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Improving Air Quality in the Classroom through the Air Conditioning Cleaning Program as an Effort to Maintain Student Health in the Learning Process at the Annur Sidoarjo Islamic Boarding School

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ABSTRACT

Objective: *A clean, tidy classroom with adequate lighting and a cool, stable temperature will encourage students to focus and feel comfortable during the learning process. Room temperatures that are too hot or too cold can disrupt concentration, cause drowsiness, and even cause physical discomfort, which ultimately reduces learning effectiveness. Managing room temperature through good ventilation or optimal use of air conditioning is important. Additionally, a pleasant classroom environment—characterized by positive teacher-student relationships, the use of interactive learning methods, and a supportive emotional atmosphere—is essential.* ***Method****: The Waterfall Method is one of the linear and sequential methods used in system or project development. This method includes the initial observation and coordination stage, scheduling of AC cleaning activities, AC cleaning implementation, counseling and education, monitoring and evaluation, which must be completed before proceeding to the next stage, like a waterfall.* ***Results:*** *The classroom AC cleaning program has proven to have a positive impact on air quality and the comfort of the teaching and learning process. Comprehensive AC unit cleaning successfully reduced dust and dirt that could potentially harm the health of students and teachers.* ***Novelty:*** *Observations and questionnaires showed an increase in learning comfort and awareness of the importance of regular AC maintenance. The educational activities conducted also successfully fostered knowledge and awareness among teachers, staff, and students about the importance of maintaining a clean learning environment. This program is expected to serve as the first step in establishing a culture of regular school facility maintenance as a preventive measure to safeguard the health of school community members.*

INTRODUCTION

The Annur Sidoarjo Islamic Boarding School is a pesantren-based educational institution that combines religious and general curriculum. In daily learning activities, some classrooms in this pesantren have used air conditioning to create a comfortable learning environment,

One of the main keys to maintaining a comfortable learning environment is the room temperature that needs to be well regulated[1]. In the closed class, an alternative is chosen using an air conditioning (AC) system, but there is a high risk of dust, bacteria, and mold buildup if routine maintenance is not carried out. Therefore, regular cleaning of the air conditioning system is essential to remove dust and microorganisms that can result in a decrease in indoor air quality [2].

An air-conditioned room that lacks maintenance can indeed cause health problems and interfere with concentration. Lack of maintenance can lead to the growth of mold and bacteria inside the air conditioning system, which is then blown into the air and inhaled by students. This can trigger respiratory disorders such as asthma and allergies, as well as reduced concentration due to poor air quality. Therefore, periodic maintenance of air conditioning is essential to create a healthy and conducive learning environment[3].

This community service activity was carried out as a form of concern for the health of the learning environment at the Annur Sidoarjo Islamic Boarding School. This program not only involves the action of cleaning air conditioners, but also education to pesantren managers and students about the importance of regular air conditioning maintenance to maintain health and air quality in the classroom. These maintenance include regular filter cleaning, checking and cleaning of evaporators and condensers, and overall cooling system maintenance[4]. Thus, the air quality in the classroom is maintained and supports an effective teaching and learning process[5].

Through this activity, it is hoped that a healthier learning environment will be created, students can learn more comfortably, and the risk of health problems due to dirty air can be minimized, as well as prevent various health problems such as respiratory infections, allergies, and fatigue. Considering that students spend most of their time learning and activities in the classroom, so that students can live the learning process optimally.

RESEARCH METHOD

This community service activity is carried out with a participatory approach through several structured stages. Method **Waterfall** is one of the methods in the development of a system or project that is **linear and sequential** . This method includes the initial observation and coordination stage, scheduling of air conditioning cleaning activities, implementation of air conditioning cleaning, counseling and education, monitoring and evaluation, completed first before proceeding to the next stage, such as waterfall flow[6].

First, initial observation and coordination were carried out with the management of the Annur Sidoarjo Islamic Boarding School to identify the number and condition of air conditioners installed in the classroom. After that, the scheduling of air conditioning cleaning activities was carried out which was adjusted to the schedule of teaching and learning activities so as not to interfere with the learning process.

The second stage is the implementation of air conditioning cleaning, which includes cleaning the air filter, blower fan, and evaporator using tools and materials in accordance with technical standards. This process is carried out by a service team consisting of experienced lecturers, students, and air conditioning technicians, while still paying attention to occupational safety protocols.

Furthermore, counseling and education were carried out to teachers, staff, and students about the importance of regular air conditioning maintenance and simple ways

to maintain air conditioning cleanliness independently. This counseling is delivered through presentation media and educational posters pasted in the classroom.

Finally, monitoring and evaluation of post-cleaning air quality was carried out through a short questionnaire to students and teachers, as well as checking the function of the air conditioner after cleaning. The data obtained is used to assess the impact of activities and develop program sustainability recommendations. The following is a table of implementation methods for service activities.

Table 1. Execution Methods

No.	Activity Stage	Description	Implementation Time	Person in Charge
1	**Initial observation and coordination**	Survey of air conditioning conditions in the classroom, teacher/student interviews about air quality.	Day 1	Service Team
2	**scheduling air conditioning cleaning activities**	Prepare schedules, tools, implementation teams, and coordination with the Islamic boarding school.	Day 2	Activity Coordinator
3	**Counseling and Education**	Providing counseling on the importance of clean air conditioning for student health.	Day 3	Team + Resource Persons
4	**implementation of air conditioning cleaning**	Cleaning of filters, evaporators, blower fans, and checking other air conditioning components.	Day 4 to 5	Team + Accompanying Technician
5	**Monitoring and Evaluation**	Documentation of activities, observation of results, and taking testimonials from teachers/students.	Day 6	Documentation Team

RESULTS AND DISCUSSION

The air conditioning cleaning activity carried out at the Annur Sidoarjo Islamic Boarding School was successfully carried out in 3 main classrooms using air conditioning systems. The cleaning process includes filters, blower fans, and evaporators that previously appeared to be filled with dust and dirt.

Filter cleaning

The process of cleaning the air conditioner filter begins by ensuring that the power source has been turned off to avoid the risk of static electricity. The indoor cover panel of the air conditioning unit is then opened, and the air filter is carefully removed. The filter is cleaned using a soft brush to remove any dust and dirt that sticks, then washed under running water. For sterilization, the filter is soaked in a mild antiseptic solution for 10–15

minutes to kill bacteria and fungal spores. After rinsing it back clean, the filter is dried naturally in the shade to preserve the quality of the material. The entire process uses standard equipment such as fine brushes, buckets, microfiber washcloths, and eco-friendly air conditioning cleaning solutions. Once it is completely dry, the filter is reinstalled, and the air conditioning unit is tested to ensure that it functions optimally again[7]. This procedure is carried out on each air conditioning unit in the classroom as part of efforts to improve air quality in the learning environment.

Figure 1. Filter condition after cleaning.

Blower fan cleaning

The process of cleaning the air conditioner blower fan is carried out after the air conditioning unit is opened and the filter and evaporator are cleaned first. Blower fans, which serve to blow air from indoor units into the room, are often a place for dust, mold, and slime to accumulate due to humidity. Dirt that sticks to the blower fan can cause unpleasant odors and interfere with air circulation. Cleaning begins by spraying air conditioner cleaning liquid or mild disinfectant onto the cylindrical fan blades. Next, scrubbing is done slowly using a small brush or used toothbrush so that the dirt is removed without damaging the fan blades. If the dirt is very thick and stubborn, a low-pressure water sprayer with a special director is used to prevent water from seeping into the electrical components. Once clean, the fan is allowed to dry naturally or assisted with a dry washcloth before the air conditioner is reassembled[8]. This process is important to keep the air quality clean and odor-free, and to support maximum air conditioning cooling performance in the classroom

Figure 2. Blower cleaning process.

Evaporator cleaning

The process of cleaning the AC evaporator is carried out after the filter is removed, while still ensuring that the power source has been switched off for safety. Evaporators, which are in the form of metal fins (fins) that serve as heat exchange sites, are generally easily covered with dust and slime due to condensation. Cleaning begins by spraying the evaporator's special cleaning liquid (coil cleaner) evenly on its surface. This liquid is left on for a few minutes to loosen the dirt and mold that sticks. Next, the evaporator section is brushed gently using a soft brush to avoid damage to the fins. If necessary, a low-pressure water sprayer is used to rinse stubborn dirt. Once finished, the inside is dried using a microfiber cloth or allowed to dry naturally before the unit is reassembled and switched on[9]. Cleaning this evaporator is important to do regularly because accumulated dirt can interfere with the cooling performance of the air conditioner and potentially spread microorganisms to the air of the classroom.

Figure 3. Evaporator cleaning process.

After cleaning, the room temperature becomes more stable and the air circulation feels fresher and cleaner, as admitted by most teachers and students through a simple questionnaire distributed after the activity.

The results of the evaluation showed that as many as 85% of student respondents felt more comfortable learning after the air conditioner was cleaned, and 75% of teachers stated that students seemed more focused and did not get sleepy easily in class. In addition, the noise from the air conditioning unit, which was previously quite annoying, was also significantly reduced after the maintenance process was carried out.

The educational activities provided also received a positive response. Teachers and administrators of the pesantren stated that they gained new knowledge about the importance of regular maintenance of air conditioners and basic ways to maintain their cleanliness. Educational materials in the form of simple air conditioning maintenance posters are also installed in each classroom as a reminder and practical guide.

These findings corroborate that good air quality in the classroom plays an important role in creating a healthy and conducive learning atmosphere[10]. In accordance with previous research, clean air has been proven to reduce the potential for respiratory

distress and increase comfort in the teaching and learning process[11], [12], [13], [14], [15]. Thus, this activity not only has a direct physical impact, but also builds awareness of the importance of a healthy learning environment in the Islamic boarding school environment.

CONCLUSION

Fundamental Finding : Acomfortable learning environment is one of the key factors in increasing students' focus and learning effectiveness. A neat, clean, well-lit learning environment can create physical conditions that support the teaching and learning process. A conducive atmosphere like this can minimize distractions, reduce stress, and encourage students to focus more and concentrate on absorbing the subject matter**.** **Implication :** The creation of a comfortable learning atmosphere has significant implications for various aspects. First, increasing students' learning focus has a direct impact on the quality of material understanding, academic achievement, and active involvement in the learning process. Second, a conducive learning environment can also reduce students' stress and boredom levels, thereby creating a positive emotional atmosphere in the classroom. Third, the existence of clean and comfortable air for teachers and students in a comfortable atmosphere encourages the growth of healthy physical conditions. Another implication is increased discipline, responsibility, as well as positive values such as cooperation, tolerance, and empathy among students. Institutionally, schools that succeed in creating a pleasant learning environment tend to have a good image and are more in demand by the community. **Limitation :** In this activity, air conditioning maintenance is limited to aspects that are directly related to efforts to improve air quality in the classroom. Maintenance carried out only includes: cleaning the air filter, to remove dust and particles that can interfere with the circulation of clean air, cleaning the evaporator, to prevent the growth of mold and bacteria that can trigger respiratory distress, cleaning of the blower fan, to keep the airflow smooth and free from accumulated dirt, inspection of the basic functions of the air conditioning unit, such as working temperature and airflow, without performing advanced technical servicing (such as freon filling, component replacement, or electrical system repair). **Future Research :** In the future, it is necessary to carry out further collaboration between the pesantren and experts to ensure the sustainability of air conditioning maintenance and the maintenance of a healthy learning environment independently and continuously.

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