



The Study of Media Literacy in 12th Graders Using Science-Technology-Society Approach on the Topic of Biomolecules

Nilin Panyapa^{1*} and Darunee Sertphon²

¹Science Teaching Program, Suryadhep Teachers College, Rangsit University, Thailand

²Faculty of Science, Rangsit University, Thailand

*Corresponding author, Email: np.nilin@gmail.com

Abstract

The objectives of the study were (1) to investigate 12th grades' media literacy after learning Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach, and (2) to study the learning management on this topic using the Science-Technology-Society approach to support students' media literacy. The study purposively selected 42 students studying in 12th grade in Math and Science program at a state school in Pathum Thani, Thailand. The research instruments were four lesson plans designed following the Science-Technology-Society approach, the pre and post-test about media literacy, worksheets about biomolecules in social media, and recordings after using each lesson plan. For data statistical analysis, the researcher used mean (\bar{X}), percentage, standard deviation (S.D.) and normalization gain <g>.

The findings showed that the students' media literacy increased after learning Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach. To extend, 34 students (80.95%) were in the medium gain of the increasing (<g> between 0.30 and 0.70), and 8 students (19.05%) were in the low gain (<g> less than 0.30). To provide the scores examined in the media literacy indicator (access, analysis, evaluation, and creation), there were increases in each indicator. The processes for management of Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach to support students' media literacy were using an article or media relating to students' living, activating and advising the students to question, analyze and interpret the content of media, and group discussing.

Keywords: Media Literacy, Science-Technology-Society Approach, STS, Biomolecules, Chemistry

1. Introduction

Media has been permeating Thai culture among users of all ages, but especially teenagers. It is a part of teenagers surrounding and learning resource (Amornwich & Chulakorn, 2006, cited in Sumalee, 2017). Moreover, media has an important role in their attitudes, social values, actions, and living patterns (Rujikarn, 2016).

High school students are particularly sensitive to the media. On the other hand, they have their own thoughts and choose what they truly feel interested in. Therefore, they usually share knowledge or experience with their friends and people in the same generation and response something new from the media easily, for example, copying the action of an idol on social media (Rujikarn, 2016). To promote the students' understanding of the complexity of media, media literacy is clearly important (Samoer, n.d.).

Media literacy is the ability to interpret media message in order to develop skills about media: access, analysis, evaluation and understanding its effects, including creating media (Xeniabok, et al, n.d., cited in Therdsak, 2014). In addition, the National Broadcasting and Telecommunications Commission (NBTC) mentioned that media literacy includes the participation for media improvement, for instance, complaining of unsuitable media. Hence, students can learn how to knowingly analyze objectives, messages and information from media by supporting their media literacy (Usa, 2011, cited in Sumalee, 2017).

From a previous study, learning media literacy through the new media technologies such as laptop computers and iPads enhanced students' media literacy since this curriculum has meaning and relevance for the students (Alice, 2016).

Sumalee (2017), has shown that the undergraduates' media literacy significantly increased after learning by the inquiry teaching method ($p < 0.05$) and the simulation teaching method ($p < 0.05$). For the



first method, the inquiry teaching method (5E) motivated the undergraduates to think and criticize media through the inquiry processes, and summarize knowledge on their own. As the simulation teaching method developed communication skills and critical thinking at the same time. Then, these skills could be used for analysis, evaluation and presentation of media. In both cases, undergraduates' media literacy was not significantly different between the two methods.

Ulichasa (2013) studied about learning management enhancing media literacy, and found that there were 2 factors; one set external (teacher and friends) and the other internal (critical thinking, media influence inoculation, media production and self-awareness) affected media literacy learning.

Based on the researcher's observation and examination of students' worksheets, most students did not place importance on the reference and the reliability of resources, and some students could not select a suitable keyword to access information. These were the examples showing a lack of the students' media literacy in the part of access which is defined as the ability to search for information from reliable sources (Napin, 2017). Furthermore, they did not openly present the source of information whereas it is a behavior indicating of media literacy (Partnership for 21st century skills, 2011 ; Aspen institute, 1992 cited in Pakorn & Anucha, 2015). Therefore, the researcher decided to undertake a study in which media literacy was supported using an approach related to Chemistry.

However, there have been no report about developing media literacy using scientific design learning. The only related paper includes Sansanee (2015) who used the Science-Technology-Society (STS) approach learning to successfully enhance critical thinking ability.

Therefore, there were two objectives in this study: (1) to investigate that how is students' media literacy after studying Chemistry on the topic of biomolecules using the Science-Technology-Society approach, and (2) to study how to manage Chemistry on the topic of biomolecules using the Science-Technology-Society approach to support students' media literacy.

2. Objectives

1. To investigate 12th grade students' media literacy after learning Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach.

2. To study the learning management for Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach to support students' media literacy.

3. Materials and Methods

3.1 Research Scope

12th graders (224 students) studying in Math and Science program at a state school in Pathum Thani, Thailand were chosen for this study. 42 participants in this study were purposively selected as they were in the researcher's responsibility, and there were different scores among these students by testing about biomolecules before starting the first cycle.

The research duration was 1 year, from May 2019 to August 2020. Data were collected in the first semester of the academic year 2019 with 4 lesson plans, 7 periods and 50 minutes per period.

3.2 Methodology

1) Research Design

This research is a quantitative and qualitative classroom action research to study students' media literacy after learning Chemistry on the topic of biomolecules using the Science-Technology-Society approach and to study its learning management.

2) Research Process

The study was designed following Kemmis and McTaggart's (1998) four stages PAR model (planning, action, observation, and reflection) which can be repeated in spirals to examine problems (Sheri, 2015) and develop solutions in the next cycle.



In the first stage (planning), the researcher observed the context of the students and school, and interviewed the mentor teacher for investigation of the problems in a classroom, then designed the research instruments.

For the second stage (action), the researcher conducted a pre-test about media literacy before using the first lesson plan to determine the students' media literacy. Then, the first lesson plan was used.

In the third stage (observation), data were collected by utilizing the research instruments. During this part, students were randomly interviewed. After that, researcher recorded the findings in four topics: learning outcomes, classroom atmosphere, issues and solutions.

The final stage (reflection), the researcher analyzed the results from the pre-test, interview, recording after using the plan and suggestion from the mentor teacher to improve the next cycles. For the final cycle (the fourth plan), a media literacy post-test was conducted to examine and compare students' media literacy before and after treatment.

3) Research Instruments

There were two categories of research instruments: experimental instruments and data collection instruments. The experimental instruments were 4 lesson plans designed following the Science-Technology-Society approach and 3 cycles. Each cycle consisted of 6 steps following SEPUP Learning Cycle (Koker, 2011, cited in Rattanaporn, 2012): (1) motivation (2) challenging (3) collection of scientific evidence (4) analysis of the evidence (5) building knowledge and making connections and (6) using the evidence.

Data collection instruments were the pre and post-test about media literacy, worksheets about biomolecules in social media, recordings after using each lesson plan and media (posters) by the students.

The pre and post-test, which were conducted at the beginning and the end of the study respectively, were adapted and modified from Napin (2017). The tests consist of 4 parts following media literacy indicators: access (5 items), analysis (4 items), evaluation (3 items) and creation (5 items). To ensure the validity of the content, Index of Item-Objective Congruence (IOC) was used and three experts were required to evaluate the items of the test. IOC of the pre and post-test were 0.90 and 0.94, respectively.

4) Data Collection

The researcher collected the pre and post-test scores to answer the first objective: to examine students' media literacy after treatment. For the second objective: to support student's media literacy using the Science-Technology-Society approach on the topic of biomolecules, the researcher randomly interviewed the students, collected each group of the students' worksheets, recorded learning outcomes, the classroom atmosphere, issues and solutions after using each plan, and each group of the students' poster.

5) Data Analysis

The collected data (the pre and post-test scores) was analyzed by calculating mean (\bar{X}), percentage, standard deviation (S.D.) and normalization gain.

4. Results and Discussion

4.1 Results

Objective 1: The results from the pre and post-test are shown in Table 1. This showed an increase in scores after treatment.

Table 1 The pre and post-test scores of student's media literacy

| Tests | Mean (\bar{X}) (full scores: 17.00) | S.D. |
|------------------|--|------|
| Pre-test scores | 9.90 | 2.78 |
| Post-test scores | 12.98 | 0.91 |



From Table 1, students' average media literacy score before treatment was 10 from 17, and after treatment was 13 from 17. For the comparison between the scores before and after treatment, there were increasing scores after treatment.

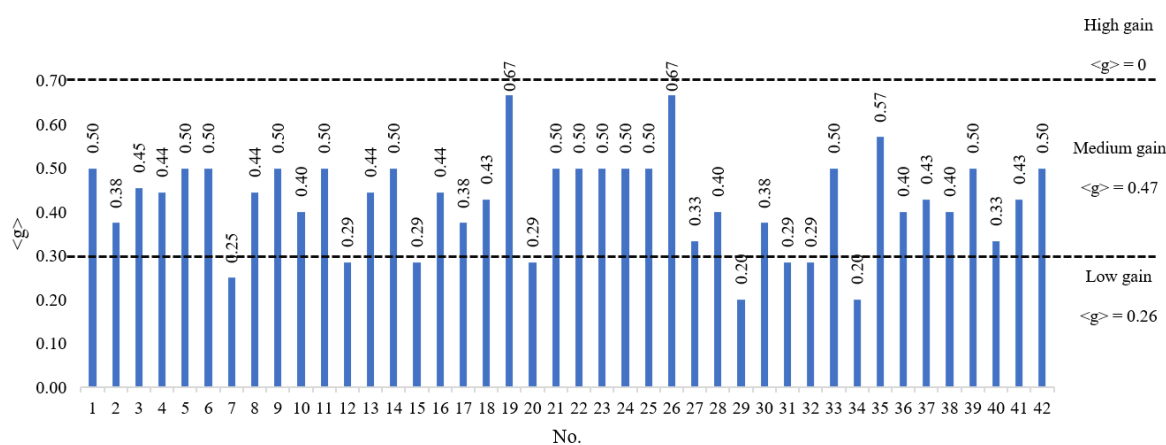


Figure 1 An increase in students' media literacy scores after studying Chemistry on the topic of biomolecules using the Science-Technology-Society approach

An actual gain of students' media literacy scores from a comparison of the pre and post-test scores was shown in Figure 1 and separated to 3 gains (low, medium, and high gain). There were 8 students (19.05%) getting the low gain ($\langle g \rangle$ less than 0.30), 34 students (80.95%) getting the medium gain ($\langle g \rangle$ between 0.30 and 0.70), and no student (0%) getting the high gain ($\langle g \rangle$ more than 0.70).

Table 2 Percentage of student's media literacy average scores separated to 4 indicators from the pre and post-test scores

| Media literacy indicators | Percentage of the average scores (%) | |
|---------------------------|--------------------------------------|------------------|
| | Pre-test scores | Post-test scores |
| Access | 44.83 | 64.83 |
| Analysis | 76.72 | 86.21 |
| Evaluation | 70.11 | 83.91 |
| Creation | 56.55 | 81.38 |

From Table 2, it showed that students' media literacy scores in every indicator increased after learning Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach. As the first indicator (access), percentages of the average scores before and after treatment were 44.84% and 64.83%, respectively. The second indicator (analysis), the score before treatment was 76.72%, and the score after treatment was 86.21%. For the third indicator (evaluation), the score before treatment was 70.11%, and the score after treatment was 83.91%. Finally, scores before and after treatment in the fourth indicator (creation) were 56.55% and 81.38%, respectively.

Objective 2: The results from the worksheets and recordings from the cycle 1 (plan 1 and 2) showed that there were 3 problems: (1) the students took too much time in step 1 "motivation" (reading the article from social media) and step 2 "challenging" (question about the article), (2) they did not give a reason for a selection of references such as reliability, and (3) they used information from only 1-2 references. From the random interview, the researcher found that the students were worried about the suitability of the question and took more time with reading the article.

According to the first problem, it was solved by showing time on a projector and writing the name of students owning each question, moreover; the researcher tried to activate the students by talking with and



advising the students in a small group. To solve the second and third problems, the researcher and each group of students discussed the importance of references.

In the second cycle (plan 3), 43% of groups of students used more than 2 references in the worksheet whereas the other groups used only 1 reference. The students using only 1 reference explained that “there was no information which matched with their topic” or “most sources were in databases which they had to pay for access”. Hence, the researcher advised some words and free sources to search for what topic they were interested in. For reasoning about the selection of references, they could give sensible reasons, for example, the website is directly about health, and the writer is a doctor who is an expert in that field.

From observation in the final cycle, the researcher found that some students did not have a part in step 3 “collection of scientific evidence” (searching for information to answer their questions). They gave a reason for this situation that there was the same content in many resources, so searching by many people was unnecessary.

4.2 Discussion

Objective 1:

1) After learning Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach, 12th graders’ media literacy increased. 80.95% of students were in medium gain and the rest of them (19.05%) were in low gain in case students’ media literacy scores from the pre and post-test scores were compared by using normalization gain.

2) Media literacy indicator 1 (access): Besides the scores for media literacy indicator 1 (access) increased from 44.83% in the pre-test to 64.83% in post-test, the time spent for reading and question about the articles in step 1 (motivation) and step 2 (challenging) in cycle 2 and 3 was decreased from cycle 1. Also, the students had deeper and various questions in cycle 2 and 3, for instance, the question “why do powder bubbles in bubble milk tea look black?” became the question “why is fat with *trans*-isomer more dangerous than fat with *cis*-isomer”. It could be indicated that they understood the content of the articles progressively following media literacy indicator 1 (access) which is about effective understanding the content of media (Thoman & Jolis, 2008 cited in Maesiya, 2017) and screening information matching with objectives or learning outcomes (Usa, 2011 cited in Sumalee, 2017).

However, almost all sources which the students used were from websites. It was probably because they were in the classroom, searching for information on the internet on their mobile phones was the most comfortable. Although there was using information from studies, it was limited in only free data, whereas some students had no idea about a free database. It was consequently summarized that the students lacked media literacy in the part of access which related to searching for information from several media types.

3) Media literacy indicator 2 (analysis): From question 6 of the pre and post-test, the students had to analyze the articles used in the class to identify fact, exaggerated proposal, opinion, and persuasion from media. The results showed that they could analyze media messages before treatment since every student chose the correct answers both for the pre and post-test. Nevertheless, the scores in the other parts of the analysis were up, so the average scores increased from 76.76% to 86.21%.

4) Media literacy indicator 3 (evaluation): As the results, it showed that the students could decide accuracy, quality and association of the content of media following media literacy indicator 3 (center for media literacy, 2008 cited in Pakorn & Anucha, 2015) due to increasing of the scores from 70.11% (pre-test score) to 83.91% (post-test score).

5) Media literacy indicator 4 (creation): From posters which were the final work before testing the post-test, most groups of students created their posters following the steps of media literacy indicator 4: (1) brainstorming, planning and editing (2) using written language and (3) creating or choosing the suitable illustrations (Usa, 2010 cited in Sumalee, 2017). There were 7.14% of students who did not have a part in the first step completely. Therefore, it could not be summarized that the students have media literacy in the part of creation. This might be caused by personal working habits or the classroom atmosphere because it was the last day of the semester in the school of the students. However, from the pre and post-test scores, the average scores in the part of creation increased from 56.55% to 81.38%.

**Objective 2:**

1) The learning design following 6 steps of SEPUP Learning Cycle on the Science-Technology-Society approach could support the media literacy of the students. Especially, for steps 2, 3 and 4 which were challenging, collection of scientific evidence and analysis of the evidence, respectively.

For step 2, the student had to read the article, then question whatever about the content of the articles. This gave them a chance to spend time with analysis and interpret the content of media which are the basic processes of media literacy (Ulichasa, 2013). Moreover, the question process leads to attentive reading and media criticism, including critical thinking which are the important factors of media literacy (Sumalee, 2017 and Ulichasa, 2013).

In step 3, there were 2 processes to collect scientific evidence. The first process was lecturing basic knowledge about biomolecules from the teacher. Another process was searching for information to answer their question from other sources such as websites, studies, and interview an expert. Based on the indicators of media literacy, the student could be supported access skills by collecting information from several sources and understanding the content (Therdsak, 2014).

For step 4, it had an evaluation of the quality and credibility of sources and discussing to collect and edit information in their own language. Both evaluation and discussion processes match with media literacy learning management, additionally, they can cause learning how to think critically (Ulichasa, 2013).

2) For the suggestions, using the article on the topic which connects to the students' living can activate them to question and search for more information. However, there have to be some advice or direction from the teacher at the beginning of learning, since some students may not be confident in their thought, or their questions do not relate to the topic.

The basic skill of searching for information on the internet should be conducted in the middle of the study in order to examine the media literacy indicators 2, 3 and 4 provided some students are not able to access some sources. Moreover, learning outside the classroom is an interesting way to find a new source of information.

There may be group work and individual work for examination of the final media literacy indicator (creation) so that observe the processes of creation media both as a team and individually.

5. Conclusions

1. After learning Chemistry subject on the topic of biomolecules using the Science-Technology-Society approach, 12th graders' media literacy scores rose from 9.90/17 to 12.98/17.

2. No student reached the high gain (<g> more than 0.70) of the increase in students' media literacy scores. There were 34 students (80.95%) got the medium gain (<g> between 0.30 and 0.70), and 8 students (19.05%) got the low gain (<g> less than 0.30).

3. The post-test scores separated into 4 media literacy indicators (access, analysis, evaluation, and creation) increase from the pre-test scores in every indicator.

4. The learning management for support students' media literacy following the Science-Technology-Society approach on the topic of biomolecules was using an article or media relating to students' living, activating and advising the students to question, analyze and interpret the content of media, and group discussing.

6. Acknowledgements

I would like to express my sincere thanks to my thesis adviser, Dr. Darunee Sertphon and my mentor teacher, Miss Sataporn Chanchaiyasit for your expert advice and encouragement throughout this research, as well as Prof. Dr. David James Harding for your kindness and the correction of writing.



7. References

- Alice, Y. L. (2016). Media education in the school 2.0 era: teaching media literacy through laptop computers and iPads. *Global media and China*, 1(4), 435-449.
- Maesiya, A. (2017). *The social media exposure and the ability for social media literacy of vocational students in Kamphaeng Phet province*. The degree of master in communication arts. College of communication arts Rangsit university.
- Napin, Y. (2017). *Development of a cloud-based training model with case-based learning to enhance media literacy of public relation officers in non-profit organization*. Master of education program in Education technology and communications. Faculty of education Chulalongkorn University.
- Pakorn, P. & Anucha, K. (2015). *The reseach and development of the measurement instruments of the media literacy skills in the 21st century for secondary students*. Faculty of Education Naresuan University.
- Rattanaporn, J. (2012). *Effects of science instruction based on science, technology, and society approach on problem-solving ability and energy and environmental conservation awareness of lower secondary school students*. Master of education program in science education. Chulalongkorn University.
- Rujikarn, T. (2016). *New media literacy of high school students in Lankrabue district, Kamghaengphet province*. Master of communication in Communication management.Naresuan University.
- Samoer, N. (n.d.). Media Literacy. Retrieved July 10, 2019, from http://www.prd.go.th/download/article/article_20180518103036.pdf
- Sansanee, T. (2015). *Enhancing global awareness and critical thinking ability of 12th grade students through Science, Technology and Society approach*. Master of education. Science education Kasetsart University.
- Sheri, L. (2015). *Exploring foreign language classroom-based assessment through subject-specific professional development: a participatory action research case study*. Doctor of philosophy. Faculty of the graduate college University of Nebraska.
- Sumalee, C. (2017). *A comparison of the effects of the inquiry teaching method (5E) and the simulation teaching method on the media literacy of undergraduates at the faculty of education, Srinakarinwirot University*. The degree of master of education. Ramkhamhaeng University.
- Therdsak, M. (2014). Media literacy: skill for 21th-century learning. *Journal of information science*, 32(3), 74-90.
- Ulichasa, K. (2013). The development of the media literacy learning's process approach for the youth leader. *Veridian E-Journal*, 6(3), 276-285.