Comparing environmental awareness between chemistry education students and non-chemistry education students

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Abstract. This study aimed to determine the level of environmental awareness including knowledge, attitudes and behaviour about the environment between chemistry education students and non-chemistry at the Teacher Training and Education Faculty of Universitas Syiah Kuala. The type of research used was descriptive quantitative with analytical survey method. The research respondents were second-semester students in chemistry, physics, and geography and history study programs. The sample was selected using non-probability sampling technique with the type of purposive sampling. The number of respondents was 100. Data was collected using a questionnaire. Data analysis was conducted using descriptive statistics. The results showed that the level of environmental awareness of chemistry education students was lower than non-chemical education students, except in the knowledge variable. This results could be due to the lack of implementation of environmental education in chemical learning materials. In chemistry education tends to strengthen the cognitive domain compared to affective (attitude) and psychomotor (behaviour).

1. Introduction
The environmental damage that occurs massively in various places in Indonesia shows that the ability of the Indonesian people to manage the environment or common property resources is still weak [1]. This fact also showed that from the national to communal level there had been a deterioration of cultural values. So the various problems that we face today such as pollution, global warming, forest destruction and so forth are our shared responsibility. This issue has now become a global problem; one of the points in the Millennium Development Goals (MDGs) stated that environmental issues need to be considered by all parties.

UNESCO, an organisation, engaged in the field of education, science, and culture of the United Nations takes a severe role in emphasising the importance of developing environment-based subject matter [2]. The problem is whether our current education, especially in higher education, has been able to form environmentally conscious students. It is undeniable that education is essential in one's life.

Law No. 20 of 2003 on the National Education System states that education is a conscious and planned effort to realize the atmosphere and learning process so that active students develop their potential and have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed for themselves, society, the nation, and country. After education is very expected behaviour change, this change in behaviour occurs because there are goals to be achieved. State
awareness was part of attitude and behaviour. Awareness arises because of the coherence between knowledge, attitude and behaviour [3].

As we know, environmental issues are very much related to the field of chemistry. Most pollutants come from chemicals. In schools and college students have been taught the basic concepts of chemistry. Chemical material such as hydrocarbons, refining petroleum, combustion of fuels, plastics, polymers and others are closely related to environmental problems, from which part of the process creates various pollutants.

The long-term effects of environmental pollution occurs when the ecosystem is no longer able to bear pollution. These problems can develop into social problems if it is too disruptive to the lives of many people [4]. The problem is now whether students, especially those who take chemistry education, have an awareness or attitude and behaviour towards the environment.

So naturally, those who have learned chemical concepts are more sensitive to the environment than those who have little contact with chemistry. However, in some previous studies, this is still difficult to prove. Theoretically contextual is to build quality meaning by linking chemistry lessons with students' personal and social-environmental lessons, for example with the phenomenon of waste that is not aware to the safety of the environment [5].

[6] in their study mentioned that there were significant differences between different education groups addressing environmental awareness. Then [7] states that general education increased the level of awareness; educated people were more actively absorbed information from media and other sources. In theory, all aspects can be influenced by education and experience. Older age groups have higher environmental awareness than younger age groups.

This is very dependent on factors of experience and learning opportunities that are directly or indirectly related to the environment. But in practice, this is still difficult to prove. So this study aims to conduct an investigation of the environmental awareness of prospective students of chemistry and non-chemistry in the Faculty of Teacher Training and Education of Universitas Syiah Kuala.

2. Method
This research was descriptive quantitative with a survey approach. According to [8] the survey is an excellent method for measuring attitudes and orientation of a community through various polling activities. Besides, it can be used as a conceptual framework to learn many variables such as understanding, awareness, willingness and participation of a group towards certain things. The survey research conducted in this study is classified as an analytical survey. In this study, researchers tried to find out how the differences in environmental awareness of chemistry education students with non-chemistry.

The research samples were determined using non-probability sampling technique (non-probability sample) with the type of purposive sampling (selected sample). Non-probability sampling technique is a sampling technique based on special considerations with useful and representative assumptions [8]. The selection of physics study programs was carried out randomly on all FKIP study programs in the field of natural sciences consisting of 5 study programs, while the selection of 2 other study programs was conducted randomly on all non-natural sciences in FKIP study programs, amounting to 13 study programs.

The sample is aimed at second-semester students because they are still very close to the subject matter at school. Besides, students at this stage are entering the phase towards maturity. The indications were observed in personality stability beginning to increase, more realistic views about himself and his environment; the ability to deal with all problems more mature and emotional turmoil began to diminish. Recorded 2016 class of chemistry education students amounted to 72 people, 64 people in physics education, 53 people in history education and 55 people in geography education. The total population is 244 people. Determination of the number of samples using quota sampling technique was taken by setting a certain amount as a target that must be met. Then the number of samples set is 100 respondents, each study program is represented by 25 students of the 2016 class.

This research was conducted in the FKIP of Universitas Syiah Kuala. Students fill out survey questionnaires using their respective Smartphone. The questionnaire used in this study is closed. The
contents of the questionnaire are divided into three groups of items, namely knowledge, attitudes and behaviours related to environmental issues.

**Tabla 1. Grid of Questionnaire for Environmental Awareness Measurement.**

| Variable | Subvariable | Total Item | Total |
|----------|-------------|------------|-------|
| 1 Knowledge | 1. Environment | 2 | 19 |
| | 2. Global warming | | 5 |
| | 3. Alternative energy sources | | 3 |
| | 4. Management of waste and waste | | 3 |
| | 5. Environmental care slogan / lifestyle | | 3 |
| | 6. Environmental pollution by organic chemicals | | 3 |
| 2 Attitude | 1. Environment | 2 | 22 |
| | 2. Global warming | | 5 |
| | 3. Alternative energy sources | | 1 |
| | 4. Management of waste and waste | | 5 |
| | 5. Environmental care slogan / lifestyle | | 5 |
| | 6. Environmental pollution by organic chemicals | | 4 |
| 3 Behaviour | 1. Environment | 10 | 46 |
| | 2. Global warming | | 4 |
| | 3. Alternative energy sources | | 3 |
| | 4. Management of waste and waste | | 5 |
| | 5. Environmental care slogan / lifestyle | | 18 |
| | 6. Environmental pollution by organic chemicals | | 6 |
| Total Item | | | 87 |

A questionnaire using a Likert scale was distributed. The scale of responses starts from 1 (not yet realised) to 5 (aware and ready to do), specifically for behaviour used 4 scales. The results of the analysis based on this scale are expected to explain the level of student environmental awareness.

**Tabla 2. Description of 5 Point of Likert Scale.**

| Scale Type | Knowledge | Attitude | Behaviour |
|------------|-----------|----------|-----------|
| 1 | Never heard | Not yet aware | Never |
| 2 | Already know but cannot explain in detail | Already aware but do not have the desire to do it | Seldom |
| 3 | Understand and be able to discuss | Realise but are not sure can do it | Seldom |
| 4 | Understand, able to discuss and connect with various other issues | Already aware and plan to do it | Always |
| 5 | Master it | Already aware and ready to do it |

Data collected from questionnaires are then processed through descriptive statistical methods, the calculations are as follows:

- Look for an ideal score or maximum score for environmental awareness.
- Add the scores obtained by each subject. The number of subject scores is the sum of the subject scores for each item.
- Look for the percentage of environmental awareness scale results with the formula:
\[ \text{Score} = \frac{\text{Total Score for each subject}}{\text{Ideal score}} \times 100\% \] (1)

3. Results and Discussion

3.1. Environmental Knowledge

Three study programs had knowledge scores in the high category, namely study programs for chemistry, physics and geography, while one study program received a moderate score, namely a history education study program. The highest score was obtained from the chemistry education study program which was 64.29%, followed by geography study program (63.36%), physics (61.93%) and history (56.29%).

![Figure 1. Differences in the Knowledge Category Score Level.](image)

3.2. Attitudes towards the Environment

Criteria for attitude scores towards the environment of the four study programs included high. The highest attitude score was obtained from history education study programs, namely 76.29%, followed by physics education study programs (75.41%), geography (73.38%) and chemistry last (68.87%).

![Figure 2. Differences in Attitude Category Score Levels.](image)

3.3. Behaviour towards the Environment

Based on the recapitulation of behavioural score data on the environment, the four study programs had scores that were included in the criteria of being. The highest behavioural score was obtained in
geography education study program, which was 65.93%, then physics education study program (64.69%), chemistry (64%) and most recent history (62.73%).

![Figure 3. Differences in Behaviour Category Score Levels.](image)

Based on the calculation of the percentage of the overall score of student environmental awareness which includes aspects of knowledge, attitudes and behaviour it was found that the four study programs had environmental awareness scores that were included in the criteria of being. The highest scores were obtained in geography education study programs, namely 67.41%, followed by physics education study programs (67.05%), chemistry (65.44%) and history (64.99%). Chemistry education students have the highest score on the knowledge variable which is 64.29% (high criteria).

![Figure 4. Differences in the Level of Environmental Awareness Score.](image)

Based on the percentage calculation, the environmental awareness score of chemistry education students is lower than non-chemical students, except in the knowledge variable. Of course this should be questioned, in fact, to establish environmental awareness there needs to be counselling and education. Based on the Republic of Indonesia's Ministry of Environment Report in 2013 it was found that only 2.5% of respondents received information about the environment through education in schools. Schools have not taken a serious role to foster student environmental awareness [2].

This is directly proportional to the findings of the study, where chemical education should know more about environmental issues, but in attitudes and behaviour, it is not yet prominent. Individuals who gain knowledge and environmental awareness, but in their attitude not yet responsible for the environment, then it is considered a failure to interpret the true meaning of environmental awareness. Regarding this finding, it could be said that there is still a need to be addressed in the chemistry education
Curriculum. Issues relating to environmental education need to be emphasised in learning. So that students' mindset towards the environment becomes more open towards environmental protection.

Chemistry education students were found to be more prominent in the knowledge variable. Means there is still something that needs to be improved. According to [4] awareness and understanding of the right environment will form the right attitude towards environmental issues. Nevertheless, [10] state that environmental knowledge does not always lead to sustainable practices, at least an individual has shown enthusiasm for the environment, although this is still not enough.

Actually environmental education does not need special subjects, it only requires the active role of the teacher in conveying values relating to environmental care. This is like incorporating character education into learning. Where religious and moral values are inserted, in this case environmental awareness. [11] state that all teachers must consider using methods that can develop cognitive, affective and psychomotor aspects of students related to the environment.

[9] mentions that the lectures in the chemistry education study program have not synergized with the achievement of teacher competency in the 21st century, namely the Millennium Development Goals (MDGs) and national education goals, one of which is preparing future teachers who are environmental care agents. According to [9] in her research she found that in the Basic Chemistry 2 and Environmental Chemistry courses the purpose of the lecture was still on developing aspects of knowledge and there was no explanation regarding the formation and development of student attitudes and behaviour. Of course this is evident from research findings where the awareness of chemical students is lower than non-chemical students, which stands out only in terms of knowledge.

[12] said that actually learning chemistry in direct contact with the environment has a great opportunity to grow and equip students with environmental awareness. Moreover, chemical material is also related to studying materials that have the potential to become environmental pollutants. It is very important for prospective chemistry students to have more awareness in protecting the environment. In fact, in chemistry, education tends to strengthen the cognitive domain rather than affective (attitude) and psychomotor (behaviour). The result is that prospective chemistry teachers are very skilled in knowledge but weak in attitude and behaviour.

[9] states that prospective chemistry teachers need to be awakened by their awareness of the environment by teaching the value of benefits (utility values) from the concept of chemistry being studied (moral knowing), forming attitudes (moral feeling) and practising behaviour (decent acting). The lack of emphasis on the importance of environmental education has made students not see the need to practice eco-friendly lifestyles that have implications for environmentally conscious behaviour.

[13] mention students with the knowledge and skills gained from environmental education are in fact more motivated to play an active role in environmental protection activities. [4] also stated that students who had studied environmental education were more inclined to consider and analyse the implications of their behaviour on the environment. For this reason educators of prospective education staff need to integrate character values into chemistry learning so that chemistry students have good environmental awareness.

4. Conclusion

No significant difference was seen between the level of environmental awareness of 4th-semester students in chemistry education and 4th-semester students in non-chemical education. This can be caused by the lack of implementation of environmental education in chemistry learning materials. Chemistry education students need to be awakened to their environmental awareness by teaching more about the value of the benefits of the chemical concepts learned, as well as forming attitudes and practising behaviour.

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