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Online Chemistry Learning Management Model Promoting Students' Scientific Communication in the Special Program Classroom on Science, Mathematics, and Technology, and Environment during the Pandemic Covid-19 Situation

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Abstract: The purpose of this qualitative research is to study the opinions of five Chemistry teachers towards online Chemistry learning management model that has promoted students' scientific communication in the special program classroom on Science, Mathematics, and Technology and Environment during the pandemic Covid-19 situation. The data are collected by a semi-structured interview. The content analysis is conducted to analyze the data and verified with the interviewees and the experts. The findings reveal that the online Chemistry learning management model 1) the online Chemistry learning management model is the 5 E's of Inquiry-Based Learning according to the Institute for the Promotion of Teaching Science and Technology, 2) this online learning management based on the 5 E's of Inquiry-Based Learning has developed students to achieve their learning objective on the knowledge about the content and developed their 21st century core skills, 3) this management based on the 5 E's of Inquiry-Based Learning has promoted 3.1) critical thinking skill and problem-solving skill, 3.2) computer and information technology and communication skill, and 3.3) collaboration, teamwork and leadership skill, 4) the online learning management promoting scientific communication are 4.1) the 5 E's of Inquiry-Based Learning and 4.2) Active Learning, and 5) some technologies integrated in this online learning management promoting scientific communication are Google meet, Google site, Zoom, Flip classroom, Padlet, and Google Jamboard.

Keywords: Online Chemistry Learning Management Model, Scientific Communication Skill, Chemistry Teachers, Special Program Students on Science Mathematics and Technology and Environment

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1. Introduction

The spread of the covid-19 virus has a wide impact on many dimensions around the world, including the impact on education in many aspects ranging from school closure, and the use of teaching applications through various mechanisms, as well to the economic problems causing many children have to drop out of school which increases more inequality in education. The situation of the Covid-19 pandemic, however, has become the driving force for adaptation and brought about technology and style innovation; new education that allows children to learn by themselves using different forms of learning which have become a model corresponding to the context of each area around the world. Such changes do not only affect students, but teachers also need to adjust and develop themselves. As a transferor of knowledge to students, teachers must be prepared in terms of skills to cope with the new approach to learning management (Agad et.al., 2019; Suanse and Yuenyong, 2021).

For this reason, science learning management needs to adapt to develop learners in accordance with changing lifestyles. The management of science learning in normal situations has determined that teachers manage to learn that promotes understanding of the nature of science (Institute for the Promotion of Teaching Science and Technology, 2021), which describes the science of meaning, how to acquire scientific knowledge, the development of scientific knowledge, as well as an understanding of the values and beliefs embedded in scientific knowledge and knowledge development (McComas, 1998). Education in the 21st century aims to develop people with knowledge or the ability to keep up with the social competition in ASEAN and the international community. There are several key skills, among which communication and cooperation are one of the most important 21-st century skills. It is a skill that determines the readiness of students to enter complex work that requires communication and cooperation leading to success. In addition, the Basic Education Core Curriculum, B.E. 2551 has set the goal that students must have the ability to communicate and use life skills, exchange information effectively, adjust to life in society, work with others, have a culture of language use, convey an idea, knowledge, understanding, and feelings for the benefit of oneself and social development. Furthermore, they should be able to use their life skills to apply in various processes in their daily life for work, building good relationships between people, and demonstrate the importance of basic communication to exchange knowledge, which will ultimately affect the adjustment in student's lives in the future.

In the chemistry course, which is one of the disciplines in the science of matter and transformation at the macroscopic and microscopic level, as well as the symbolic level. The macro change describes chemical phenomena which can be observed. This is different from the micro change that explains the chemical phenomena of substances at the atomic and molecular level, which is not visible to the naked eye. In the part of the change in the symbolic level, it is an explanation of the relationship between macro and micro-level interconnecting through chemical notation. A distinctive feature of chemistry is that it uses structural formulas to describe the structure of a substance. These are the basis for chemists to communicate with one another and allow them to understand the meaning (Udomkan et.al., 2015; Sarawan and Yuenyong, 2018)

From the study of the preliminary data of the School Quality Assurance Group regarding the model of online learning management in chemistry courses during the situation of COVID-19 to promote scientific communication skills of a large special school in the lower northern region for students in the Special Classroom for Science, Math, Technology and Environment Program which is a classroom for students with special and outstanding abilities in science and mathematics and who are able to learn things quickly, it was found that the learning management model in an online chemistry course is mostly a 5-step learning process, according to the Institute for the Promotion of Teaching Science and Technology, which is not different from normal classroom learning.

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Such learning management aims only at improving academic achievement, which is not consistent with the goals of education in the 21st century. Therefore, the learning management model in online chemistry courses during the situation of COVID-19 that promotes science communication skill challenges the ability of teachers to adapt themselves to organize new normal science learning.

Regarding the aforementioned problem, the researcher is interested in studying the learning management model in the online chemistry course during the situation of COVID-19 that promotes students' science communication skills in the Special Classroom for Science, Math, Technology and Environment Program through the perspectives of the chemistry teachers teaching in a similar context, that is being a chemistry teacher of a large school with students in the Special Classroom for Science, Math, Technology, and Environment Program. The findings of the research will lead to the approach of the learning management model, which can be used to develop online learning management that promotes effective science communication skills of the students.

2. Objectives

To investigate the perspectives of chemistry teachers on the COVID-19 online learning management model that promotes science communication skills of students in the Special Classroom for Science, Math, Technology, and Environment.

3. Study Group

The study group consisted of five teachers of science and technology subjects who had the task of teaching a chemistry course for students in the Special Classroom for Science, Math, Technology, and Environment Program under the Office of the Basic Education Commission. Purposive sampling was used to select the samples. They were willing to provide information in the interviews by using English characters instead of their real names, according to research ethics, as shown in Table 1.

Table 1: Teacher characteristics

Name	Age (Years)	Teaching experience (Years)	Education	Teaching tasks	Grade	Other tasks
T1	58	35	B.Ed. (Chemistry), M.Ed. (Chemistry)	Chemistry, Basic Laboratory Techniques	M.4, M.6	Assistant Director of Academic Promotion
T2	31	5	B.Sc. (Chemistry), M.Ed. Science Education (Chemistry), The Project of the Promotion of Science and Mathematics Talented Teachers (Premium)	Chemistry, Basic Laboratory Techniques	M.4	Head of Research and Development
T3	31	4	B.Sc. (Chemistry), M.Ed. Science Education (Chemistry), The Project of the Promotion of Science and	Chemistry, Basic Laboratory Techniques	M.4	Educational Management Working Group

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Name	Age (Years)	Teaching experience (Years)	Education	Teaching tasks	Grade	Other tasks
			Mathematics Talented Teachers (Premium)			
T4	31	4	B.Sc. (Chemistry), M.Ed. Science Education (Chemistry), The Project of the Promotion of Science and Mathematics Talented Teachers (Premium)	Basic Chemistry, Additional Chemistry, Physical Science	M.2, M.3, M.5	Information Services, Learner Developmen t Activities
T5	28	3	B.Sc. (Chemistry), M.Ed. Science Education (Chemistry), The Project of the Promotion of Science and Mathematics Talented Teachers (Premium)	Basic Science, Basic Chemistry, Basic Laboratory Techniques	M.3, M.4, M.6	Head of Special Classroom for Science Program

4. Methodology

This qualitative research aims to investigate the perspectives of the teachers by using in-depth interviews. The details are as follows

4.1 Research Instruments

A semi-structured interview was used, and it was developed from the study of documents, document verification, and relevant research to form eight main questions. Then, the interview questions were peer-reviewed by three experts, who were scientists, and used to try out. It was found that, after the improvement, there were five questions left as follows:

1. Which learning management model did the teachers use to manage online learning in the chemistry course during the situation of Covid-19?

2. In what areas (knowledge and thought/attitude/ skill) did the teachers use online learning management of this model to help develop learners to achieve their learning goals?

3. Did the teachers use online learning management of this model to promote learning skills for the 21st century? How? (3R: Reading, (W)Riting, and (A)Rithematics)

7C
- Critical Thinking and Problem-solving skills
- Creativity and innovation skills
- Intercultural and different paradigm understanding skills
- Cooperation, teamwork, and leadership skills
- Information communication and media literacy skills
- Computer, information, and communication technology skills
- Career and learning skills

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4. Which form of online learning did the teachers use to enhance science communication skills? Why?

5. What technology did the teachers use in online learning management? Did it help promote scientific communication skills? How?

4.2 Data Collection

Before collecting the data, the researcher explained to all five teachers that the data collection was part of the research to guide the learning management model in online chemistry course during the situation of COVID-19 that promotes science communication skills of students in the special classroom for science, math, technology, and environment program. The interview answers would be kept confidential, and the questions would be answered based on their own perspectives and experience by setting a time of 30 minutes each. The interviews would be recorded from the beginning to the end of each conversation. The researcher also recorded some points of interest in a notebook. The data were collected from 8-23 January 2022.

4.3 Data Analysis

The data from the interview was analyzed by content analysis consisting of five steps as follows:

1. Preparing: It was conducted by organizing the information from the transcription of the interview by showing it as a conversation between the researcher and the five teachers. The interview was transcribed into a document. For member Checking, the document was sent to the research participants to confirm that it was paraphrased exactly what the research participants interviewed.

2. Coding: It was conducted by organizing the content of information by reducing the information to only the issues that needed to be analyzed (Miles & Huberman, 1994). Then the information was coded.

3. Categorizing data: The data were related to the issues analyzed.

4. Drawing conclusions: This was conducted by explaining the evidence based on the content of the interview.

5. Checking the credibility: This was conducted by using the credibility criteria of qualitative research with "trustworthiness" (Lincoln and Guba, 1985). The researcher peer-debriefed with three experts and discussed the findings from the perspectives of the science teachers.

5. Findings

Regarding the semi-structured interview results with five teachers in a chemistry course for students in the special classroom for science, math, technology, and environment program, this allows the researcher to know the perspectives of the learning management model of online chemistry course in the situation of COVID-19 that promotes science communication skill as follows:

1. Which learning management model was used in the online learning management of the chemistry course in the situation of COVID-19?

The online learning management model during the COVID-19 situation in the chemistry course of five teachers was the 5E model according to the guidelines of the Institute for the Promotion of Teaching Science and Technology. Due to the pandemic of COVID-19, students were unable to attend classes normally, and teachers had to adjust their teaching suddenly without planning in advance. Many teachers must adhere to the old classroom practice.

2. In what ways did online learning management help develop learners to achieve their learning objectives?

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For the management of online learning according to the 5E model, three teachers recommended that online learning management was still a lecture-only by teachers, and what students received was only the knowledge of the content in that matter. The other two teachers viewed that what students received consisted of the knowledge of the content from the teacher's presentation and the skills in using technology to answer the questions or present their work using an online platform.

3. Did the online learning management model promote learning skills for the 21st Century? How?

For the management of online learning based on the 5E model, two teachers stated that it helped to promote 1) critical thinking and problem-solving skills in the process of doing exercises, and 2) computer, information, and communication technology skills in the verbal question-answer process, the submission of tasks, exercises, and presentation. The other three teachers recommended that besides promoting 1) critical thinking and problem-solving skills, as well as 2) computer, information technology, and communication skills, it enhanced 3) cooperation, teamwork, and leadership skills when teachers assigned a group work in order to give students the opportunity to exchange online learning contents to promote more interesting learning management.

4. Which online learning management model enhanced science communication skills? Why?

For the online learning management model that enhanced science communication skills, five teachers stated that 1) the 5E model was used as the basis to manage science learning based on NSTDA guidelines, as well as 2) the active learning model since they helped learners to engage and interact with other students through a variety of practices. In addition, the management of online learning strongly needed communication between teachers and students; the teacher transferred knowledge of the course contents to students while students must communicate back to the teacher to show a level of understanding of the content, which can help eliminate errors and make learning management more effective. Besides the communication, students can also be checked on how scientific the content they used when they communicated.

5. What technology did the teachers use to manage online learning management and help promote science communication skills? How?

For technology used in online learning management that helped promote science communication skills, five teachers stated that technology should be included in online learning management to check students' understanding and develop the skills in managing online education. The technology used to promote science communication skills includes Google meet, Google site, Zoom, Flip classroom, Padlet, and Google Jamboard, since these platforms supported communication between teachers and students.

6. Summary and Discussion

Due to the Covid-19 pandemic, every system in society has been affected especially the education system resulting in the adjustment of the educational model in the style of the new normal. Therefore, an online learning management model in chemistry that promotes scientific communication skills is detailed as follows:

1. The model of online learning management in chemistry is the 5E model according to the guidelines of the Institute for the Promotion of Teaching Science and Technology. This is because this model is considered a basic method for teachers in science courses with the goal of student learning. Certain learning management strategies, such as lectures and discussions, can be used to organize online learning because they help facilitate effective learning (Shivangi, 2020).

2. Online learning management according to the 5E model helps develop learners to achieve content knowledge learning objectives and provides opportunities for students to

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participate in learning management by using answering questions and exchanging students' opinions. This type of learning management encourages students to collaborate online and develop information searching skills, which is an important skill for the 21st century. Moreover, this creates interactions among students to develop effective communication abilities in a variety of ways such as writing and conversation. By interacting with students in organizing online learning, they develop effective communication skills (Zayabalaradjane, Z., 2020; Hardman & Ntlhoi, 2021).

3. Online learning management according to the 5E model promotes the 21st-century learning skills, namely 1) critical thinking skills; and problem-solving skills when students do the exercises by themselves; 2) computer, information, and communication technology skills when students have the opportunity to exchange ideas and collaborate online through the interaction among students who help develop effective communication skill (Zayabalaradjane, Z., 2020); and 3) cooperation, teamwork, and leadership skills when the teacher assign group work to give students the opportunity to exchange ideas online and encourage them to create interesting learning management.

4. The online learning management model that helps promote science communication skill includes 1) the 5E model, and 2) the active learning model since they are a learner-centered model. In addition, learners participate and interact through a variety of practices. Online teaching and learning necessarily need the communication between teachers and students, as the teacher is the one who transfers the subject content to the students while students must communicate back to the teacher to show what level of understanding they have of the content so that they can make learning management more efficient. In addition to the communication, it can also be checked what level of science communication students communicate.

5. Technology in online learning management includes the use of Google meet, Google site, Zoom, Flip classroom, Padlet, and Google Jamboard since they are technologies that help communicate information between teachers and students, check student understanding, and develop science communication skills in transferring information and accurate scientific knowledge via discussion and written responses through various channels. The selection of technology should be appropriate for the content, activities, and techniques of media transmission to help encourage students to be interested in learning because innovative communication technology can facilitate the learning management process effectively (Tull et al, 2017).

References

Dhawan, S. (2020). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology*, 49(1), 5–22.

Hardman, J., & Ntlhoi, T. (2021). Online Quizzes as Mediating Tools for Teaching Information Communication Technology to First Year Students at a College of Education in the Developing Context of Lesotho. *Asia Research Network Journal of Education*, 1(2), 50–60. Retrieved from https://so05.tci-thaijo.org/index.php/arnje/article/view/251470

Institute for the Promotion of Teaching Science and Technology. (2021,March 15). *New Normal Education*. Retrieved from https://proj14.ipst.ac.th/about-project14/

Johnstone, A. H. (1993). Introduction. In Wood C. and Sleet R. (Eds.), *Creative problem-solving*. London: Royal Society of Chemistry.

Lincoln, YS. & Guba, EG. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications.

McComas, W. F. (1998). The Nature of Science in Science Education: Rationales and Strategies. Boston: Kluwer Academic Publishers.

Miles, M, B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded Sourcebook*. (2nd ed). Thousand Oaks, CA: Sage.

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Sarawan, S. and Yuenyong, C. (2018). Thai students' mental model of chemical bonding. *AIP Conference Proceedings*. 1923, 030042-1 – 030042-7.

Suanse, K and Yuenyong C. (2021). Development of the analytic geometry flipped classroom teaching model through Google Classroom. *Journal of Physics: Conference Series* 1835 (1), 012077

Agad, L.M.L., Pitonang, D.J.A., Terrado, T.F., Salic-Hairulla, M.A., Gomez, R.G., Nabua, E.B., and Yuenyong, C. (2019). Development of webquest using Google Site in teaching Circulatory System. *Journal of Physics: Conference Series*, 1340 (1), 012060

Tull, S. P. C., Dabner, N., & Ayebi-Arthur, K. (2017). Social media and e-learning in response to seismic events: Resilient practices. *Journal of Open, Flexible and Distance Learning*, 21(1), 63–76.

Udomkan, W., Suwannoi, P., Chanpeng, P., Yuenyong, C. (2015). Thai Pre-service Chemistry Teachers' Constructivist Teaching Performances. *Mediterranean Journal of Social Sciences*, 6(4 S3), 223-232.

Zayabalaradjane, Z. (2020). Interaction analysis of faimer mentor-learner web online collaborative learning session. *Malaysian Online Journal of Educational Technology*, 8, 16-27.

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