CHAPTER I
INTRODUCTION

1.1 Background

Sustainability education aims to provide students with abilities that may be applied to new challenges, in addition to solving current ones (Green et al., 2022). Students must have a stance on various environmental and societal concerns and make choices to address the difficulties that result from the sustainable challenges (Janoušková et al., 2020). Knowledge, skills, values, and attitudes are required to equip students to contribute to sustainable development (UNESCO, 2017). Education for Sustainable Development (ESD) is considered a form of lifelong learning and necessary for all students (Green et al., 2022). The application of ESD may raise consciousness and concern for the environment, expand knowledge and understanding, and boost performance (Perwitasari et al., 2023). Moreover, through the implementation of ESD in the classroom, students can more easily identify problems in their surrounding environment, design and develop appropriate solutions, and effectively communicate those solutions (Vilmala et al., 2022). Therefore, the education through ESD equips students with the competencies, awareness, and problem-solving abilities needed to address current and future environmental and social challenges, while fostering lifelong learning and active participation in sustainable development.

Sustainable Development Goals (SDGs) discuss 17 goals that covers various topic, such as environmental pollution in one of their goals. The impacts of environmental issues have become increasingly evident, leading to widespread recognition of the need for sustainable practices. Environmental issue is related to the organic waste accumulated that impact the soil and greenhouse effect with polluting gases (Lins et al., 2021). Food waste, a pressing issue worldwide, substantially impacts our planet's resources and contributes to food insecurity. Globally, there is increasing awareness that poor management or disposal of food waste can negatively affect climate change, deplete resources, and threaten food security (Chew et al., 2021). Moreover, food waste worsens poverty by wasting

resources needed for food production and contributes to unsustainable consumption, pollution, and biodiversity loss (Waluyo et al., 2023).

In promoting SDG 12 “Responsible Consumption and Production”, students must comprehend the ways in which personal lifestyle decisions impact environmental, social, and economic development (UNESCO, 2017). As students strive to make sustainable choices, it's crucial to address this problem and explore innovative solutions to reduce food waste and promote a more sustainable food system. Nonetheless, in the recent studies, the researchers consistently believe that address the worldwide issue of food waste, awareness campaigns and early education about the subject are essential (Bathmanathan et al., 2023). Food education offers a valuable opportunity to foster civic responsibility in students and to explore food waste as a cross-cutting issue that connects various aspects of sustainability (Antón-Peset et al., 2021). Hence, reducing food waste is crucial to achieving sustainable goals and draws in a variety of stakeholders both locally and globally (Bathmanathan et al., 2023). However, based on direct observation in one of junior high school in Bandung, it revealed that students have not learned about food waste topic. The findings showed that teacher have never introduce food waste issues to students, while students seemed unfamiliar with the topic and also had misconception about it. This led to the conclusion that students did not have the foundation to take further action due to their limited knowledge.

Human understanding and behavior, which are impacted by environmental interventions, sustainability strategies, and policy development are crucial to the success of efforts to move towards sustainability (Topal et al., 2021). Integrating environmental education at all levels fosters an understanding of sustainability, empowering students to make sensible decisions that benefit present and future generations (Samuel, 2024). To apply disciplinary knowledge to make evidence-based decisions along with the environment, social, and economic dimensions, they require a thorough comprehension of disciplinary ideas and procedures as well as a high level of scientific literacy (Trott et al., 2020). Peer organizations provide students with opportunities to influence their school and enhance their action competence because of the action-taking aspect of participation (Torsdottir et al.,

2024). To promote sustainability, science education must be crucial, especially in terms of enabling students to understand and take action.

Students as the future decision-makers, are required to demonstrate and apply an interconnected and interdisciplinary understanding of sustainability, which stated that people who understand about either the issue or the action are tend to have pro-environmental behavior (Petrun et al., 2021). Furthermore, considering how difficult sustainability issues are, it is necessary to support students' educated activities on sustainability issues in ways that foster their ongoing interest and involvement (Trott et al., 2020). The study from Alsaati and Colleagues (2020) found that most students do not care because they are not aware of sustainability in general. They lack sustainability knowledge, especially when recognizing recycling materials or renewable materials and energy consumption measures (Alsaati et al., 2020). Moreover, previous study found that students' unwillingness in addressing environmental issue is often linked to limited understanding of key physical processes (Carmella, 2025). Researcher found that students' understanding of environmental issue is limited by their lack of prior knowledge and misconception (Ahmed, 2024). Specifically, students' knowledge about food waste was poor indicated by their understanding on its impact (Neubig et al., 2020). This earlier research suggests that education on sustainability has to start early.

Finding connections between the SDGs and everyday interests is also essential if we go on with further implementation and achieve all of the SDGs. (Leiva-Brondo et al., 2022). There is a significant difference in comparing student who exposed by the sustainability-related content and those who are not, in terms of their intention to address issues related to the topic (Sitompul et al., 2025). The problem in students' sustainability understanding showed that students must be taught about sustainability through variety of platforms, such as government initiatives, school programs, and the media; it will take more time for students to develop a habit of self-perceived action competence for sustainability (Alsaati et al., 2020; Olsson et al., 2022).

Students' actions are essential for promoting sustainability systemic issues, such as food waste, also play a significant role in contributing to environmental and

social challenges. To take action for sustainability, students may need a range of skills, knowledge, and attitudes (Oinonen et al., 2024). Students' Action-Oriented learning experiences provide them the chance to interact with real-world issues in a democratic and pluralistic manner, which are crucial component in helping them develop action competence (Chen et al., 2020). Sustainability actions hardly result in concrete sustainability implications, therefore it's reasonable that confidence in the students' influence was the biggest predictor of sustainability action (Oinonen et al., 2024). However, the finding stated that the students' self-confidence in their ability to influence others did not grow considerably, which may reflect their level of participation in decisions and actions at their school, mostly caused by less exposure to the sustainability content in teaching (Olsson et al., 2022). This means that a lack of understanding leads to a lack of action, resulting in limited outcomes from students.

Study in the UK has shown that students who have limited knowledge of environmental sustainability and are unwillingly to make significant changes to their behaviors, it raises concerns about their ability to act responsibility and competently (Höppner et al., 2011). Moreover, research in Indonesia found that although students are aware of and have experienced the impact of environmental issues, they still do not take enough action to address them. The findings suggest that a strong commitment to these issues does not always result in real actions, which emphasize the need for continued education to encourage their involvement (Djirong et al., 2024). Students must have the opportunity to participate in real-world, actual sustainability-related activities (Torsdottir et al., 2024). Students' understanding of how other disciplines contribute to the solutions is developed through the multidisciplinary character of sustainability initiatives (Sinakou et al., 2019).

Action-Oriented learning may bridge the gap between food waste issue and sustainability knowledge and practice, promote ESD competences, and encourage environmental learning. It shows there is an interconnectedness between sustainability understanding and action (Bramwell-Lalor et al., 2020). ESD competencies underline the cognitive domain that shows the knowledge and

thinking ability will be more effective to developed first as the foundation for the behavioral domains that taking action competence (Vilmala et al., 2022). Providing students with more opportunities to influence sustainability issues in society can help them better understand the importance of their actions and increase their motivation to take further action (Torsdottir et al., 2024). These students' participation in advancing sustainable societies through SDG contributions from all sectors must be encouraged (Antón-Peset et al., 2021).

Implementing teaching and learning based on an Action-Oriented approach focused on the topic of food waste can contribute to creating more sustainable societies by providing meaningful learning experiences. It promotes sustainable action, deepen sustainable understanding, and foster a sense of agency in addressing environmental challenges (Derqui et al., 2020). The recent studies also confirmed that in order to encourage students to understand their role and responsibility as citizens and to see themselves as agent of change, the intervention must be implemented through active and participatory methodologies, knowledge, awareness, and student involvement in the food waste issue that (Antón-Peset et al., 2021). Meanwhile, other researcher developed food waste reduction project so that students' awareness of the food waste problem will create a more sensitive food waste management behavior including taking on board the habit of reusing leftover food and food sharing practices (Bathmanathan et al., 2023). The study focused on the importance of understanding the concept of sustainability to promote sustainable behavior, especially action-taking, but its intervention not used the Action-Oriented ESD learning (Chaplin et al., 2014). On the other hand, the previous research doesn't seem to find the interconnectedness between the sustainable understanding and action through the Action-Oriented ESD approach specifically on food waste topic. Most of them, focus solely on sustainable understanding or action without applying the Action-Oriented ESD learning as their interventions.

This study separate sustainability competences into two dimensions, understanding and action. It will provide significant insights into the benefit of particular pedagogical approaches for cultivating various competencies (Wang et

al., 2022). Based on this distinction, the present study focuses on fostering both dimensions through the Action-Oriented ESD learning approach. This study aims to improve the students' sustainability understanding and action towards the management of food waste in order to reduce environmental pollution through the Action-Oriented ESD learning approach. By positioning students as agent of change, the teaching and learning process fosters their interest in science and creates routes to a sustainable future (Trott & Weinberg, 2020). It also concentrates to foster students' sustainability competencies, thereby changing their attitudes towards food waste, involving their family and community.

1.2 Research Problem

Based on the background stated, the research problem is "How does Action-Oriented ESD learning improve students' sustainable understanding and action on food waste topic". The research attempts to investigate the following questions:

a. How does the students' sustainability understanding improve after implement the Action-Oriented ESD learning approach on food waste topic?
b. How does the students' sustainability action improve after implement the Action-Oriented ESD learning approach on food waste topic?
c. How does the interconnectedness between sustainable understanding and action in Action-Oriented ESD learning?

1.3 Operational Definition

This research used several variable terms in order to make a clear purpose of the study, those are:

1.3.1 Action-Oriented ESD Learning Approach

Action-Oriented ESD learning approach is the learning instructional design to promote students' understanding and action competence in the framework of ESD. Students are asked to identify the problems related to food waste that happened in their environment. Once the problem has found, students must find the solution through direct contribution to reduce the problems. This research applies several components from Action-Oriented ESD framework in the teaching practices which

are action-taking, peer interaction, and community involvement. These sustainable actions that students proposed may be different from one to another, as long as able to reduce and manage the food waste based on SDGs 12. The topic includes food waste reduction strategies and practices, sustainable lifestyles, waste management, impact of food waste, and food consumption's behavior. The implementation of Action-Oriented ESD learning approach including several stages: (1) problem identification, (2) problem formulation, (3) investigation planning, (4) doing investigation, (5) data analysis, (6) making conclusion, and (7) implementation. The learning started by observation inside the school area to create a sense of responsibility to take action from students. Students continue to investigate and manage the mitigation of the problem based on the observation that involve the action-taking and peer-interaction framework. In the next meeting, students are process to develop their action along with filling the journal action. Once their action fully developed, the students will focus on implement their action to their surroundings. With the total of three meetings and 20-days implementation of action. Therefore, the implementation of their action will be broadly applied to the bigger community. Moreover, the implementation of the learning is assessed through the observation sheet to track the process of learning food waste topic. The observation is focus on assessing the implementation in students' perspective and their outcomes of learning.

1.3.2 Sustainability Understanding

Sustainability understanding is the comprehension of students about the interconnectedness relationship between economic, environmental, and social domains that is vital for fostering the students' responsibility in a real-life action. Students are guide to understand key topics related to the three pillars of ESD, including the topic sustainable lifestyles, food consumption patterns, food waste management, and strategies and practices to reduce and manage food waste. The data are collects through the open-ended essay questions related to the learning objective in SDGs 12 in the aspect of cognitive learning. The questions are

distributed before and after the teaching and learning practices in the form of pre-test and post-test.

1.3.3 Sustainability Action

Sustainability action refers to practices to provide students with knowledge, skills, and attitudes to address environmental challenges and promote sustainable development. It fosters students' understanding of sustainability principles and encourages proactive behavior to contribute in a sustainable future. Students' efforts on sustainability issues must be supported in ways that foster their ongoing interest and involvement. As one of the dependent variables in the research, sustainable action will be measured by pre-test, post-test, and action journal. The instrument used is the 4-Likert scale questionnaire addressing the economic, social, and environmental challenges to strengthen students' sense of agency to make a difference in food waste. The framework of the questionnaire is based on the Environmental Citizenship Questionnaire (ECQ) by (Hadjichambis et al., 2020), consisting past, present, and future actions, also students' competencies as the indicator. It will also use the ESD learning objective SDGs 12 which are the socio-emotional and behavioral learning. The topics covered in the learning include the impact of food waste, sustainable strategies in food waste management, food consumption's behavior, sustainable lifestyle.

1.4 Research Objective

The objectives of this research are:

a. To analyze the improvement of students' sustainable understanding through Action-Oriented ESD learning in food waste topic.
b. To analyze the improvement of students' sustainable action through Action-Oriented ESD learning in food waste topic.
c. To investigate the interconnectedness between sustainable understanding and action in Action-Oriented ESD learning.

1.5 Research Benefit

The result of this study is expected to provide the following benefits below:

1. For students, the results of this study are expected to help them to improve their sustainability action and understanding towards food waste topic. As a result, they are able to preserve their surroundings and put their skills to use in solving environmental issues that happen in their lives.
2. For teacher, this research is expected to be beneficial to apply innovative teaching methods in introducing the importance of teaching food waste management to students. Moreover, the results of this research can also give information of the effectiveness in implementing Action-Oriented ESD learning at school.
3. Researchers can use this research to provide them data and materials about students' sustainability understanding and action with the Action-Oriented ESD approach on food waste topic for junior high school that may be used as a reference for their future studies.

1.6 Scope of Research

The research investigated sustainability competences of students, which are understanding and action. Students learn science, specifically food waste topic which related to the environmental pollution that students likely encounter also exist in SDGs 12. This research investigated the sustainability understanding and action of students through Action-Oriented ESD learning approach. The investigation carried out through the pretest of students' initial sustainability understanding and action. Then, continue with learning process through the Action-Oriented ESD approach, including observation, group discussion, and individual action. Lastly, students took the posttest as their final assessment to compare the impact of the learning process before and after. The research involved five meetings, including pretest and posttest, also 20-day of students' action-taking. The instrument is designed to analyze the impact of the learning using the approach to students' limited understanding and action related to sustainability. Both quantitative and qualitative instruments have been developed to measure and support data collection from students' work, in order to accomplish the research objectives. Students' sustainability understanding and action were measured before

and after intervention through open-ended essay questions and 4-Likert scale questionnaire respectively. The essay questions developed through UNESCO's learning objectives. Meanwhile, the action questionnaires were adapted from (Hadjichambis et al., 2020), which included past, present, and future actions and action competences as the indicators. Students worked in groups using worksheets and recorded their individual actions in personal action journals. They submitted weekly reports and received regular feedback. The entire process conducted at school was observed and assessed using observation sheet. The study covered environmental pollution and climate change topics from the existing curriculum. The sample consisted of 7th grade junior high school students in Bandung who had not previously studied the topic of food waste.