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A New Chemistry Multimedia: How Can It Help Junior High School Students Create a Good Impression?

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Most junior high school students considered chemistry as a complicated science subject with an abstract concept, symbols, and terms that must be memorized. The difficulty of learning chemistry made students had low positive perceptions of chemistry. It was needed the right ways to introduce chemistry to them. The purpose of the multiple case study was to explore chemistry multimedia could help students understood chemistry and created a good impression. The study was conducted in three 7th grade classes in different schools. Classroom observations were done in four meetings to collect students' responses toward this multimedia by ending students filling out a questionnaire of impression. Test of classification of matter and its change was given in the last meeting to investigate the level of students' understanding. In the way to gain more depth information, two students from each class were an interview about the application of multimedia. The chemistry multimedia made it easier for the teacher to introduce chemistry through a podcast, molymod-like, and digital simulation. This study documented that the appearance of this multimedia could make the students attracted and curious about chemistry.

Keywords: chemistry, multimedia, junior high school student, good impression, case study

INTRODUCTION

Chemistry is an important subject that studied the matter, energy, and the interaction between them. Most students do not really like chemistry, although learning chemistry helps them to understand the way the world works (Hofstein et al., 2011). In general, the

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students have problems and difficulties in three main problems area, language-based problems, a problem due to conceptual understanding, and problems due to inadequate selection and interpretation of formulae (Taskin & Bernholt, 2014). In the problem area of conceptual understanding, the students often have a lack of understanding of the necessary chemical concept, so they struggle to solve chemistry problems (Gabel & Samuel, 1987). Chemistry curricula incorporate many abstract concepts, which are central to further learning in chemistry (Taber, 2002) and essential because advanced chemistry or theories cannot be easily understood if the students do not master these underpinning concepts (Ayas & Demirbas, 2009; Nicoll, 2001; Nakhleh, 1992). Understanding these concepts involves mentally engaging with representation and phenomena to which they relate. This concept is the essence of a representation that is discussed in chemistry. One way to understand each concept can be described using three types of representation in which chemical ideas are expressed (Johnstone, 1991). The first type of representation seeks to represent phenomena as experienced with the senses. The second seeks to support a qualitative explanation of those phenomena; then, the third seeks to support a quantitative explanation of those phenomena (Gilbert & Treagust, 2009).

The terminology used for these representations commonly was called the macroscopic, the sub-microscopic, and symbols, which are inter-related and support each other (Gilbert & Treagust, 2009). The students will be able to understand the meaning of the terms by integrating the three levels of chemistry learning. Also, they can understand the explanation between the symbol and sub-microscopic levels with their current concept. The interaction of three levels is the critical characteristic as well as the source of difficulties for the students. However, the fact is the primary source of learning used are the textbooks that only presents two representative levels, the macroscopic and symbolic (Tania & Fadiawati, 2015). The absence of a sub-microscopic level makes the students unable to understand what happens in chemical processes. They often directly connect the macroscopic, things they see with symbols without understanding the sub-microscopic level (Farida, 2009). It is difficult for them to visualize the interactive and dynamic nature of chemical processes by looking at symbols and equations and for making three-dimensional (3D) images by visualizing a two-dimensional (2D) structure (Gilbert & Treagust, 2009).

The lack of understanding of the significance of chemistry in the future (Kubiatko, 2015) and the complex chemistry concept (Sausan et al., 2018) resulted in the low perception of the chemistry of most junior high school students. Even chemistry is also hard to be learned by senior high school students as it has various concepts at the school level to learn in a short time, so it makes the students' attitudes toward chemistry decline from junior to senior grades (Cheung, 2009). The senior high school students do not want to learn chemistry and are reluctant to work in the chemistry field because of the difficulties of chemistry, and the teacher's explanation of the chemistry topics is not related to the real life.

The chemistry was first taught to the 7th-grade students of junior high school. It was integrated with biology and physics. Many junior high school teachers are not junior high school science graduates, but from the other fields that should be intended to teach at the high school level according to their areas of expertise. From data of the new science teachers during their first five years, just 35,7 percent of them are teaching only in their trained subjects (Nixon et al., 2017). Many of new science teachers practice as out-of-field (OOF) teaching (Donaldson & Johnson, 2010) that has been shown negatively influence instruction and constrain teachers' development. The science teacher educator should prepare prospective teachers to teach multiple science disciplines because disciplinary differences require variations in understanding and instruction (Kloser, 2012). The less-mastered materials by the teachers in the classroom make the students have less meaningful learning experiences. The chemistry materials challenging to deliver without preparation will make the students more aware of chemistry.

The students' interests can be influenced by their perceptions, from their treatment and attitudes towards chemistry. Therefore, chemistry must be appropriately introduced so that the students have a good impression of it. The impression is that the socio-cognitive process represents how people perceive and process social interactions with others, including the very first moment of interaction (Asch, 1946). The students make an impression based on the first elements perceived through which they form a positive or negative judgment. Having a good impression will make them tend to minimize the negative aspects of the surrounding elements and exaggerate the positive ones.

Even though in the 2013 national curriculum, there is only a small amount of chemistry material given at the junior high school level, an introduction that is not well prepared will add to the bad impression of chemistry. The negative impression will tend to minimize the positive aspects and accentuate the negative ones. The stereotype that chemistry is difficult has become a burden for students to begin this subject. Making a good impression is critical in organizational and affective influences on many social judgments (Forgas, 2011; McNulty et al., 2010). A good first impression is when students can influence their interpretation of the chemistry subject in the future and consistently remember that chemistry is a fun and useful topic. The first impression about something begins with a visible cue, including physical appearance, nonverbal communication, environments, and behavior (Smith et al., 2015). Cues that attract attention in a context in which they occur are particularly influential.

The teacher must organize the learning environment to create active and meaningful real worlds learning for the students. To deal with the time, cost, and explanation of contents, the media can be the solution. The teacher must prepare various media in teaching chemistry to improve the students' motivation and impression using fun and more realistic subjects. Instructional media can assist science teachers who are not from the chemistry field and are less capable of understanding chemistry topics to deliver the subject well. Learning media is one of the variables that are particularly suitable for a chemistry reflection in the area of teaching processes (Barke et al., 2012). The goal of using media is the advancement of teaching and learning processes in which the choice of media and their use should be appropriate for the teaching goals, contents, and methods. In the classification of general media regarding education at school, there is a differentiation between the kind of sensory experience (visual, audible, audio-visual) and the level of experiences, either primary or secondary experiences (Barke et al., 2012).

Media such as podcasts (Drew, 2017; Abdous et al., 2012), the example of audio media, and Molymod (Priyambodo & Wulaningrum, 2017) the example of secondary hands-on media, which can improve students' learning experiences. Audio-visual media can improve students' activity (Saputra et al., 2018). Along with times, technology has an essential role in the development of learning media like multimedia, which led to the infinite application of computer technologies. Multimedia is one of the best educational techniques because it addresses more than one sense simultaneously (Aloraini, 2012). The efficiency of the multimedia achieved in the educational domain can help students remember and transfer their knowledge (Aloraini, 2012), can improve the learning achievement of junior high school students (Khoiriah et al., 2016), students 'generic skills (Mulyani et al., 2016), develop oral production skills (Muslem & Abbas, 2017), character development (Komalasari & Rahmat, 2018)and students' outcome in chemistry (Sugiharti, 2018; Cahyana et al., 2017). The advantages of using learning media are currently obtained from the use of media separately. Each media has weaknesses so that there needs to be innovation in the use of media, which can maximize media efficiency, such as the integration of learning media. However, the use of the various types of media in integration has not been done. Integrated learning media needs to be developed and applied in learning that can provide more benefits instead of separate use.

Integrated learning media, such as chemistry multimedia, was developed as one of the best ways to introduce chemistry to beginners. Chemistry multimedia, which included several types of media in integration learning considered to facilitate the three levels of representation of chemistry because they can support one another and cover each other's shortcomings. Based on the learning subject, the 7th-grade students of junior high school, the choice of media types used must be more attractive in terms of both appearance and ease of use. A podcast is one type of audio media rarely used in learning in the form of sound recordings that can be accessed online. It supports students with an audio learning style more excitingly. Students like to listen to their teachers' voices, and podcasts are their multitude of ways to get the information (Carvalho & Aguiar, 2009). Based on the three levels of chemistry, sub-microscopic is the level that often becomes the source of student difficulties. Molymod can be used to represent the sub-microscopic level regarding the 3D shapes of atoms and molecules in the introduction of chemistry to junior high school students. Real objects that can be sensed by the students can help build concepts that are difficult to accept. The description of phenomena such as molecular movements can be presented through animation and digital simulation using digital-based media such as Macromedia Flash. Animation and digital simulation can easily display interactions and the sub-microscopic of chemical changes and observations of macroscopic levels that cannot be done in the classroom. The chemistry multimedia considers the students' convenience in building mental models through images, animations, simulations, and real objects because of the visuospatial abilities as an important role in chemistry learning (Stieff et al., 2012). The various media which use in chemistry multimedia can improve chemistry learning and support students' understanding of the three relationships of multiple chemical representations.

One of the most critical factors of this chemistry multimedia to be developed because it sees from various kinds of different students' learning styles so that it can facilitate their learning. Teachers should adjust and facilitate their teaching styles to meet their students' learning styles and create fun and more effective learning (Awla, 2014). Instead of choosing and favoring a teaching style, the teacher should strive for a balanced teaching style to accommodate multiple learning styles. The presence of media that combines some characteristics, i.e., visual, auditory, and kinesthetic, will make learning more effective (Risnawati et al., 2018). Chemistry multimedia is developed as a solution for introducing chemistry more enjoyable by considering multiple representations in chemistry and student learning styles. From the result of the successful learning with numerous interpretations, the students choose the vital information for the subject, organize and connect its parts to be new knowledge. New knowledge gained with a good impression will be retained in the future, especially in senior high school. Thus, students will be more interested in learning more deeply.

In can be concluded that the literature about the effect of multimedia on the students' impression, especially in the introduction of chemistry is limited. An in-depth investigation of learning proses to create a good impression of chemistry needs to be done. The increase in students' impressions through chemistry multimedia can be studied with a case study because it gives time and space to build a detailed understanding of the topic and explore the factors influencing it. A case study can investigate the underlying principles of an occurrence within a real-life context that enables us to gain a more detailed impression that appears time by time in each case of chemistry learning. This problem is an essential concern for teachers in the use of appropriate learning media for the introduction of chemistry for beginners. This study aimed to explore the usefulness of chemistry multimedia in assisting students in understanding chemistry and building a good impression. This study was to see the response and success of chemistry multimedia. Based on the characteristics of different students viewed from various aspects such as origin, attraction, and learning style, a multiple case study is needed to analyze the use of media in high, medium, and low-ranked schools.

METHOD

A descriptive analysis was used in this study in the form of a multiple case study. The multiple case study (O'Brien et al., 2014; Stake, 2006) helps gain in-depth insights into the studied entity (Yazan, 2015; Creswell, 2012). A case study places the researcher into the field in order to observe and record objectively what is happening (Stake, 1995) in the learning process. This multiple case study was conducted in the science course of three schools to investigate how chemistry multimedia influences the students to create a good impression of chemistry.

Participants

The participants were selected using stratified random sampling. They came from three different schools with different final examination scores, high, moderate, and low in Pekalongan regency, Central Java. The 7th-grade students from heterogeneous populations came from private schools consist of 94 students (38 male, 56 female, average age 13 years). Table 1 presents the demographic detail of the participants.

Private schools, as the subject of the study, have class divisions that are relatively different from schools in general. The students had a class with additional Islamic subjects that made them had more learning burdens than in general; they study in school from morning to evening. They never had a chemistry lesson before.

Table 1
Data of the Participants in This Study

Type of School	Male	Female
High-ranked school	10	19
Moderate-ranked school	12	20
Low-ranked school	16	17

Classroom Context

Four meetings occurred in this study, each of which lasted for 3 x 45 minutes. The chemistry topic that was given to junior high school students was classification about the matter and its change. In the first meeting, we were starting with the definition of matter and its classification, then at the second, third, and fourth meetings were about the nature of solutions, the separation of substances, and the properties and changes of matter.

Chemistry multimedia was implemented at each meeting. There were three types of media integrated into chemistry multimedia, namely audio (podcast), real objects (Molymod-like), and audio-visual (digital simulation). The first media that was implemented in classroom learning was the podcast. The podcast contained online accessible sound recordings contains monolog or dialog that discussed a simple case about the classification of matter and its change at each meeting according to the subtopics. The students have first introduced chemistry through a macroscopic level, the most natural level, because they only need the ability to concrete operational thinking. The other media that was used to introduce the abstract concept was Molymod-like. The Molymod-like is the molecular model which was made from plastic by the teacher that helped to visualize abstract thing such as elements, molecules that consisted of substance through a real object. The process, such as the motion of the particle and the experiments such as distillation that cannot be done in the classroom, could be presented through a digital simulation in Macromedia flash. The sub-microscopic and symbolic level could be delivered using Molymod-like and digital simulation after the students accepted the explanation about the macroscopic level with the podcast.

Data Collection

The data collection techniques were classroom observation, questionnaires, test, and an interview. Classroom observation was the collection of documents and processes, significant incidences, and evidence about students' responses toward chemistry multimedia. The questionnaire was referred to as the raw materials of impression i.e., familiarity, physic appearance, nonverbal communication, and environment (Smith et al., 2015), with ten questions consisted of four Likert scales. The type of Likert scale used is the level of satisfaction, which uses four options, namely not at all satisfied, slightly satisfied, moderately satisfied, and very satisfied.

The classification of matter tests was given (multiple choices test) to find out the students' levels of understanding. The test consists of four subtopics; classification of matter, type of mixture, separation of substances, and physical and chemical changes. A semi-structured interview was conducted with two students of each class to explore the nature that chemistry multimedia can assist the students in understanding and creating a good impression toward chemistry, their thought, and interest in this field in the future.

FINDINGS AND DISCUSSION

Facilities and Class Environment

The three schools had different facilities that support learning in the classroom. The high-ranked school provides a supportive learning environment for its students, such as adequate laboratory and multimedia projector in each class. The characteristic of high-ranked school students were excellent students that selected using test and national test score, and they usually used learning media in the classroom but not so varied. The frequently used media was a powerpoint presentation where it contained only the writing and pictures. The moderate and low-ranked schools had inadequate implementation learning media in the classroom. The print books were the only media that were used in learning by their teachers. However, in the moderate-ranked school, sometimes still using laboratory as a simple experiment place. On the other hand, the low-ranked school did not have adequate laboratory so their students could not perform experiments well.

The school facilities are one of the essential factors that can influence the students' performance in learning and have a vital role to ensure the quality of teaching and learning (Hasbullah, Yusoff, Ismail, & Vitasari, 2011). There was a significant relationship between school facilities and academic achievements (Figueroa, Lim, & Lee, 2016), psychomotor, and affective domain (Timilehin, 2012). The number of students in the moderate and low-ranked schools is over thirty students per class. It made the interaction between teacher and students did not play well because there are enable learning as students feel well to participate in class while spacious classroom (Enjoh, 2018).

Teachers' creativity in finding the solution of limited facilities has not been done yet in third schools. The topics in chemistry needed a tool, media, that help students comprehend it. The characteristics of chemistry, three-level representation, and the interplay between them made junior high school teachers must try harder to convey and explain to their students because inappropriate ways could make students have a bad impression of chemistry.

Students' Responses toward Chemistry Multimedia

The followings are the principles of designing multimedia tools that assist the students in understanding chemistry: (1) giving multiple representations and descriptions, (2) creating visible linked referential connections, (3) providing the dynamic and interactive nature of chemistry, (4) promoting the transformation between 2D and 3D, and (5) reducing cognitive load by creating explicit information and integrating the information for students (Gilbert & Treagust, 2009). Chemistry multimedia is developed based on these fundamental principles by integrating podcasts, Molymod-like, and Macromedia Flash to introduce chemistry to junior high school students. The three types of media were used to introduce chemistry to 7th-grade students to produce various responses. The high-ranked school students who had previously been introduced to several media in other subjects were not too surprised by the media used in this study, while the moderate and low-ranked schools students seemed very excited about the existence of chemistry multimedia.

Podcasts were the first type of media displayed in learning. There were nine podcasts used in learning classification of matters and their changes. The contents of the podcasts are shown in Table 2. The three schools needed at least 2-3 repetitions in listening to the podcast because they need time to adapt and digest information. Because it is in the form of sound recordings, podcasts can be easily repeated or used by the students to review the results of previous learning. Podcasts are useful and practical because they allow students to slow down. Podcasts are quite centralized and straightforward, which helps the students to listen, reflect, and understand the topics discussed. The length of the podcast is around 1-2 minutes, which contains macroscopic phenomena that are easily imagined by junior high school students. The survey results show that podcast listeners prefer different podcast durations depending on the content (Matava et al., 2013). For case discussions and presentations, the preferred type of podcast is the short-survey podcast. Based on students' result worksheet, podcasts can promote good teaching practice (Donnelly & Berge, 2006; Lee, McLoughlin, & Chan, 2008; Leite, 2016; Powell & Mason, 2013).

The students seemed to concentrate on what they heard because they were previously instructed that there would be an exercise sheet to be done related to the content of the podcast. Such as in Figure 1, the students were given the content about the definition of the matter; then, they were asked to distinguish matter and nonmatter. Based on the students' facial expressions, it was seen that they rarely used audio media types. Therefore, they needed time for adaptation. The type of media in the form of sound recording provides new experiences for the students. In the activity of doing podcast exercises, the students immediately understood what needs to be done because they are familiar with the problems raised in the podcast. Familiarization was chosen as the first variable in influencing students' assessment of chemistry because we tend to develop positive feelings about the target we encounter frequently. In line with some researches that familiarity has a substantial impact on perception (Zebrowitz & Montepare, 2008; Dubois et al., 1999; Moreland & Beach, 1990).

Table 2
Types of Podcasts that were used in the Chemistry Multimedia

Item Podcast	Contents
Podcast-1	Definition of matter
Podcast-2	Classification of matter based on phase
Podcast-3	Classification of matter based on the composition
Podcast-4	Types of mixture
Podcast-5	Acid, Base and Salt
Podcast-6	Example of acid-base
Podcast-7	Indicator of acid-base
Podcast-8	Separation of mixture
Podcast-9	Change of matter

After the students had been introduced to the phenomena and activities around them, which were the macroscopic level of chemistry, the next step was that the teacher entered the sub-microscopic level using the molecular model (Molymod-like). Molymod-like is a three-dimensional (3D) model defining the molecular structure wherein this study was made using plastic balls. The application of the hand-made 3D molecular model has the potential to provide a fresh and unique way for students to recognize the composition of matter. There was a positive impact on teaching and learning using the molecular model in chemistry education (Copolo & Hounshell, 1995; Gyasi, Ofoe, & Samlafo, 2018; Keshavarz, 2018).

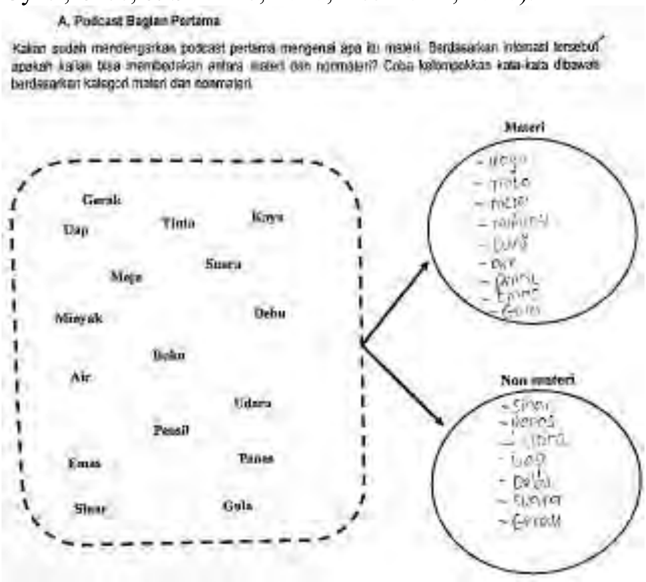

Figure 1
Students' Worksheet of Podcast-1

In general, male students were more expressive in expressing their interest in Molymod-like. They were curious about the shape and color of Molymod-like, which have varied shapes and colors (see Figure 2). Physical appearance is used as a variable in creating a positive assessment of the media because it is proven to be one factor that affects first impressions (Smith et al., 2015; Lennon & Miller, 1984). Molymod-like was chosen in multimedia chemistry because it has an attractive and varied physical appearance. In general, male students asked more questions about Molymod-like compared to female ones. This finding was following the research results that male students are more courageous in speaking in discussions (Sadker, 2002). Compared to female students in the middle and low groups, female students in the high group were more courageous in asking questions related to it. The high group class environment was slightly different compared to the other two classes. In the upper group class, gender differences are not visible, and the students are accustomed to being active in learning. The middle and low classes were more dominated by male students who actively asked questions and answered questions from both the teacher and other students. The female students were a little bit shy, so they were silent and listened to the communication between the male students and the teacher. To overcome this, the teacher formed small groups so that each student, both male, and female, got the opportunity to study chemistry at the sub-microscopic level. Students should be given a chance to construct 3D molecular models using a physical model such as Molymod-like, which can be used in conjunction with two-dimensional images (Harris et al., 2009). Through experience, they got after the discussion with their peer friends or teacher. Learning molecular structures using models becomes easier to understand by the students and can enrich their learning experiences (Sarita, 2015).

Figure 2
Molecular Model (Molymod-like) of Water

Media is needed to facilitate students' understanding of transmitting from 3D molecular representations to their 2D analogies. Macromedia Flash is the solution used by the teacher in giving instructions to students to describe their 3D observations into two-dimensions so that they do not lead to a different understanding. The implementation of learning using Macromedia Flash influences the students being more focused on the material being taught. The classroom situation is better because the students' attention is focused on the images, animations, and digital simulations shown by the media. Bright and varied colors are the main reason the students focus their attention on learning. Colors can be very useful in learning with influencing students' attention (Dzulkifli & Mustafar, 2013). This is because the emotional reaction of the students to bright colors becomes increasingly positive (Kurt & Osueke, 2014; Pope, Butler, & Qualter, 2012) which the right color selection may contribute to a longer span of concentration in learning, improve performance and influence emotions and positive perceptions (Jalil et al., 2012).

The students more active and had interactive experiences when they have introduced digital simulation and interactive experiments through Macromedia Flash. It motivated and actively engaged them in learning. The students from the moderate and low-ranked schools were very excited about learning. It was seen from the expressions of showing positive emotions like the body posture that looks relaxed and focused on the media and their tone of voice that sounds excited because, in this lesson, the teacher brought something new for them. They liked it when trying to do experiments through a computer and analysis their experimental results.

Figure 3 illustrated the acid-base indicator; the students used interactive experiments in chemistry multimedia to understand how indicators work. The students participated effectively in an interactive lesson that can promote active learning and heighten attention and motivation (Steinert & Snell, 1999). Sezer, et al. (2017) proposed to create

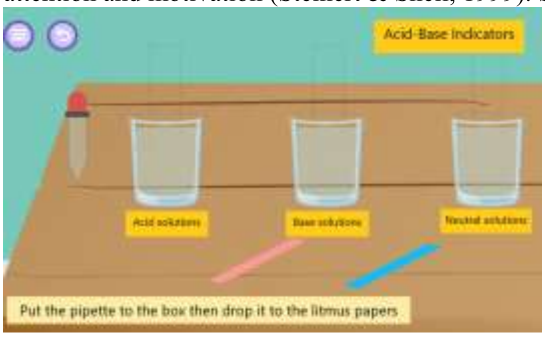

Figure 3
An Interactive Experiment in Chemistry Multimedia

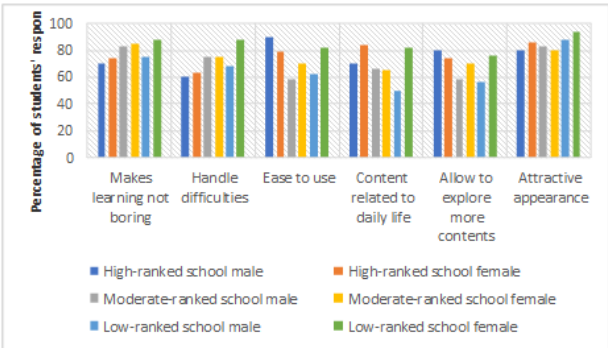

Figure 4
Percentage of Students' Responses (Very Satisfied) in Using Integrated Chemistry Triangle-based Multimedia

A learning setting with more focus on teaching strategies, approaches, and methods that would enable students to participate more actively in the learning process. The results of the questionnaire in Figure 4 showed that three ranked schools chose the scale of "delighted" more than 50% after using chemistry multimedia in terms of usability, appearance, ease of use, and making chemistry look not as tricky as previously imagined. Based on these results, the students from all three groups were delighted with the introduction of chemistry using chemistry multimedia.

In general, from the three classes, the appearance of chemistry multimedia is an essential factor that causes the students to have a good impression of chemistry. Through bright colors, unique molecular shapes according to them, animation, and the digital simulations that they see make them happy to learn the classification of matter. Negative stereotypes about chemistry can be changed by student learning experiences that are joyful learning, where they enjoy each level of chemical representation introduced through the help of chemistry multimedia. The side effects of this good impression cause the students not to get bored during classroom learning, to raise them to ask questions actively, and to find out more about the use of chemistry in solving problems in their lives. The students need active and interactive experiences to motivate and actively engage them in learning. An interactive electronic media can make it easier for students to get high learning outcomes (Suyatna et al., 2018). This reason is why chemistry multimedia is essential to use. The use of chemistry multimedia is not only fun because it contains many things such as collaboration and exploration, but also able to motivate, provide feedback, and enable the students to repeat the topics they want.

How is the Learning Process?

The topic, which is the subject of the case study research, is the classification of matter given at the beginning of the semester in the 7th grade — the situation of third-ranked schools when learning had differences due to the characteristics of their students. In the high-ranked school, the students are more active in asking questions and answering questions from their teacher or their peers than those from two other schools. They have many great imaginations reflected from the questions such as “is the burnt paper included in the example of the change of matter into non-matter?”

Based on students’ experiences, they matched new information that they just got with their preconceptions. In case of separation between water and alcohol, they gave different answers based on each of their preconceptions, such as "it cannot be separated," "using filtration with filter equipment with a tiny net," "I do not think the two substances can mix." In Table 4, it can be seen what the teacher and students do in learning processes.

Level of Students’ Understanding

Based on the level of students' understanding of the three levels of representation, there are three categories of students, namely no conceptual understanding, partial understanding, and sound conceptual understanding. The results of the exercise indicate that the students whom no conceptual understanding have difficulty at the primary level, such as not being able to transform 3D molecular model images into 2D on their answer sheets. Figure 5 showed they looked confused in describing the molecular shapes and placement of distances between molecules when they are solid, liquid, or gas. Even though the teacher has used chemistry multimedia, this type of students still had difficulty distinguishing between elements, compounds, and mixtures. The interview results stated that they assumed that water in all three phases had different molecular forms.

Table 4
Activities in The Classroom

	Teacher's activities	Students' activities
Using the podcast to deliver macroscopic level in typical daily case	Explaining about the definition of matter using case of matter and non-matter podcast	The students listened to podcast carefully, but they still had difficulties in differentiating between matter and nonmatter. Especially about something that cannot be touch, such as air, they considered that it was an example of nonmatter.
	Explaining the classification of matter based on phase using the third phase of water podcast	In general, the students understood very well about different phases about the matter because it was studied in elementary school. They could describe a 2D model of a third matter.
	We explained the classification of matter based on composition using objects in daily life.	Most students of high, moderate, and low-ranked schools had difficulty in describing the 2D model of the composition of matter, such as the composition of pencil and water-based on only what they heard from the podcast.
	Explaining about types of a mixture with a soft drink and oil-water podcast	The students felt more enthusiastic because the podcast contains dialogues between male and female students that were buying some snack in minimarket for their study tour. They could differentiate between cola-cola and oil-water based on the information that they got from the podcast about homogeneous and heterogeneous mixtures.
Using a concept map assisted by a symbol	Before going into the material explanation, the teacher showed a concept map to give an idea of what will be learned	The students compared to the concepts in the map concept. They were more interested in the symbol/images printed on the concept map. It was easier for them to remember images than concepts.
Using an interactive periodic table	In ways to introduce elements in chemistry, the teacher used an interactive periodic table that could show the picture of each element and data of elements if she clicks the button in there.	The students of the low-ranked school were the most excited students when they were introduced to the periodic table. The male students had many questions and gave many responses to their teacher.
Using Molymod-like to deliver the submicroscopic level	The teacher brought some molecules model with varied colors and shapes. She explained that each element or compound has a different shape and colors.	The students were divided into a small group that consists of a 4-5 person/group. Each group got varied Molymod-like that could be studied and analyzed by them. The students that had high curiosity asked many questions such as they asked why oxygen and carbon dioxide gases had a different shape and contained different colors?
Using interactive experiments	The teacher demonstrated the indicator of the acid-base experiment using digital simulation	Most students wanted to try this interactive digital simulation by themselves. For the first time, they just wanted to play, but they started to be curious about the different results of the experiment.
Using digital simulations of separation of substance experiments	The teacher substituted the real experiment with a digital simulation that consists of motion and voice recording about the explanation of each experiment, such as chromatography and distillation.	The students paid more attention to the digital simulation than the concrete object. Some factors that attracted them were varied colors and voices that showed in the digital simulation. Most students got the concept of each separation process but still found difficulties in explaining their definition.
Using pictures of properties and changes of matter	The teacher used some pictures to describe the definition of properties and changes of matter	They matched pictures with the types of properties or changes of matter. In general, they still had many wrong answers, but they seem excited in this game.

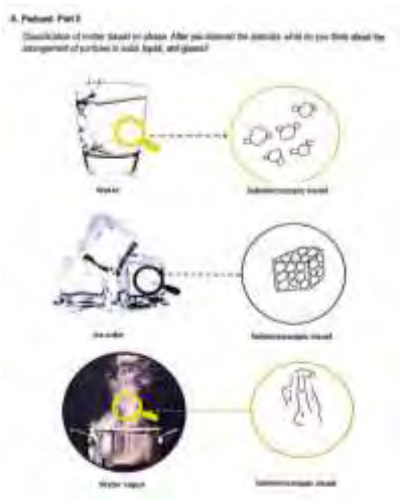

Figure 5
Student's Answer of no Conceptual Understanding Type

The students whom partial understanding have understood the basics of sub-microscopic representation, but they had difficulty in interpreting the terms and symbols introduced by the teacher. In Figure 6, it can be seen that they were confused when they had to use the terms atoms, elements, molecules, compounds, and mixtures. New terms and symbols that they think have similar meanings make them challenging to understand. The last types, the students who sound conceptual understanding, have the right concepts and can connect the three levels in explaining a problem. Figure 7 was the students' answer of this type. They accept all concepts that can accept logic, then connect them with the facts in real life. The number of students who sound conceptual understanding is the higher of all the other two types.

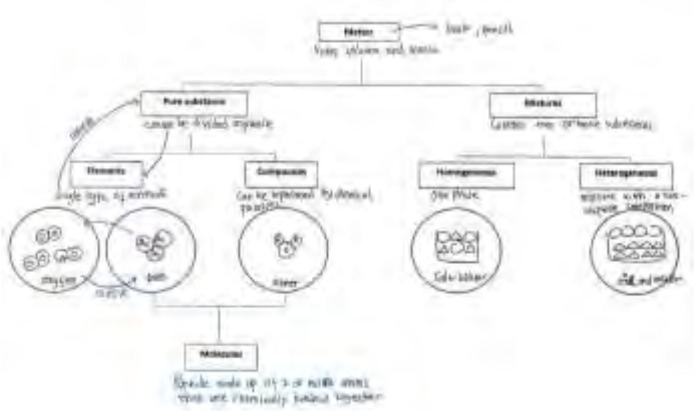

Figure 6
Student's Answer of Partial Understanding Type

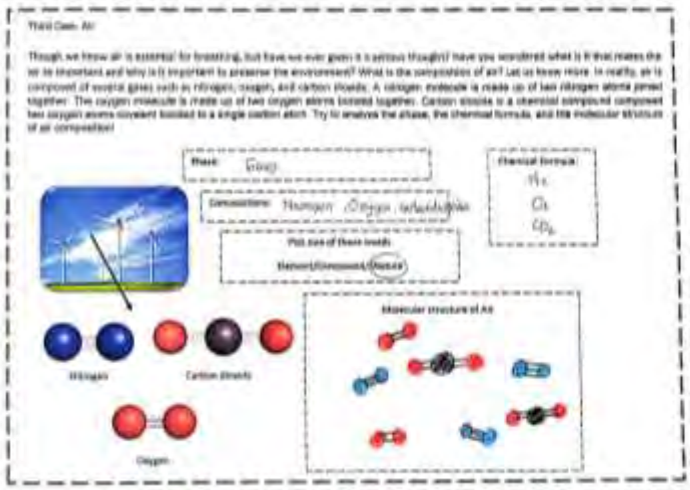

Figure 7
Student's answer to sound conceptual understanding type

The level most readily accepted by the students is a phenomenon or macroscopic. This part is evident when the students easily distinguished between mixtures and pure substances but required a longer time to understand the differences in elements and compounds. The teacher used the Molymod-like molecular model assisted by Macromedia Flash animation to visualize elements and compounds. The difference between elements and compounds cannot be easily made from macroscopic activities without resorting to explanations using molecular models representing elements and compounds (Gabel, 2009).

Starting from an understanding of what are the various types of elements in the periodic table, the students began to understand why elements and compounds are different. The teacher introduced a periodic table of elements with Macromedia Flash that can show names, symbols, and images of elements. These images make it easier for the students to remember visually from a significant number of elements. In classroom observations, the students had difficulty understanding the meaning of metalloids compared to metal and non-metal. This result is because the term metalloid is a new term for them, so they do not have any idea about what metalloids look like. Scientific literacy is one of the factors that significantly influence the students' success in studying chemistry (Woldeamanuel et al., 2014). The role of the teacher is needed in building the right concept of new terms — needed by the teacher with an excellent understanding of the context because the most crucial model in teaching chemistry is the chemistry teacher himself/herself (Cardellini, 2012).

The students' understanding of changes in the phase of water was limited to seeing from the microscopic level without knowing what happened at the sub-microscopic level. One source that causes low student perceptions of chemistry is the difficulty of understanding at the sub-microscopic level, which connects between macroscopic and symbolic levels. The chemistry multimedia helps teachers by providing representational relationships from all three levels so that science teachers, especially those not from chemistry graduates, can give the explanations more precise and clear paths. This way is intended to minimize conceptual errors early on by the students because one of the problems in learning is that the teacher presented incomplete concepts (Redhana et al., 2017). Sub-microscopic representations such as atoms and molecules that describe matter at the particle level are considered as a beginner's teaching method that makes sense because it allows them to understand what happens to the microscopic level from the perspective of particles (Gilbert & Treagust, 2009). Based on characteristics of the subject of the study, they have additional Islamic subjects, so adopted strategies were important without being overload with excessive and unnecessary information that would help students be held independently in working memory in order to remember (Cowan, 2014).

CONCLUSION

The method to introduce the right chemistry can give a good impression, which can then lead to curiosity to learn more. A chemistry multimedia media can introduce chemistry through the perspective of the three levels of chemical representation so that the students can understand it clearly and easily. The main factor that makes the students very interested in learning using chemistry multimedia is its attractive appearance, such as bright colors, molecular forms, and visualization of Macromedia Flash. The chemistry multimedia helps teachers to explain chemistry in a way that is not boring and readily accepted by logic through daily activities that are used as examples of problems.

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