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# LOW CARBON EDUCATION BASED WASTE MANAGEMENT APPLICATION

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**Abstract**

This study aims to measure the competence of low carbon education (LCE)-based waste management from cadres. This quantitative analysis research used a quasi-experimental approach. The population was all cadres in Mekarmanik Village, Bandung Regency. Meanwhile, the sample was taken purposively consisting of 30 active cadres, who were then involved as respondents. The research variables measured were the cadres' knowledge, attitudes, and behaviors. The data were collected employing a questionnaire as an instrument filled directly by the respondents. Data were taken before and after providing education to cadres. After the data were processed and analysed by categorizing the observations, the data were then calculated for their N-Gain. The results revealed that there was an increase in the competency score: the knowledge score from 82 to 94 (N-Gain = 0.7), the attitude score from 68 to 85 (N-Gain = 0.53), and the Behavioral score from 67.7 to 79 (N-Gain=0.35). Cumulatively, competence increased from a score of 72.6 to 86 (N-Gain=0.49). This competency score has been categorized as good, meaning that the cadres are eligible to provide counselling to the community.

Keywords: Cadre, Competence, Low carbon education, Waste management.

## 1. Introduction

Waste is something that is not used, not liked, or thrown away, which comes from human activities and does not happen by itself. Waste must be treated. Many reports showed how to treat waste [1-18]. Waste management is a systematic, comprehensive, and sustainable activity, which comprises reduction (waste generation restriction, waste recycling, and/or waste reuse) and waste management (selection, collection, transportation, processing, and final processing).

This waste management has strong relevance to global warming because waste generation produces $CO_2$ and $CH_4$ gases [19], which are some causes of global warming. Currently, the world is facing enormous problems, one of which is global warming. 17 sustainable development goals (SDGs) have been used to over current problems [20-22]. One of which is the third goal, a healthy and prosperous life. It relates to waste management. Good waste management that does not cause an increase in $CO_2$ and $CH_4$ in the air will contribute to meeting the third goal. Countries in the world make various efforts to reduce $CO_2$ concentrations in the air with various programs, one of which is through low carbon education (LCE). LCE -based waste management means minimizing or even preventing carbon release as waste into the environment. It can contribute to meeting the third goal. Many papers discussed LCE [23].

Based on waste data in Bandung, West Java, Indonesia, the highest percentage is household waste generation at 66.00%. Specifically, in Mekarmanik Village, Bandung, Indonesia, there is a habit of burning and littering, which can pose a health risk, the environment becomes dirty, drains are clogged, and the environment is prone to becoming a breeding ground for disease-causing germs. It can also lead to the growth of pathogens, such as bacteria, parasites, and fungi. If exposed to humans, fungi found in waste piles can cause various diseases, such as diarrhea, typhus, and intestinal worms. In addition, waste can be a place to live and breed disease vectors, such as rats, cockroaches, and flies.

To deal with this problem, cadres are needed to educate the public to convey information broadly and quickly. For the success of this program, before cadres go into the community to conduct education, it is better to measure their competence. It is to determine their readiness to educate the public. Therefore, it is deemed necessary to research the competence of cadres in low-carbon waste management in Mekarmanik Village, Bandung Regency.

## 2. 2. Method

The research design used was quantitative with a quasi-experimental research type and a pre-post-test approach. The population in this study was all cadres in Mekarmanik Village, while the sampling was carried out purposively. The sample consisted of cadres who were still active in guiding the community, totalling 30 people. This study's variables comprised cadres' knowledge, attitudes, and behavior regarding low carbon-based waste management in Mekarmanik Village. The instrument employed was a questionnaire regarding cadres' knowledge, attitudes, and behavior regarding low carbon-based waste management. Instrument validation was performed in a content manner with discussions with experts. The research data were collected by filling out questionnaires by cadres directly. These data were taken before and after education to cadres.

The collected data were then processed utilizing a computer. The results were analysed visually and categorized. Detailed information on how to analyse data is explained in the literature [24]. To find out how much increase occurred, the N-Gain calculation was carried out using Eq. (1):

$$\text{N-Gain} = \frac{Score\ (Posttest - pretest}{Score\ (-\ pretest} \quad (1)$$

The N-Gain was calculated for each variable and cumulatively to find out the N-Gain of cadre competencies. Then, it was interpreted as a whole. From this analysis results, it is expected that the research objectives can be achieved.

## 3. Results and Discussion

### 3.1. Observation results

The minority of 324 students in this study had prior experience learning through online media. Table 1 displays the descriptive analysis results for students' experiences with online learning. The measurement of knowledge before education yielded a score of 82 (see Table 1). It was a good category. After education, there was an increase in the knowledge score by 12. Thus, the knowledge score became 94 (good category). When the N-Gain was calculated, it was found to be 0.7, where this increase was in the moderate category.

**Table 1. Knowledge score before and after education.**

| Knowledge Before Education | | | | Knowledge Before Education | | | |
|---|---|---|---|---|---|---|---|
| **No** | **Score** | **Total** | **Percentage (%)** | **No** | **Score** | **Total** | **Percentage (%)** |
| **1** | 20 | 3 | 10 | 1 | 80 | 9 | 30 |
| **2** | 40 | 1 | 3.3 | 2 | 100 | 21 | 70 |
| **3** | 60 | 1 | 3.3 | | | | |
| **4** | 80 | 10 | 33.3 | | | | |
| **5** | 100 | 15 | 50 | | | | |
| **Total** | | 30 | 100 | **Total** | | 30 | 100 |
| **Mean Score** | | 82.0 | | **Mean Score** | | 94.0 | |

Measurement of attitudes before education gave a score of 68 (see Table 2), which was a sufficient category. After education, there was an increase in the attitude score by 17. Thus, the attitude score became 85 (good category). When it was calculated, the N-Gain = 0.53, which was a moderate increase. Measurement of attitudes before education gave a score of 68 (see Table 2),

Measurement of behavior before education showed a score of 67.7 (see Table 3). It was a sufficient category. After education, there was an increase in the behavior score of 11.3. Therefore, the behavior score became 79 (good category). When the N-Gain was calculated, the result was 0.35, in which the increase was in the moderate category.

Based on observations made employing questionnaires (see Fig. 1), the education carried out succeeded in increasing the competence of cadres in LCE-based waste management from the knowledge, attitudes, and behavior aspects. Thus, cadres who previously only had sufficient competence (score of 72.6), who were considered not yet eligible of conducting outreach to the community, increased their competence to

good (score of 86) after being educated. Thus, they became eligible to provide education to the public regarding LCE-based waste management.

From the recapitulation in Table 4, there was an increase in the cadres' competence after education. Initially, the competence of the cadres was sufficient, but after receiving education, it became good. This competency improvement was categorized as moderate.

**Table 2. Knowledge score before and after education.**

| Attitude Before Education | | | | Attitude After Education | | | |
|---|---|---|---|---|---|---|---|
| **No.** | **Score** | **Total** | **Percentage (%)** | **No** | **Score** | **Total** | **Percentage (%)** |
| **1** | 20 | 1 | 3.3 | 1 | | | |
| **2** | 40 | 3 | 10 | 2 | | | |
| **3** | 60 | 10 | 33.3 | | | | |
| **4** | 80 | 15 | 50 | | | | |
| **5** | 100 | 1 | 3.3 | | | | |
| **Total** | | 30 | 100 | **Total** | | 30 | 100 |
| **Mean Score** | | 68.0 | | **Mean Score** | | 85.0 | |

**Table 3. Behavior score before and after education.**

| Attitude Before Education | | | | Attitude After Education | | | |
|---|---|---|---|---|---|---|---|
| **No.** | **Score** | **Total** | **Percentage (%)** | **No** | **Score** | **Total** | **Percentage (%)** |
| **1** | 30 | 1 | 3.3 | 1 | 35 | 3 | 10 |
| **2** | 40 | 1 | 3.3 | 2 | 65 | 3 | 10 |
| **3** | 45 | 1 | 3.3 | 3 | 70 | 1 | 3.3 |
| **4** | 60 | 3 | 10.0 | 4 | 75 | 6 | 20 |
| **5** | 65 | 10 | 33.3 | 5 | 80 | 9 | 30 |
| **6** | 70 | 1 | 3.3 | 6 | 85 | 6 | 20 |
| **7** | 75 | 6 | 20.0 | 7 | 90 | 2 | 6.7 |
| **8** | 80 | 6 | 20.0 | | | | |
| **9** | 85 | 1 | 3.3 | | | | |
| **Total** | | 30 | 100 | **Total** | | 30 | 100 |
| **Mean Score** | | 67.7 | | **Mean Score** | | 79.0 | |

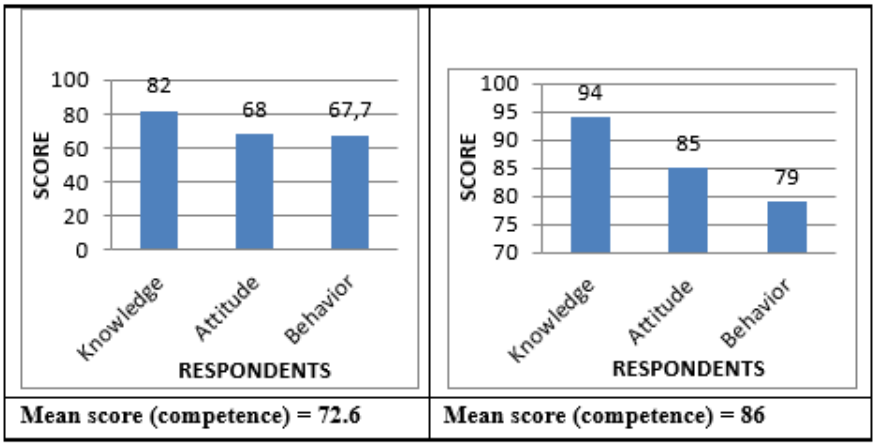


**Fig. 1. Cadre competency score before and after education.**

**Table 4. Recapitulation** of **score and N-Gain.**

| No. | Competence | Test Score | | | | N-Gain Score | Category |
|---|---|---|---|---|---|---|---|
| | | Pre | Category | Post | Category | | |
| **1** | Knowledge | 82 | Good | 94 | Good | 0.7 | Moderate |
| **2** | Attitude | 68 | Sufficient | 85 | Good | 0.53 | Moderate |
| **3** | Behavior | 67.7 | Sufficient | 79 | Good | 0.35 | Moderate |
| **Mean** | Competence | 72.6 | Sufficient | 86 | Good | 0.49 | Moderate |

## 3.2. Discussion

When cadres conduct outreach to the community, the readiness of their ability to carry out counselling must be good so that they are considered eligible for conducting counselling. To determine their eligibility, an observation of competence was conducted by giving a pretest. The observation results (pretest) showed that the competence of the cadres was still categorized as sufficient (score of 72.6). Thus, education had to be given to improve their competence. In more detail, their knowledge (score of 82) was good, but their attitude (score of 68) and behavior (score of 67.7) still needed to be improved because they were still categorized as sufficient. In addition, it would be even better if their knowledge was also improved so that it became even better. Thus, education was carried out on the three competence aspects (knowledge, attitude, and behavior).

After the education was carried out, another measurement (posttest) was conducted on the competence of the cadres. This is in line with other research that additional treatment can increase the quality of students [25-36]. The measurement results uncovered an increase in the three competence aspects: knowledge increased from 82 (good) to 94 (good), attitude increased from 68 (sufficient) to 85 (good), and behavior increased from 67.7 (sufficient) to 79 (good). To find out the overall competence, the three aspects are averaged. Thus, information was obtained that the competence of cadres after being given education increased from 72.6 (sufficient) to 79 (good). These good competencies made the cadres eligible to provide counselling to the community regarding LCE-based waste management [37]. To find out how much increase occurred after education, N-Gain was calculated utilizing the R. Hake formula. The results revealed an increase in knowledge N-Gain of 0.7 (moderate), attitude N-Gain of 0.53 (moderate), and behavior N-Gain of 0.35 (moderate), while the N-Gain for competence was 0.49 (moderate). Finally, we found that the results are good. But, indeed, additional some topics to the curriculum can be used as the excellent alternative. Thus, many teachers can apply and improve to broader students in the country[38-45].

The majority of primary school children who took part in this study reported feeling anxious during the online deployment of distance learning. The difficulty of understanding mathematical content delivered by teachers via online media contributes to the student's anxiety. According to our findings, the roles of teachers and parents in supporting students through distance learning were critical. Because the majority of the children in our study received guidance from teachers and parents during distance learning, there is no significant correlation between parental and teacher guidance and students' anxiety during distance learning.

There are several limitations to this study that suggest future research priorities. First, this study's participants were students from both rural and urban areas. Students in rural areas who participated in this study had an internet connection and

were able to learn online. Future studies could focus on students who live in remote areas and have limited access to the internet. Then, this study's participants were students in grades four, five, and six. Therefore, the findings of this study cannot be applied to all students in primary school. The result may differ for students in lower grades, such as first, second, and third grades.

## 4. Conclusion

This study intends to assess cadres' proficiency in waste management based on low carbon education (LCE). The findings showed that the competency score increased: the knowledge score increased from 82 to 94 (N-Gain = 0.7), the attitude score increased from 68 to 85 (N-Gain = 0.53), and the Behavioral score increased from 67.7 to 79 (N-Gain=0.35). Competence improved overall, going from a score of 72.6 to 86 (N-Gain=0.49). The cadres are qualified to offer counselling to the community since they received a strong competency score.

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