Dissemination of Climate Change Education in the Merdeka Curriculum within the Inter-School Chemistry Teachers' Work Group Community

Khoirotun Nisa SA[a)], Ahmad Suriansyah

Educational Administration Doctoral Program, Postgraduate, Lambung Mangkurat University
nisa8kimia@gmail.com

Abstract. This dissemination activity aimed to describe how climate change education within the Merdeka Curriculum is integrated into chemistry learning in the inter-school learning community of the Chemistry Teachers' Work Group (MGMP), as well as to analyze the level of understanding and evaluate the activity for the teachers involved. The activities were delivered face-to-face between the facilitator and chemistry teachers as participants. Data analysis was conducted descriptively qualitatively based on response questionnaires, used to measure the teachers' level of understanding and evaluation of the dissemination activities. The results showed that the dissemination was carried out through various activities such as workshops, group discussions, and the development of teaching materials. These activities successfully provided a good understanding of the concept of climate change education to teachers and enabled them to integrate the material into chemistry learning as a form of best practice. However, there are still challenges in implementation, such as limited time and resources. The dissemination of climate change education in the Chemistry Teachers' Work Group is a good first step and needs to be supported by more comprehensive policies and ongoing training.
Keyword: Climate Change Education, Merdeka Curriculum, Teachers' Work Group Community

1 Introduction

In climate issues, education plays three important roles. First, education empowers people; build awareness and capacity to mitigate climate and prevent climate change from getting worse. Second, education builds people's adaptability to the impacts of the climate crisis that has already occurred. Third, education encourages a continuous learning process, so that people can continue to find the latest and accurate information and facts related to the climate crisis, to then respond appropriately[1], [2], [3]

Climate change education is a form of fulfilling children's rights, especially the right to life, protection rights, right to education, and the right to participate [4], [5], [6]. Present and future, children will face the issue of the climate crisis head-on; some children, because of the location of their residence and socio-economic background, may be more vulnerable to being affected. To be able to realize a prosperous life in the midst

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of the climate crisis, they need adequate provisions in the form of basic attitudes, knowledge and capacity to respond effectively to the climate crisis. Especially for children with multiple vulnerabilities (e.g. children from poor families, children with special needs, children of victims of violence, etc), they are also entitled to special protection from climate impact risks.

Permendikbudristek Number 12 of 2024 states, the educational philosophy of the merdeka curriculum is based on Ki Hajar Dewantara's thinking about building independent human beings who can rely on their own strength [7]. One of the philosophical foundations of the merdeka curriculum also states that "Indonesia's national education is responsive to social, economic, political, and cultural changes". In this context, climate change education is very much in line with these regulations, because climate change education can foster students' independence in facing one of the global changes that has a real impact on them, namely the climate crisis [8]

The goals of climate change education include three aspects, namely reasoning, social-emotional, and action [9]. Reasoning: developing students' knowledge and scientific thinking skills to face the challenges of the climate crisis [10]. Social-emotional: encouraging the development of attitudes and characters that enable collaboration, negotiation, and communication in responding to the climate crisis. Building self-reflection skills, values, attitudes and motivation to develop students' capacity in dealing with the climate crisis. Action: enabling students to act together to tackle the climate crisis, and build a low-carbon lifestyle in the context of their region.

The principles of implementing climate change education refer to Climate Change Education Inside and Outside the Classroom (2013), namely: Relevant – despite being a global issue, each region feels the climate crisis in different ways. Therefore, climate change education needs to be relevant: providing a global understanding, but applied according to the uniqueness of the context of the climate crisis in the area of the education unit. Affective – climate change education needs to inspire school residents/students to take an active role in responding to the climate crisis. Therefore, an affective approach (touching feelings/emotions, fostering empathy, building values and ethics) is important. Referring to knowledge - there are various knowledge that can complement our understanding of the climate crisis issue, for example scientific data, technological information, local wisdom, and even information from the surrounding nature. All of this knowledge is useful and needs to be found out together in the learning process in climate change education. Real action – the expected impact of climate change education is increased climate adaptation and mitigation action. Therefore, its implementation needs to be oriented towards concrete actions to solve the problem of the climate crisis in the education unit. Holistic – the climate crisis is a cross-cutting issue, not just a science issue. Therefore, in the curriculum, climate change education can be studied in various subjects and even become part of the co-curricular, extracurricular, and school culture.

Climate change education from the Ministry of Education and Culture using a framework [11]which is divided into four elements: impact, cause, adaptation, and mitigation. Through climate change education, students are expected to have the

following competencies by the end of phase F. Impact: awareness of the climate crisis situation that affects the lives of students. Understanding the various consequences of climate change, both immediate (e.g. extreme weather) and slow (e.g. sea level rise), on a local and global scale [12], [13]. Understanding that the impacts of climate change occur in various aspects including economic, social, and ecological/environmental, as well as that these impacts are suffered differently by each person. Causes: an understanding of how human activities cause an increase in the average temperature of the earth's surface outside of natural patterns, among other things through greenhouse gas emissions from various economic and social activities [14], [15], [16]. The awareness that his lifestyle affects the preservation of nature, and ultimately affects the sustainability of the life of all creatures on earth. Adaptation: understanding, willingness, and capacity to build resilience to the various impacts of climate change, both through technological solutions, local culture/wisdom, and nature-based solutions [17], [18]. Mitigation: understanding, willingness, and capacity to prevent climate change from worsening or restore climate conditions to the way they were as soon as possible, either through emission reductions (e.g., switching to clean energy) or sequestering GHGs from the atmosphere (e.g., greening) [19], [20], [21].

Based on the above analysis, community service activities were carried out in the form of dissemination of climate change education in the merdeka curriculum in the inter-school learning community of chemistry teachers' work group. This activity aims to increase the knowledge of chemistry teachers in Banjarmasin City on how climate change is one of the serious discussions so that it is included in the school curriculum, and its implementation in the integration of chemistry learning to improve the quality of learning in schools in accordance with curriculum guidelines. Innovations carried out in this community service activity include: dissemination of climate change education in the independent curriculum, provision of climate change education teaching materials, and providing a format for making learning objectives, learning goal flows, and assessments whose subject matter has been integrated with climate change education.

2 METHOD

This community service activity applied the Participation Action Research (PAR) method which is an adaptation of Participatory Action Research [22], [23]. This approach involves all relevant stakeholders - implementers, participants, and community members - in the activity process to increase knowledge and make positive social change. Participants and implementers work together to identify problems, develop research questions, collect data, and interpret findings. Participant involvement helps ensure that the activity addresses the real needs and priorities of the community. Implementers and participants constantly reflect on their work, helping to ensure that the research remains relevant and responsive to community needs [24], [25]. Community service activities consist of 4 stages as presented in Figure 1.

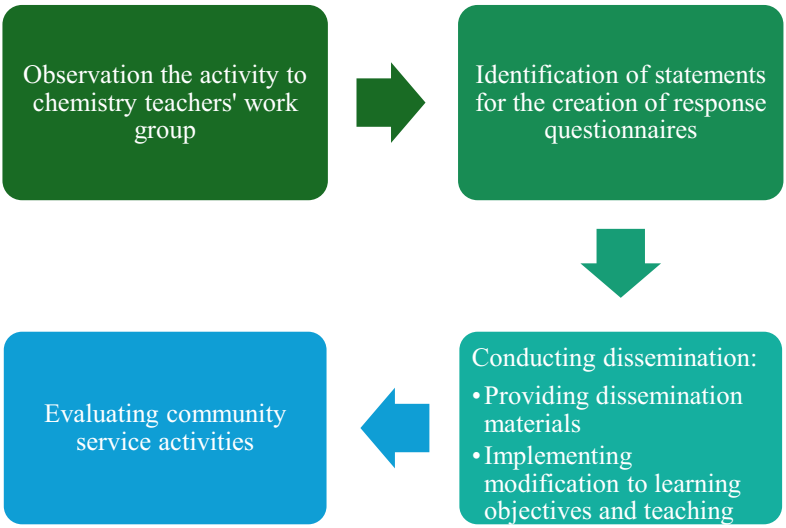

Figure 1. Activity implementation method

Observation the activity to chemistry teachers' work group

The observation stage is a preparatory stage filled with data collection from teachers who are members of the chemistry teachers' work group in the form of contextual problems and learning needs of students in accordance with the real situation in the education unit. The team identified the potential conditions for the implementation of learning, coordinated with related parties to conduct dissemination.

Identification of statements for the creation of response questionnaires

Before carrying out community service activities, the team identified learning needs based on data obtained from the observation stage. The data in the initial findings were identified and a response questionnaire was developed to test the level of understanding of chemistry teachers who were members of chemistry teachers' work group who participated in dissemination activities.

Conducting dissemination materials

This stage is the main stage of community service activities together with related parties, namely teachers who are members of the chemistry teachers' work group. The dissemination activities carried out include:

Providing dissemination materials

At this stage, the team provided material on climate change education in the education unit. The results of the dissemination are expected to increase knowledge of how climate change is one of the serious discussions so that it is included in the school

curriculum, and its implementation in the integration of chemistry learning to improve the quality of learning in schools in accordance with the real situation of the education unit environment. The method used in this activity is lectures and interactive discussions between resource persons and participants.

Implementing modification to learning objectives and teaching modules

At this stage, the team provides an explanation of how to make modification of learning objectives and learning steps, as well as formative and summative assessments in teaching modules. This stage is important to provide an overview to the dissemination participants so that there are no misconceptions in integrating the content of climate change education into the chemistry subjects taught.

Evaluating community service activities

This evaluation stage is carried out after the implementation of the activity to evaluate the level of knowledge of dissemination participants. The response questionnaire given contains statements related to the material presented at the dissemination (climate change education and implementation in learning in educational units). The evaluation of activities was also observed based on the assessment on the response questionnaire which included indicators of the success of the activity, as well as the readiness of teachers in implementing implementation in their respective educational units. An indicator of the success of this service activity is the increase in participants' knowledge about climate change education in the merdeka curriculum and/or the average final score in the good category. The criteria for assessing the knowledge of dissemination participants are presented in table 1 [26].

Table 1. Criteria for assessing the knowledge of dissemination participants

Score interval	Category
3.51 – 4.00	Excellent
2.51 – 3.50	Good
1.51 – 2.50	Medium
1.00 – 1.50	Not good

3 Results And Discussion

The results of the activity showed a high level of understanding of participants in participating in the dissemination of climate change education in the merdeka curriculum. The level of understanding of participants towards the results of the activity is presented in Figure 2.

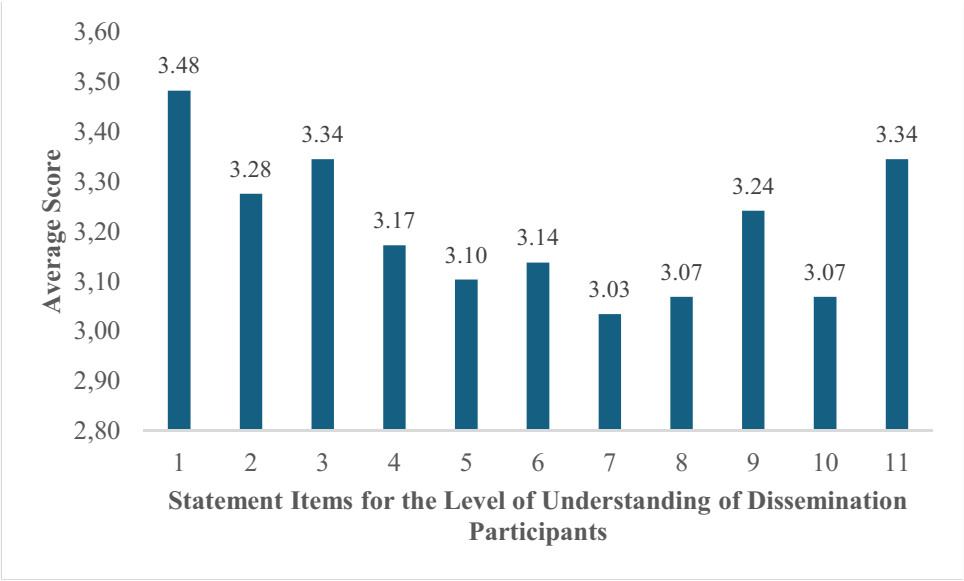

Figure 2. The level of understanding of activity participants towards the results of dissemination

Information:

1. I understand the definition of climate change and its impact on the environment and society
2. I can explain the relationship between climate change and the chemistry taught
3. I know the main goal of integrating climate change education in the Merdeka curriculum
4. I was able to identify learning objectives relevant to climate change education in chemistry subjects
5. I am aware of the learning resources available to support the implementation of climate change education in the merdeka curriculum
6. I can explain the materials presented in the dissemination
7. I can design learning activities that integrate climate change materials into chemistry learning
8. I can use various effective learning methods to deliver climate change materials to students
9. I can involve learners in project activities or related to climate change materials
10. I was able to identify the challenges that may be faced in implementing climate change education in schools
11. I am willing to collaborate with other teachers to develop good practices in climate change education

Based on Figure 2, there are 3 indicators with the lowest average achievement score, namely in statements number 7, 8, and 10. The low average score on the 3 indicators

needs to be improved again in terms of understanding and competence, so that increasing understanding and competence will also have an impact on increasing student learning outcomes.

The implementation of activities was also evaluated using a questionnaire filled out by dissemination participants. The participant's evaluation of the implementation of the activity is presented in Figure 3.

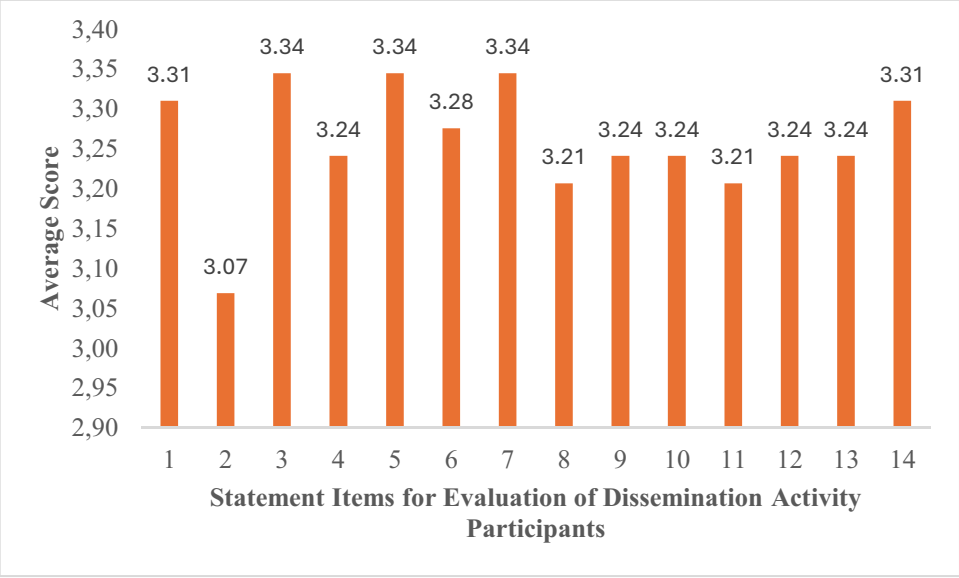

Figure 3. Evaluation of activity participants on the implementation of dissemination

Information:

1. The dissemination material is relevant to the needs and level of understanding of students
2. The material presented can be practiced directly in classroom learning
3. The case examples given in the dissemination are relevant to the context of learning in the Education unit
4. The method used in this activity is effective in conveying information
5. Facilitators are able to create an interactive and fun learning atmosphere
6. Chemistry teachers' work group participants are motivated to apply climate change education in learning
7. Chemistry teachers' work group participants gain useful new knowledge and skills
8. Chemistry teachers' work group participants feel more confident in facing the challenges of implementing climate change education
9. Chemistry teachers' work group participants need further support in the form of advanced training, mentoring, or access to resources

10. Participants of the chemistry teachers' work group actively participated in discussions during the activity
11. Chemistry teachers' work group participants provide constructive questions and inputs
12. Participants showed high enthusiasm in participating in the dissemination
13. Participants have a commitment to share information and experiences with peers
14. Overall, this dissemination was assessed successful

Figure 3 shows the high assessment of participants on the implementation of activities contained in all indicators. This means that the team has succeeded very well in organizing the program collaboratively with related parties, namely the participants of the chemistry teachers' work group.

Based on observation and dissemination, it shows that the chemistry teachers' work group is an association of chemistry teachers who teach at SMA/MA/equivalent in Banjarmasin City since 2015. Human resources with great potential are developed through various programs and trainings, so that they can improve the knowledge and skills of teachers in the field of pedagogy and technology. The flagship program in this community is to share good practices carried out by teachers alternately at each meeting, with discussions related to educational issues, learning development, innovations in the fields of pedagogy, management, and technology in learning [27]. In addition to teachers, weekly activities in this community are also often filled by education practitioners from university representatives. This is done in the framework of research cooperation or community service by lecturers or students at a university.

Chemistry teachers' work group as an inter-school learning community is a very representative association in the development of a teacher's teaching competence. Through this community, teachers can get a variety of the latest information about education and the development of the implementation of climate change education in the merdeka curriculum in Indonesia. This is a very good opportunity because not all teachers have free time to access the newness of existing information on their own, even though the information is available and can be accessed on various internet pages. Therefore, the dissemination activity in this community service program is an effort to increase the understanding of teachers, especially those who are members of the chemistry teachers' work group community so that it can be implemented in accordance with the mandate of the curriculum development team of the Ministry of Education and Culture.

Figure. 4. Inter-school learning community chemistry teachers' work group

The first stage of the activity started from preliminary observation. The team made initial observations on current learning problems and students' learning needs, observations were based on contextual learning. What we are actually seeing and feeling today is how the climate is changing drastically, so it is no longer possible to predict how the environment will be in the next few minutes or hours [28]. At the same time, the Curriculum Standards and Education Assessment Agency of the Ministry of Education and Culture published the latest learning content on the merdeka curriculum, namely climate change education. This content is intended to be integrated in all subjects at every level of education which is socialized in various forums such as the chemistry teachers' work group, so that with this drastic climate change, students already have provisions to anticipate and mitigate in the future [29].

The second stage is to identify the results of the initial observations in the first stage. The data obtained is then collected, which will later be a reference in developing a questionnaire for response to socialization activities. There are 2 types of response questionnaires developed, namely a.) response questionnaire to measure the level of understanding of teachers in the inter-school learning community chemistry teachers' work group towards the climate change education materials delivered, then; b) Response questionnaire to evaluate the level of effectiveness of the dissemination activities carried out [30]. The results of the development of this response questionnaire are then applied in climate change education dissemination activities in the inter-school learning community of chemistry teachers' work group.

The third stage is the implementation of activities. At this stage, it is the main stage of community service activities together with related parties. The total number of

participants in the activity was 29 people, all of whom were chemistry teachers as active members of the chemistry teachers' work group. The methods of dissemination activities carried out include lectures and questions and answers. At the stage of delivering dissemination materials, participants are equipped with knowledge about climate change education and the implementation of climate change education in their respective educational units.

Figure 5. Presentation of material and interactive questions and answers between facilitators and participants

The last stage is the evaluation of activities. Based on the average response questionnaire score from the dissemination participants, it shows that there is an increase in teachers' understanding in analyzing the content of climate change education and its implementation in their respective educational units. Dissemination participants were also asked to provide an assessment of the implementation of this dissemination activity. The dissemination activities have gone well, assessed in terms of planning, implementation, services, and supporting facilities and infrastructure. In addition, observations were also carried out by the implementation team during the learning process. The highest response was in statement items number 3, 5, and 7 which explained about the "relevance and new understanding" related to the climate crisis between the examples presented in the material and the real situation on the ground. While the lowest response was "the material presented can be practiced in classroom learning". Based on the assessment of this statement, it is necessary to make improvements in the next activities by providing meaningful further understanding so that teachers are motivated and ultimately able to implement the content of climate change education in chemistry learning in the classroom [31].

This community service in general has been able to equip chemistry teachers in the inter-school learning community of chemistry teachers' work group both understanding and modifying teaching modules in implementing climate change education content in their respective educational units. Meanwhile, how to develop learning objectives and

modify teaching modules still requires further assistance so that in the future it can be practiced directly in classroom learning.

4 Conclusion

This community service activity is based on the problems experienced by everyone around the world, namely the climate crisis since the 18th century until now. The activities that have been carried out through the form of socialization with the Participation Action Research approach have proven to be able to improve the understanding of chemistry teachers, although there are still challenges in the aspect of integrating climate change education content in learning objectives and modifying teaching modules. The implementation of community service activities is in the good category. Teachers still need further assistance regarding the modification of teaching modules, especially for the implementation of chemistry learning in the classroom. The results of this dissemination are expected to improve the quality of teaching modules, teacher competence, and learning outcomes. In the end, it has a positive impact on teachers, students, schools, and the environment around the residence and environment in the education unit.

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