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Analysis of the Administration of Chemistry Laboratory Facilities and Infrastructure at a Senior High School in Agam Regency: Inventory, Procurement, and Utilization of Facilitie

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ABSTRACT

This study aimed to analyze the administration of facilities and infrastructure in the chemistry laboratory of the state senior high schooolsin Agam district, west sumatra, focusing on inventory management, procurement mechanisms, and the utilization of laboratory facilities in learning activities. This research used a descriptive qualitative method with data collected through observation and interviews involving one chemistry teacher and three science students from different grade levels. The findings indicated that the school already has a chemistry laboratory with adequate room capacity and several basic tools and materials that support learning. However, the utilization of the laboratory remains limited due to insufficient availability of tools and practicum materials. The scarcity of materials restricts learning activities and limits the implementation of practical-based lessons. Furthermore, the use of laboratory coats has not met the standard operating procedures due to insufficient quantity and mismatched sizes. The study concludes that improvements are needed in procurement planning, laboratory safety equipment, and regular inventory updates to support the optimal use of laboratory facilities.

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1. INTRODUCTION

The administration of educational facilities and infrastructure plays a crucial role in supporting the quality of the learning process in schools. The availability of adequate facilities enables effective learning activities, including in subjects that require practical activities such as chemistry. According to Nur Efendi and Jayanti (2024), good laboratory management directly contributes to improved student learning outcomes because laboratories provide scientific experiences that cannot be achieved through theoretical learning alone. The chemistry laboratory is one of the main facilities in high schools because it serves as a place for students to practice chemical concepts through scientific experiments (Widyastuti & Kurniawan, 2021).From an educational management perspective, facilities and infrastructure must be managed through a structured process of planning, procurement, inventory, maintenance, and utilization (Mulyasa, 2017). Inventory plays a crucial role as the basis for planning laboratory facility needs, as without accurate data, schools struggle to procure materials that meet learning needs (Rahmawati, 2020). Furthermore, national education standards, including the "Standards for High School Facilities and Infrastructure," stipulate that schools must provide complete laboratory facilities, including basic equipment, chemicals, and safety equipment (Ministry of Education and Culture, 2019).

However, various studies have shown that the management of laboratory facilities in schools often faces various obstacles, such as limited equipment, procurement delays, and underutilization of facilities

(Fauziah & Setiawan, 2020). The availability of work safety equipment such as lab coats, goggles, and first aid kits is also often overlooked by schools, even though these equipment are part of the standard operating procedures for laboratory safety (Sutrisno, 2020). The lack of laboratory facilities and infrastructure has been shown to impact the low frequency of practicums and cause chemistry learning to become more theoretical, thus reducing students' opportunities for direct scientific experience (Ayu et al., 2024). Matur 1 State Senior High School is one of the high schools in Agam Regency that has a chemistry laboratory with adequate space. However, initial observations indicate that the laboratory is not being utilized optimally. The inventory of equipment and materials has not been regularly updated, the procurement process for facilities has not fully met learning needs, and safety equipment such as lab coats remains limited. This situation creates problems in the implementation of lab-based learning and hinders student competency achievement as required by the curriculum.

To address these issues, the school needs to strengthen its facility and infrastructure administration system through regular inventory updates, procurement planning based on core competency needs, and increased laboratory utilization in the learning process. Consistent with research recommendations from Asmarany (2021), structured laboratory management has been shown to improve the effectiveness of the teaching and learning process and support student competency achievement. Based on this background, this study aims to analyze the administration of chemistry laboratory facilities and infrastructure at SMA Negeri 1 Matur, focusing on inventory, procurement, and facility utilization. This research is expected to provide empirical insights and management recommendations that can improve the quality of chemistry learning in schools.

2. METHOD, DATA, ANALYSIS

This study uses a descriptive qualitative approach to describe the administrative conditions of chemistry laboratory facilities and infrastructure at SMA Negeri 1 Matur. The research informants consisted of one chemistry teacher as the main informant responsible for the implementation of practicums and equipment management, and three science students (representatives of grades X, XI, and XII). Data collection was conducted through structured observations of the physical condition of the laboratory, existing inventory documentation (books/manual inventories), and semi-structured interviews with teachers and students to explore experiences of facility utilization, procurement application processes, and laboratory safety practices.

Data were analyzed using reduction, presentation, and conclusion procedures according to the Miles and Huberman (2013) model to provide a descriptive picture of the inventory administration practices, procurement, and utilization of laboratory facilities. Data validation techniques included source triangulation (teachers and students) and technical triangulation (observation, interviews, documentation) to increase the credibility of the findings. The principles of facility management used in the analysis refer to national guidelines on school facility management.

3. RESULT AND DISCUSSION

Result

Administration of facilities and infrastructure is a fundamental part of education, particularly in science and chemistry learning, which requires laboratory facilities as spaces for scientific practice (Bafadal, 2018; Sagala, 2019). Based on research findings at SMA Negeri 1 Matur, the management of chemistry laboratory facilities and infrastructure demonstrated optimal function in supporting practical learning. This condition was demonstrated by weak inventory, limited procurement of equipment and materials, low laboratory utilization, and minimal occupational safety facilities, as also found in research by Nurhadi and Wahyuni (2022).

From an educational management perspective, the principal plays a strategic role in managing school facilities and infrastructure (Mulyasa, 2017; Usman, 2019). However, conditions at SMA Negeri 1 Matur indicate that this role has not been optimally implemented. Periodic inventories are not a regular part of the school's agenda, resulting in procurement planning not being based on accurate data. This finding is in line with research by Rahmawati and Suryatono (2020) which states that weak inventory causes the procurement policy for sarpasn to be inaccurate. Furthermore, budget allocation for chemistry laboratories

has not been a top priority for schools. School funds are focused more on administrative needs and general procurement, resulting in slow laboratory development. These results are consistent with research by Pratama et al. (2022) and Fauziah et al. (2021), which showed that budget constraints are a dominant factor in the poor quality of laboratory facilities in secondary schools.

Laboratory utilization in the chemistry learning process is also suboptimal. Although the laboratory space is quite spacious and adequate, it is only used a few times per semester. Students confirmed that many practical activities could not be carried out due to limited equipment and materials, so chemistry learning was often conducted theoretically in class. Laboratory safety facilities were also found to be substandard, particularly the insufficient number of lab coats for one class and the worn condition of some coats. Other safety facilities such as fire extinguishers, first aid kits, and eyewash were also incomplete. However, observations also noted several advantages, such as the availability of lab tables with access to water and electricity, and the availability of basic laboratory equipment that was still functioning well, such as test tubes, Erlenmeyer flasks, and beakers. However, the overall results indicate that the quality of laboratory facility and infrastructure management does not fully support the implementation of lab-based learning.

Discussion

Administration of facilities and infrastructure is a fundamental part of the implementation of education, particularly in science and chemistry learning that requires the support of laboratory facilities as a space for scientific practice. Based on research findings at SMA Negeri 1 Matur, the management of chemistry laboratory facilities and infrastructure has not shown optimal function as a primary support for practical learning. This condition is indicated by weak inventory, limited procurement of tools and materials, low laboratory utilization, and minimal occupational safety facilities. However, more than that, the results of the study also revealed that the suboptimal administration of facilities and infrastructure is related to the lack of synergy between the roles of the principal, teachers, and administrative staff as the main actors in the management of educational facilities. The following discussion comprehensively examines this condition by referring to the theory of educational facilities and infrastructure management and empirical studies from previous research.

From an educational management perspective, the principal is a strategic leader responsible for ensuring that all school resources, including infrastructure, are managed effectively and support learning objectives (Mulyasa, 2017). However, conditions at SMA Negeri 1 Matur indicate that this strategic role has not been fully implemented. Based on interviews, the principal does not have a long-term or short-term plan for developing the chemistry laboratory. Inventories, which should be conducted periodically to determine equipment needs, damage, or shortages, are not part of the school's routine agenda. As a result, damaged equipment is not promptly replaced, expired chemicals are not promptly separated, and the overall condition of equipment is not accurately monitored. This situation aligns with Rahmawati's (2020) findings that the absence of an inventory system results in inaccurate infrastructure data, thus hindering targeted procurement planning.

Furthermore, school principals have not optimally allocated the infrastructure budget specifically for chemistry laboratories. School operational funds are prioritized for administrative needs and general procurement, while chemistry laboratories receive disproportionate attention. Ideally, principals should develop procurement plans based on an analysis of curriculum needs, student numbers, and annual practicum plans. However, research findings indicate that laboratory needs are only addressed when teachers propose them, and even then, these are not always fully realized due to limited funding or a lack of awareness of the equipment's urgency. The Ministry of Education and Culture (2019) stipulates that schools are required to provide minimum laboratory facilities that meet standards, including basic equipment, essential chemicals, and safety equipment. The lack of compliance with these standards for laboratory conditions demonstrates the principal's weak planning and supervisory function in infrastructure administration.

On the other hand, the role of chemistry teachers as technical implementers and primary users of the laboratory is also a key focus in this discussion. Teachers are responsible for developing lab-based learning plans, optimally utilizing laboratory facilities, recording equipment usage, and proposing infrastructure needs. However, limited facilities are a major obstacle for teachers in implementing lab

activities routinely. Teachers reported that several experiments that should be carried out according to the curriculum, such as equilibrium reactions, colligative properties of solutions, or determining reaction rates, could not be carried out due to the lack of adequate chemicals and supporting equipment. Equipment such as burettes, volumetric pipettes, synthetic indicators, and standard solutions were often unavailable, forcing teachers to substitute theoretical explanations for lab activities. This finding is consistent with a study by Widyastuti and Kurniawan (2021), which stated that laboratory limitations lead teachers to provide only minimal demonstrations or replace lab activities with lectures, thus reducing opportunities for students to gain hands-on scientific experience.

Teachers also face challenges in laboratory safety. The available lab coats are substandard, insufficient in number, and some are damaged or improperly sized. Other safety equipment such as fire extinguishers, eyewash, or first aid kits is unavailable, raising concerns for teachers when conducting experiments involving heat, fire, or reactive materials. Research by Sutrisno (2020) emphasizes that safety equipment is a key prerequisite for conducting quality lab work, as without such equipment, teachers lack the security to conduct risky experiments. This situation has led to teachers becoming increasingly reluctant to use laboratories for lab work, as they feel unsafe for themselves and their students.

Administrative staff (TU) also play a significant role in laboratory infrastructure administration through recording, documenting, archiving inventory data, and reporting assets. However, research has found that the laboratory inventory process is not professionally managed by TU. Inventory recording is done manually and is not updated regularly. Many instruments are not recorded as damaged or lost, and chemical expiration dates are not reported administratively. The absence of a digital recording system makes inventory data difficult to access and prone to loss. According to Rahmawati (2020), infrastructure administration must be supported by a neat, accurate, and well-documented data system so that planning and procurement can be carried out systematically. Disorganized TU administration prevents teachers from receiving accurate information about laboratory conditions, while principals do not obtain a true picture of infrastructure needs.

From a modern infrastructure management perspective, the three roles of the principal, teachers, and administration should work within a single infrastructure management cycle encompassing planning, procurement, storage, maintenance, utilization, and evaluation. However, in practice at SMA Negeri 1 Matur, each role operates independently without a formal coordination mechanism. Teachers communicate equipment needs, but administration does not update inventory data, and the principal does not prioritize these proposals for procurement. Administration records items but does not communicate this data to teachers or the principal. The principal prepares a budget without accurate data from administration or systematic recommendations from teachers. This demonstrates weak horizontal and vertical coordination within the school's administrative structure. As stated by Nur Efendi and Jayanti (2024), good infrastructure governance requires synergy between all elements, not just one party. Without coordination, the infrastructure management cycle will be disrupted and hinder the development of educational facilities.

1. The Principal's Role: Weaknesses in Strategic and Supervisory Functions

Normally, the principal functions as an educational resource manager responsible for developing short-term and long-term strategic plans (Mulyasa, 2017). This strategic function includes providing laboratory infrastructure, allocating budgets, supervising facility utilization, and evaluating the effectiveness of infrastructure use. However, research results indicate that at SMA Negeri 1 Matur, this strategic role is not fully implemented. The principal has not yet prepared laboratory development planning documents, either in the form of a School Work Plan, a Strategic Plan for Facilities and Infrastructure, or an annual operational plan.

The absence of planning documents results in procurement of laboratory equipment and materials that are not systematic, not priority-based, and not oriented towards improving the quality of learning. The absence of a periodic inventory system results in inaccurate infrastructure data, so that school principals do not have an objective basis for making procurement decisions. This is reflected in the existence of damaged equipment that has been left for a long time, expired chemicals mixed with active ingredients, and equipment that is lost but not administratively recorded. This situation shows a gap between policy and implementation, where infrastructure management is still reactive, not preventive. School principals tend to wait for suggestions from teachers without proactively identifying needs. This condition has an impact on

not meeting the minimum standards for laboratory facilities as regulated by the Ministry of Education and Culture (2019), and causes laboratories to not develop progressively.

2. Budget Limitations and Unsustainable Procurement Decisions

Another significant obstacle lies in budget allocation. Research data shows that neither BOS funds nor internal school budgets are adequately allocated for laboratory needs. The budget is directed more toward administrative activities and general school procurement. However, budget allocation covers not only initial procurement but also maintenance, replacement of damaged equipment, purchase of consumables, and provision of safety equipment. When laboratory budgets are not allocated in a planned manner, practicum activities will depend on immediate availability, rather than on curriculum design. Furthermore, incidental procurement policies result in laboratories lacking standard equipment, such as burettes, volumetric pipettes, analytical balances, or basic safety devices. This is not simply a matter of equipment but also results in a decline in the quality of scientific inquiry learning, a key principle of 21st-century science education.

3. The Role of Chemistry Teachers: Barriers to Implementing Practical Learning

Chemistry teachers, as the technical implementers of learning, face significant obstacles in implementing practical-based learning. Limited tools, materials, and safety facilities prevent several important practical activities in the chemistry curriculum from being implemented. As a result, teachers replace practical activities with lectures or limited demonstrations. This situation aligns with the findings of Widyastuti and Kurniawan (2021), Lestari et al. (2023), and Handayani et al. (2020), who reported a decline in the quality of chemistry learning due to a lack of laboratory facilities.

Teachers play a crucial role in the administration of school facilities and infrastructure due to their position as both planners and direct users of learning facilities. In the context of chemistry learning, teachers identify the need for laboratory equipment and materials based on the curriculum, develop laboratory usage plans, and report damaged or unusable facilities. Research by Maulida and Santosa (2021) shows that teacher involvement in infrastructure planning significantly influences the suitability of facilities to learning needs. Teachers who are active in infrastructure administration tend to be able to optimize the use of available facilities, despite limitations.

However, teachers' role in administering facilities and infrastructure is often hampered by limited facilities and weak school support systems. A study by Puspitasari et al. (2022) revealed that teachers experience difficulties in recording equipment usage and submitting procurement requests due to the lack of a clear and integrated administration system. Consequently, laboratory needs are not systematically documented and often do not form the basis for procurement decisions by school management.

Furthermore, limited facilities and infrastructure directly impact the implementation of lab-based learning. Chemistry teachers are forced to shift from lab activities to theoretical learning due to insufficient equipment and materials. Research by Khasanah and Widodo (2020) confirms that limited laboratory infrastructure leads to low frequency of labs and reduced opportunities for students to develop science process skills. This situation demonstrates that the role of teachers in infrastructure utilization is inextricably linked to the quality of institutional infrastructure management.

On the other hand, teachers also have responsibilities in laboratory maintenance and safety. Teachers play a role in ensuring the use of safety equipment and supervising the implementation of practicums to ensure they adhere to safe work procedures. However, research by Ramadhan et al. (2021) shows that the lack of safety facilities places teachers in a dilemma between curriculum demands and the risk of workplace accidents. This situation often leads teachers to limit laboratory use to avoid potential hazards.

Thus, the role of teachers in facility and infrastructure administration is strategic but highly dependent on the support of the school management system. Teachers cannot work optimally without coordination with the principal and administrative staff, and without clear policy support. Research by Sulastri and Hadi (2023) confirms that strengthening the role of teachers in infrastructure administration can only be achieved through collaborative management involving all school elements. Without such synergy, infrastructure administration will be ineffective and impact the quality of learning.

4. The Role of Administrative Staff: Manual and Unintegrated Administration

Administrative staff (TU) also play a crucial role in infrastructure administration, particularly in recording and recording inventory data. However, this study shows that inventory administration is still carried out manually and unintegrated. This results in inaccurate inventory data that is difficult to use as a basis for planning. This finding aligns with research by Rahmawati (2020) and Kurniawan et al. (2021), which emphasizes the importance of an integrated data collection system in educational infrastructure management.

5. Impact on Learning Quality and Learning Outcomes

The most significant impact of weak infrastructure administration is the decline in the quality of chemistry learning. The laboratory is only used two to three times per semester, far below ideal standards. Learning becomes theoretical, not experiment-based, and does not support the strengthening of scientific skills. These impacts include: low student motivation, limited observation and analysis skills, weak understanding of abstract concepts, underdevelopment of scientific attitudes, and low learning outcomes. In the context of the Merdeka curriculum and 21st-century learning, this condition strongly contradicts pedagogical demands that encourage inquiry learning, critical thinking, and problem-solving.

The consequences of ineffective infrastructure administration are clearly visible in learning. The chemistry laboratory at SMA Negeri 1 Matur is only used two to three times per semester, far below ideal standards. Chemistry learning becomes highly theoretical, lacks practical experience, and does not meet curriculum standards that emphasize discovery and inquiry learning approaches. Students miss out on opportunities to gain empirical experience, which is the core of chemistry learning. A study by Ayu et al. (2024) strengthens this finding, that the lack of laboratory use has a direct impact on low student motivation and learning outcomes in science subjects.

When viewed holistically, these infrastructure administration issues are not merely technical but also structural and managerial. At the structural level, schools lack clear infrastructure administration standard operating procedures (SOP). There are no explicit guidelines governing inventory procedures, damage reporting, procurement mechanisms, or laboratory utilization. At the managerial level, principals have not optimally implemented their infrastructure supervision function. At the operational level, teachers and administrative staff are not supported by an integrated work system. This lack of regulation and coordination has resulted in ineffective and unsustainable infrastructure administration.

The results of this study also demonstrate the need for systemic reform of chemistry laboratory infrastructure administration. Principals must establish inventory and procurement standard operating procedures (SOPs), conduct regular supervision, and allocate budgets according to curriculum needs. Teachers must be more active in developing laboratory needs based on the annual learning program and ensuring optimal laboratory utilization. Administrative staff must improve their competency in inventory recording and archiving and transition from a manual to a digital system. All three parties must work synergistically through regular coordination meetings, periodic infrastructure evaluations, and clear reporting mechanisms. Only with such integrated management can chemistry laboratories function optimally as a meaningful learning tool for practical work.

4. CONCLUSION

The results of this study indicate that the administration of chemistry laboratory facilities and infrastructure at SMA Negeri 1 Matur is still not optimal in supporting the implementation of practicum-based learning. Laboratory inventories have not been conducted regularly, resulting in inaccurate data on the condition of equipment and materials and unable to be used as a basis for effective procurement planning. The procurement process is also still hampered by budget constraints and has not been fully aligned with the needs of the chemistry curriculum, resulting in the lack of availability of several important tools and materials in sufficient quantities.

Furthermore, laboratory utilization in chemistry learning remains very low due to limited equipment and inadequate safety facilities, including lab coats and other safety equipment. This situation results in a low frequency of practicums and makes chemistry learning more theoretical. Despite several advantages,

such as adequate laboratory space and functional basic equipment, this potential has not been optimally utilized. Therefore, improvements to the infrastructure administration system are needed through regular inventory updates, needs-based procurement, and increased utilization of laboratory facilities to ensure more effective chemistry learning and align with curriculum requirements.

Based on the research results, several corrective measures need to be taken to improve the quality of administration of chemistry laboratory facilities and infrastructure at SMA Negeri 1 Matur. First, the school needs to implement a more structured and regularly updated inventory system to ensure that equipment and material data are always accurate and can be used as a basis for procurement planning. Second, the facility procurement process should be based on curriculum needs by involving chemistry teachers in compiling a priority list of equipment and materials, and utilizing various funding sources such as BOS, school committees, or partnerships with related institutions. Third, the use of laboratories in learning should be improved through the development of a regular practicum schedule, the development of simple practicum modules, and increased collaboration between teachers and laboratory staff. Fourth, occupational safety facilities need to be equipped to meet standards, including the provision of adequate lab coats, fire extinguishers, first aid kits, and safety training for students. Fifth, the school can implement a regular maintenance program to ensure all equipment remains in good condition. These efforts are expected to improve the effectiveness of practicum-based chemistry learning and support optimal student competency achievement.

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