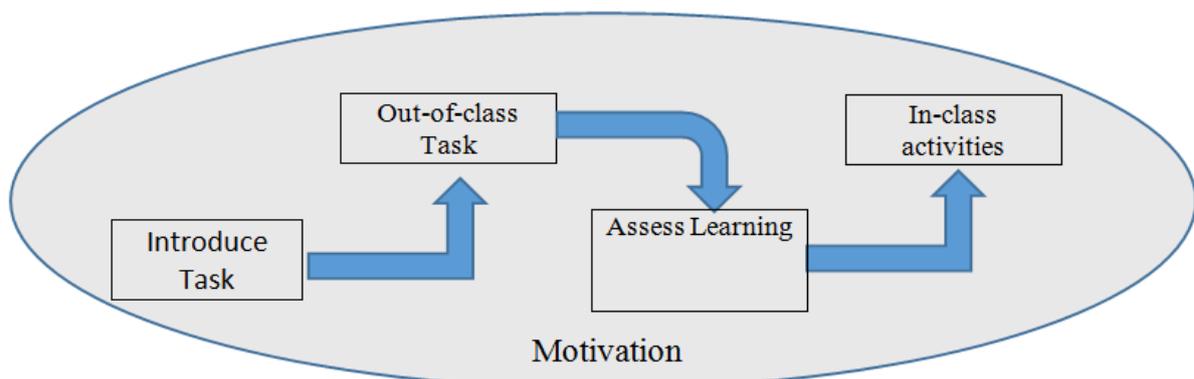
Model 1. Flipped classroom model

According to the above plan, there are three types of flipped classroom that are commonly used: model-oriented flipped classroom - commonly used in teaching Mathematics, Physics, Chemistry; discussion-oriented flipped classroom - commonly used in teaching History, Painting, English; Basic flipped classroom can be applied to subjects depending on the themes or topics.

2.3.2. The Use of Flipped Classroom Planning Model to Develop Critical Thinking for Students through Thematic Teaching

As mentioned above, the flipped classroom planning model is different from the traditional classroom model. In traditional classroom the teachers present lesson in class, and give homework to students. In flipped classroom, the teachers give students assignment or materials for study first.

Bloom's taxonomy offers six levels of thinking from low to high: knowledge, comprehending, applying, analyzing, synthesizing, and evaluating (Bloom, 1956). By 2001, Anderson and Krathwohl adjusted and offered six levels of thinking in turn: remembering, comprehending, applying, analyzing, evaluating, and creating. Accordingly, we can see the difference between the flipped classrooms and traditional classrooms as follows:

So how to use flipped classroom model to develop critical thinking for students outside the classroom and in the classroom. In this study we used the Socrates Questionnaire and the Bloom's Taxonomy to design homework as well as classroom activities aimed at developing critical thinking for high school students through thematic teaching.

a) Socrates Questionnaire

This is a method of questioning in order to pursue thinking in multiple directions and purposes, including: exploring complex ideas, learning the nature of things, eliciting topics and explore problems, exploiting assumptions, analyzing concepts, distinguishing what we know with things we do not know, grasping the meaning of scientific thinking or control the discussion. Socrates questioning method differs from asking common questions in that this is a method of questioning in clear order; Used to guide thinking in multiple directions and purposes including: (1) exploring complex ideas; (2) learning the nature of things; (30) eliciting topics and explore problems (4) exploiting assumptions (5) analyzing concepts (6) distinguishing what we know with things we do not know; grasping the meaning of scientific thinking; (8) controlling the discussion [16].

- Questions for clarification: Why do you say that?
- Questions that probe assumptions: What could we assume instead?
- Questions that probe reasons and evidence: What would be an example?
- Questions about Viewpoints and Perspectives: What would be an alternative?
- Questions that probe implications and consequences: What generalizations can you make?
- Questions about the question: What was the point of this question?
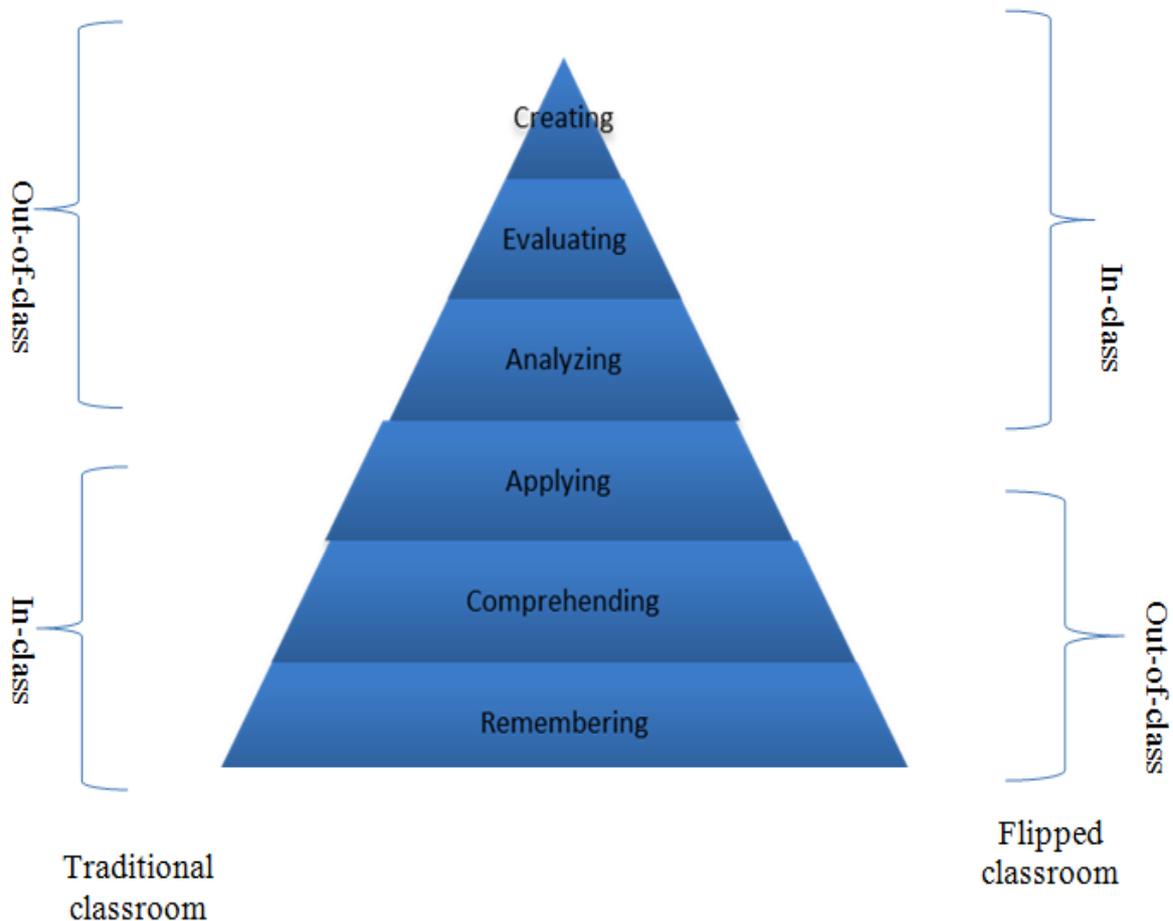
Model 2. In-class and out-of-class thinking development between traditional classroom and flipped classroom

b) Questioning according to Bloom's taxonomy

Bloom's taxonomy provides six levels of thinking from low to high. We can develop critical thinking for students when constructing questions for each step of the scale (Bloom, 1956).

- Remembering question: This is the lowest level question and requires students to remember the information. Remembering questions often require students to identify the approximate information in the way it is presented.

- Comprehending question requires students to select pieces of information and rearrange them by category or group them. These questions go beyond conventional memorization and require students to combine information with one another.

- Applying question: The teacher asks the students to retrieve information they have learned in the new situation. In other words, they need to use their knowledge to determine the correct answer.

- Analyzing question: This question asks the students to go from the whole, breaking the whole into parts. Analyzing question requires students to identify reasons, motivations, and make conclusions or generalizations.

- Synthesizing question: Ask students to think creatively. These questions help students come up with unique ideas and solve problems.

- Evaluating question: Evaluating question has no right or wrong answer. Evaluating question requires each student to evaluate a problem. When students participate in decision making and problem solving, they need to think at this level.

c) Thematic teaching

As stated above, in the 21st century skills model, in addition to the subjects and learning skills, there must be interdisciplinary subjects that are included in the curriculum: global awareness; financial, economics, business and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy. These are big themes, each subject, the field of science in the general school will have smaller and narrower themes related to these major themes and many different models, ways and methods can be used in thematic teaching.

Thematic teaching is characterized by the way in which learning objects are defined as problems in reality. Issues are complex, multi-faceted and motivational, developing (or varying degrees). That means that thematic teaching to some degree means integrated and multi-disciplinary teaching. This concept of learning content is reflected in the content structure of multi-faceted learning in many fields: culture, science, art, ethics, political society, mathematics, which are built up around a certain themes (with different degrees of complexity). The learning requirements for the student will gradually increase with the complexity of the themes or levels, the relationships between component structures in that theme). More importantly, this study considers that learning content is not just an objective world outside of the subject but the cognitive, thinking, emotional, and subjective value of the subject in the activity and relationships with elements in their living environment. This emphasizes the field of knowledge in high, latent, and abstract level of knowledge - metacognitive knowledge (knowledge of events, processes occurring in the subject) [17].

This study also considers the core idea of the thematic teaching strategy to be in the complex, multi-dimensional nature of reality - that is, not separated by subjects. In other words, every phenomena in the world (nature, society and people) exists in complex relationships (many internal components and many levels of internal and external relations). Thus, the general perception of the objective world and of ourselves in relation to the surrounding world is a condition for each person to govern his (personal and social) lives and to solve problems effectively. It means that thematic teaching strategy will facilitate the integration of learning with the lives of students and make the learning and learning content meaningful to them. That also contributes to enhancing learning motivation.

According to the above analysis, thematic teaching has three main characteristics [18]:

- The content is designed by themes (linking the contents of the themes in different subjects) – related to the main theme. Each theme addresses practical (definable and measurable) goals, including general and basic educational goals and specific and separate educational goals;

- Thematic learning is linked to the issues of life, of the real world, including nature, society and people (themselves and others). The problems of life are considered as a resource for learning in the thematic teaching strategies. By structuring the content of the program according to the theme, the lessons in individual subjects will be replaced by learning units (such as sub-topics);

- Objective formation in learners through each theme is directly related to the practical action capacity of the subject regarding to the theme. Thematic teaching helps the learner to master the reality, that is, towards the formation of the practical capacity of the subject. The capacity for action in each subject will vary widely depending on the age and level of the learner. In other words, practice is considered to be the object of study and object of change at the same time on the basis of its understanding. Thus, thematic teaching links the learning cycle from understanding to action to improve practice in a tight and relatively short cycle.

Accordingly, thematic teaching can be understood as a way to organize teaching so that students interact with different aspects of a matter (not separated by subjects) in their life to develop the practical capacity. It is closely related to the development of thinking including critical thinking in students.

2.4. The Application of Flipped Classroom Model in Teaching the Topic "The Use of Cosmetics in School - Risks to be Learned" to Develop Critical Thinking for Grade 11 Students

2.4.1. Designing a Theme to Organize Teaching by Flipped Classroom Model

The theme "The use of cosmetics in School - Risks to be learned" is designed based on flipped classroom model teaching for student learning experiences after teachers have completed their semester II: outline of organic

chemistry, hydrocarbons and derivatives, etc. for grade 11 students in Vietnamese high schools.

This theme comes from the current reality of the trend of young people, including high school students who have the tendency to use cosmetics. However, the safety issue in cosmetic use as well as the health risks associated with cosmetic quality are being warned and introduced into the education of students in high school.

Objectives of thematic teaching:

Students use the knowledge they have learned in the school, especially the knowledge of Chemistry and Biology to:

- Know the banned substances and levels of substances prohibited in cosmetics.

- Students understand the harms and health risks associated with cosmetic quality

- Learn about the use of cosmetics in schools by high school students.

- Examine some toxins in cosmetics.

- Know some methods of preparing natural cosmetics.

2.4.2. Instructing Students to Find Materials Related to the Theme and Designing Questions, Assignments, Learning Situations for Homeworks

a) Teachers guide students to search for materials related to the theme:

- Technical documents for cosmetics in accordance with ASEAN [19]: definition of cosmetics, cosmetic ingredients, cosmetic ingredients, cosmetic labeling, etc.

- Content of certain substances and prohibition in cosmetics; Harms of prohibited substances in cosmetics.

- The current situation of using cosmetics of high school students.

- Understand the risks and harms of cosmetics related to human health.

- Some methods of screening prohibited substances in cosmetics.

- Some methods of preparing natural cosmetics.

b) Develop questions, assignments, and learning situations for homeworks

Situation: Actually, there are many teenage customers who use makeup cosmetics of a company that advertises on television (emphasizing that this product is natural) and encounter some health problems: pimples, dermatitis, dryness and flaking, more severe body anaphylactic shock, etc. Explore the above matter based on information sources and answer the questions below:

- Why customers do encounter health problems when using the makeup cosmetics of the advertising agency?

- Which subject will you use to solve the situation?

- Does the quality of cosmetic products have bad components that affect the health of customers?

- How can you determine that makeup cosmetics contain prohibited ingredients or levels of prohibited substances?

- What tests can be used to demonstrate that cosmetic ingredients are prohibited to exceed the permitted levels?

- In what way can authorities verify the quality of cosmetics and which papers should TV stations depend to control the content of advertising?

- According to you which measures cosmetic management agencies need to take to control the quality of cosmetics?

- Is the production of natural cosmetics feasible and what are management measures?

- Which subject is the situation we are addressing related to?

- What is the bottom line when we solve this situation?

- Why should the issue of cosmetic use in school be considered and recommended for students?

c) The teacher asks students to submit their homework online.

2.4.3. Developing the Follow-up Activities

a) Early test

The teacher conducts an early test in the self-study test questions at home. Through this test, teachers can compare the results of the test with the results of homework submitted online to assess the self-study of students; it will help find out whether homework assignments are done correctly to timely correct the student's learning.

b) In-class activities

Activity 1: Teachers ask students to report content in groups prepared at home about: (1) Find out the ASEAN rules relating to the definition of cosmetics and cosmetic categories; (2) Cosmetic ingredients, cosmetic labeling; (3) the content of certain substances and the prohibited substances in cosmetics; (4) Harmful effects of prohibited substances in cosmetics on human health

- The group(s) report the content as required by the teacher in four sections.

- Other groups of students listen, exchange, discuss and supplement.

- The teacher ask students to make important conclusions and add missing content.

Activity 2. The teacher ask students to work in pairs to find out about the current situation of cosmetic use of high school students and the risks and harms of cosmetic on human health.

- The group(s) report the content as required by the teacher.

- Other groups of students listen, exchange, discuss and supplement.

- The teacher ask students to make important conclusions and add missing content.

Activity 3: The teacher asked the students to work in a team to perform some experiments to test the toxicity of makeup cosmetics being marketed.

Experiment 1:

- Dissolve an amount of make-up cream in a glass of cold water, stir the same to dissolve the maximum amount of cream in a glass of water; observing the phenomenon.

- Ask students to explain how to test the toxicity of cosmetics when they are dissolved in water.

+ Cosmetics stick to the glass wall: The cosmetics contain animal oil. If the cosmetics you buy do not have a clear origin or are not purchased at reputable cosmetics stores, then it is possible that in the production process it is mixed with a chemical derived from animal oils. These substances can make your skin very beautiful and smooth, with quick effect, but if you stop using, the skin will have symptoms like swelling, or worse than before using cosmetics.

+ Cosmetics float on the water: If cosmetics float on the water, it may contain substances made from mineral oil.

Mineral oil is a substance extracted from crude oil. Cosmetics containing mineral oil have a good moisturizing effect, but no ventilation, affect the ability of the skin to breathe, clog pores, and easily cause skin aging.

+ Cosmetics settle to the bottom of the glass: This phenomenon indicates that cosmetics contain ingredients extracted from heavy metals, lead, mercury, etc. This type of cosmetic is very toxic to the health of the user, especially pregnant women as the baby may have cerebral palsy.

+ Cosmetics are dissolved completely in the water: Cosmetics are of high safety and can be used for makeup.

Experiment 2:

Apply lipstick to the lips, then drink water so that the lipstick sticks to the glass mouth.

- If lipstick sticks to the glass mouth, cannot be removed by paper and stick to it for a long time, then it is toxic, containing large amounts of chemicals derived from animal oils.

- If lipstick sticks to the glass mouth, can be wiped out easily by paper, this lipstick contains many natural medicines.

Activity 4: The teacher ask students to discuss in group to present reports on what methods can be used to prepare natural cosmetics.

- The teacher ask students to work in groups to learn how to prepare natural cosmetics.

- The groups present their results and discuss.

- The teacher comment and make conclusions.

c) The teacher asks students to take an in-class test

In this activity, in-class tests are administered as multiple choice questions: self-administered questions; practical questions; Knowledge expansion questions.

2.4.4. Asking Students to Submit Assignment Online

The teacher asks students to do homework that include questions to apply knowledge to practice and questions that expand their knowledge. Students submit online, teacher gives mark and feedback to students.

2.4.5. Developing Activities for Students to Use as a Learning Portal

In in stage of the process, teacher often creates online forums for students to answer questions they have not learned in class. Online forums help teachers to grasp the difficulties of students in learning, and provide timely support to students. Also, teachers can collect feedback on how their teaching is organized and make adjustments accordingly.

In addition, based on the knowledge of classroom activities and other sources of information, teachers can build additional material for this theme to help students expand, deepen knowledge about the problem and offer interesting suggestions to help students want to learn more. This is a great resource for students who need to find out about this matter and explore even more.

3. Conclusion

We would like reaffirm that the 21st Century requires the training of a comprehensive human being, a global citizen with lifelong self-study skills, and the ability to work in a collaborative environment and critical thinking. However, how can high schools organize learning activities with modern teaching methods to develop critical thinking skills for students, especially by placing them in the learning environment in order to be able to contribute ideas should be paid more attention to.

The use of the flipped classroom model in teaching the subject is one of the most modern teaching methods, successfully applied by many scientists and countries in teaching of model-oriented subjects and discussion-oriented subjects. The advantages of this approach combined with the technique of using Socrates' questioning method and Bloom's taxonomy in designing homework as well as in-class activities can help students solve homework, in-class assignments and specific situations very effectively. Students are able to better control their learning and understanding with their peers' views so that when they give their opinions students always provide reasonable evidence, not simply accepting the reasoning of other individuals, it means that students have critical thinking. We also illustrate the use of the flipped classroom model in the teaching the topic "The use of cosmetics in school - Risks to be learned" for high school students. If the teacher only organizes the students to understand the individual knowledge of the subject of Chemistry, Biology in the traditional classroom model to solve some of the issues when students "encounter" them, then the understanding is not deep, and may not be accurate. Just when we apply the flipped classroom model in teaching this subject, the learned knowledge is maximized by taking turns in answering questions, completing assignments, applying lessons to practical situations…; and only when doing so the student's critical thinking is gradually developed and attained at a high level.

Acknowledgements

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