JPII 13 (4) (2024) 623-632

Jurnal Pendidikan IPA Indonesia

https://journal.unnes.ac.id/journals/jpii

OPTIMIZATION OF BIOLOGY LABORATORY QUALITY MANAGEMENT IN IMPROVING STUDENTS' COMPETENCIES

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DOI: 10.15294/jpii.v13i4.4251

Accepted: May 16th, 2024. Approved: December 29th, 2024. Published: December 30th 2024

ABSTRACT

This study analyzes and examines laboratory quality management in improving students' competencies. This research is a case study with a qualitative approach. This study employed the case study research method through observations, interviews, documentation studies, and literature reviews of laboratory management in improving students' competencies at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran. The instruments utilized in this research are observation sheets, interview guidelines, and field notes. The results from both schools indicated that the laboratory quality management plan was prepared at the beginning of the new academic year, which included annual and semester programs, equipment procurement, and inventory management. Implementing laboratory quality management involved conducting practical work as scheduled, with facilities used optimally. Monitoring and evaluating laboratory quality management included regular assessments through observations and interviews with teachers and students to identify shortcomings. Follow-up actions for laboratory quality management included corrective actions based on evaluation results, such as facility improvements and the addition of equipment. Barriers to laboratory quality management included equipment maintenance. Solutions to overcome these barriers involved facility improvements, equipment additions, additional training for staff, increased involvement of lab technicians, and optimizing funding. It was concluded that the series of laboratory quality management within the PDCA framework functioned effectively, commencing with planning, implementation, monitoring and evaluation, and follow-up. The optimization of biology laboratory management can improve students' competencies at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran.

Keywords: laboratory quality management; student; competencies; biology

INTRODUCTION

Biology learning in the 21st century will be optimal with the support from real experiences, including practicums in the laboratory. Alozie et al. (2012) suggest that students must interact and communicate for important 21st-century skills throughout the lab activity, creating a cohesive understanding of complex systems in science. Laboratories in schools are fundamental in supporting teaching and learning activities because some materials need observations or experiments in the laboratory to be understood. According to Government Regulation Number 19 of 2005 concerning National Education Standards Article 42 paragraph 2, each education unit must have

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facilities and infrastructure to support students' learning competencies, including a laboratory. According to Cahyani et al. (2018), the scope of biology includes basic concepts of biology, the life of organisms, the physiology of living beings, and the environment and natural surroundings. Learning objectives should adopt the formation of attitudes, skills, and knowledge (Afandi et al., 2019; Annisa et al., 2022; Jamaluddin et al., 2023).

UNESCO emphasizes four pillars of education: learning to know, learning to do, learning to be, and living together (Agustina et al., 2019). Therefore, learning in the laboratory can support the education system by UNESCO. In addition, Government Regulation Number 32 of 2013 explains that every education unit must have the infrastructure to support an orderly and continuous learning process, such as a laboratory. Biology learning should emphasize direct experience to develop competencies so students can scientifically explore the environment. Practicums provide direct experiences for students. Edgar Dale compiled the knowledge dimensions in the pyramid of experience (cone pyramid), which illustrates that students can gain learning experiences from doing or experiencing what they have learned, observing and listening to certain media, and listening to language (Jackson, 2016). The more concrete students learn, for example, through direct experience, the more experience students gain. Conversely, the more abstract learn, for example, only relying on verbal language, the less experience students gain.

Practicums are learning to find or prove a concept or principle that already exists or is formulated by experts. From the students' point of view, practicums aim to find concepts or principles from the experts' point of view, verifying concepts or principles. Practicums aim to increase students' motivation and comprehension in using tools or materials in the school laboratory. That way, students can gain more knowledge and make it part of their lives (Rahmawati et al., 2018). Sauri (2021) also explained that practicum is carried out to process God's creation by using the potential of the mind possessed by students so that their needs are met.

Optimal quality management is also needed to optimize the utilization of the biology laboratory as a learning resource. Quality, according to Deming, is conformity to needs. The concept is PDCA (Plan, Do, Check, and Action), which plans, implements, monitors, and makes improvements. Isniah et al. (2020) revealed that PDCA is a quality management system used as a continuous improvement tool widely used in the service and manufacturing sectors. PDCA activities consist of four repeating steps: Plan, Do, Check, and Action.

Terry (2012) suggests that management is a distinct process of planning, organizing, actuating, and controlling. It is performed to determine and accomplish stated goals using human beings and other resources. In the context of quality management, laboratory management is concerned with several aspects: planning, structuring, organizing, administrating, securing, maintaining, and supervising. Therefore, every personnel involved must know how to organize, maintain, and strive for work safety. Sirojudin and Al Ghozali (2022) suggest that quality is an absolute and relative concept. According to Nashihin et al. (2021), the term quality is appropriate. It emphasizes that the basis of the mission of a quality school (educational institution) is "developing programs and services that meet the needs of users such as students and the community."

Managing and maintaining the laboratory is an effort to keep it functioning as it should. Furthermore, laboratory activities provide security and safety skills, laboratory manipulative skills, laboratory process skills, and thinking skills.

Researchers conducted a preliminary study at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran to analyze the need for laboratory quality management. Based on observations and interviews, SMA Negeri 1 Ciamis has biology, physics, and chemistry laboratories. The head of the biology laboratory is a biology teacher without an assistant and technician. Similarly, SMA Negeri 1 Pangandaran has biology, physics, and chemistry laboratories. A biology teacher also leads the biology laboratory without an assistant or technician. The needs analysis results show that the laboratories at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran clearly illustrate the gap between real and desired conditions. At the same time, laboratories will contribute and benefit optimally if they have good management because they know the direction of the program to be prepared.

The needs analysis results reveal a significant gap between the laboratories at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran and the expected ideal standards. According to Permendiknas No. 24 of 2007, laboratories must accommodate many students, have adequate ventilation and lighting, and have appropriate practical tools and materials. Additionally, laboratories must have safety equipment, safe waste disposal procedures, and adequate facilities to

support practicums (Fadzil & Saat, 2020). However, SMA Negeri 1 Ciamis had issues such as outdated equipment, expired materials, and insufficient waste management. At SMA Negeri 1 Pangandaran, although the laboratory has been renovated, much equipment was missing, and the materials were outdated. Budgets were the main obstacle in laboratory management and equipment upgrades.

This gap indicates that the current laboratories do not fully meet the established standards, which impacts the effectiveness of practicums and ultimately affects students' competencies. This research aims to identify and address these issues and formulate strategies for improving laboratory management. The results are expected to improve students' competencies in biology. According to Gunawan et al. (2017), laboratories will contribute optimally and be beneficial if managed well, as good laboratory management will guide the direction of the program to be developed. Thus, researchers are interested in further analyzing "Biology Laboratories Quality Management in Improving Students' Competencies."

METHODS

This research is a case study with a qualitative approach. This study employed the case study research method through observations, interviews, documentation studies, and literature reviews by examining various books and other sources related to the planning, implementation, evaluation, and follow-up of laboratory management in improving the competencies of students at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran.

The observation involved examining the laboratory quality management, which consists of planning, implementation, evaluation/monitoring, follow-up, obstacles, and solutions to address the challenges in managing the biology laboratory at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran.

The data collection in this research was conducted through interviews to obtain information directly through face-to-face interactions with the school principal, the head of the laboratory, the laboratory administrator, biology teachers, and students. This approach allows for an insight into the thoughts and feelings of the informants. The instrument used was an interview guide. The interview in this research involved a question-and-answer format regarding laboratory quality management.

The documentary study conducted in this research served to supplement the data collected through interviews and observations and to acquire precise written information about the quality management systems of the biology laboratories at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran. Such documentation, encompassing laboratory profiles, Standard Operating Procedures, syllabi, lesson plans, and student performance records, was scrutinized to ensure the veracity of the data obtained.

Data was analyzed through the following steps: data reduction, data presentation, and conclusion drawing or verification. The three steps are expected to make the data meaningful. According to Huberman and Miles (2002), descriptive analysis is carried out through three steps of activity that are most related to each other. Researchers conducted data analysis through the following three steps:

1. Data Reduction

Data reduction sharpens, classifies, directs, removes unnecessary ones, and organizes data so that a conclusion can be drawn and verified. It takes place continuously throughout the study. After data collection, all field notes are analyzed and summarized, describing research results and focusing on solving problems in laboratory quality management.

2. Data Presentation

Data presentation finds meaning from the data and compiles it systematically to make the presentation simple yet selective.

3. Conclusion

Analysis of the data collected is used to conclude and describe a pattern of the events. Continuous data analysis has implications for reducing and/or adding the required data, allowing researchers to return to the field.

In this study, the data must be acceptable to support the conclusion. Therefore, it is necessary to use data validity standards. In qualitative research, data validation by Cresswell et al. (2003) consists of credibility, transferability, dependability, and confirmability.

RESULTS AND DISCUSSION

Findings at SMA Negeri 1 Ciamis

a. Planning of Biology Laboratory Optimization (Plan)

The interviews, observations, and documentation studies revealed that the optimization of biology laboratory facilities and infrastructure at SMA Negeri 1 Ciamis was done through estab-

lished procedures. The first step was identifying and analyzing laboratory managers' needs in collaboration with teachers. The head of the laboratory checked the inventory data, which was later submitted to the school to the vice principal and was later registered and handed over to the principal. Furthermore, the principal determined the allocation of funds from the School Revenue and Expenditure Budget Plan and School Activity and Budget Plan, adjusted to the level of the proposed facilities and infrastructure needs. The availability of inventory data for facilities and infrastructure in the biology laboratory assisted procurement planning.

b. Implementation of Biology Laboratory Optimization (Do)

Based on interviews, observations, and documentation studies, the implementation of Biology laboratory management at SMA Negeri 1 Ciamis was constrained by human resources and infrastructure factors. Some biology teachers could not use equipment and materials in practicum learning. Therefore, they conducted special activities to gather and share skills in using biology equipment for practicum learning. In addition, some equipment was damaged, so the equipment was repaired and maintained. In addition, the lack of time for practicums made biology teachers add more time outside of learning hours. However, biology teachers implemented practicum activities based on laboratory availability schedules.

Biology laboratory activities at SMA Negeri 1 Ciamis did not collaborate with external parties. Cooperation was still internal around the school, except for procurement to the relevant agencies. In addition, in terms of operational services for the biology laboratory at SMA Negeri 1 Ciamis, the role of the laboratory was replaced by a biology teacher and the head of the laboratory, who collaborated with office assistants at school in preparing practicum activities. The preparation step is at least two days before the practicum. The teacher had deposited a list of tools or materials to be used, confirmed by the laboratory head the day before the practicum. Students and teachers did store and maintenance after the practicum. The practice concerned cleanliness and tidiness so that the material and tools could be stored again.

c. Monitoring/Evaluation of Biology Laboratory Optimization (Check)

Based on interviews, observations, and documentation studies, the principal and supervisory team supervised the biology laboratory, including the vice principal. It was documented in the report from the person in charge of managing the Biology laboratory to the supervisory team. The report was submitted at least once a semester. The content included the suitability of implementation with the planned program, including scheduling and infrastructure needs. Reports on academic interests, such as scheduling and implementation processes, were submitted to the academic vice principal. In addition, the condition of infrastructure facilities and equipment needed was also reported to the vice principal of infrastructure for reference in annual submissions. Instruments for laboratory personnel assisted supervision activities. It was a flexible activity report instrument because it can be used monthly, semester, and yearly. In addition, instruments for reporting the condition of facilities and infrastructure, including tools and materials, are also available to facilitate activity supervision.

Based on students' achievements, the average scores of two biology tests at SMA Negeri 1 Ciamis exceeded the passing grade. It aligns with their achievement of biology scores in the 2022 national examination, the second highest in the Ciamis Regency. However, the average score is still higher.

d. Follow-up of Quality Management of Biology Laboratory (Act)

In an interview with the principal, he explained that the school makes regular improvements through the School Activity and Budget Plan and is responsive to minor problems. Biology laboratories have systematic procedures for equipment repairs, with regular evaluations to identify repair needs. Biology teachers use formative and summative evaluations to improve laboratory management and allow students with unsatisfactory results to repeat practicum.

Based on the interview, the head of the laboratory was committed to developing an interesting practicum and building students' competencies. The biology teacher emphasized the importance of continuous innovation and proposed the formation of a working team to renew the practicum. Although students have not applied many of the results of their innovations in real life, they believe practicum development can increase their interest and understanding of science.

The principal added that the school has ICT staff who support the integration of ICT in practicum learning. The use of smartboards in biology laboratories increases interactivity. ICT facilitates access to information and efficiency of laboratory administration, and teachers plan

for structured ICT use. Students benefit from the updated laboratory facilities with ICT, although they need to master additional applications.

Findings at SMA Negeri 1 Pangandaran

a. Planning of Biology Laboratory Optimization (Plan)

Based on interviews, observations, and documentation studies, biology laboratory facilities and infrastructure optimization at SMA Negeri 1 Pangandaran were planned with established procedures. The head of the laboratory, the laboratory manager, and the biology teacher analyzed the need for infrastructure to benefit the biology laboratory, which was then proposed to the principal. The biology teacher proposed to the laboratory coordinator, which was then handed over to the head of the laboratory to be submitted to the vice principal of infrastructures for review with the principal.

In addition, SMA Negeri 1 Pangandaran has physics and biology laboratories. The laboratories are strategic and spacious. The room has good lighting, ventilation, electricity, adequate water, teacher chairs and tables, and student chairs and tables. It also has good shelves, warehouse space, preparation rooms, whiteboards, screens, projector, and emergency kits. Rules and organizational structure are put on the wall, but the organizational structure is outdated.

b. Implementation of Biology Laboratory Optimization (Do)

Based on interviews with the head of the laboratory and biology teachers, laboratory activities are adjusted to the lesson plan's basic competencies. All biology teachers of all grades used the laboratory availability schedule. The schedule never conflicts and is created according to the annual needs of practicum activity and laboratory optimization programs.

Biology teachers used student worksheets as instructions and directions for students in implementing practicum. Students knew the rules in the laboratory directly from the teacher, read them, and applied them in the learning process. According to students, the practicum instructions from the teacher are clear. Students mastered how to use the tools before carrying out the practicum. The teacher explained the details of the steps, how to use the tools, and the practicum instructions, both the steps and worksheets. Students mastered how to use the tools. The biology teachers or laboratory managers prepared their practicum needs due to the absence of assistants. The tool and student ratio was 1:5.

Students concluded the practicum results by summarizing and presenting the results and clearly understanding the essence of the materials. Students concluded as directed by the teacher in the practicum instructions, and students who had difficulty asking for help from other classmates so that their grades and achievements exceeded passing grades. In addition, after completing the practicum, students and teachers tidied up the seats and cleaned the tools used.

Students also created products in practicum activities, such as rocket models from used bottles and replicas of cell parts from styrofoam. The products were stored in the laboratory for teaching materials. Students' food products from the practicum, such as tape from mantang, were consumed.

The biology laboratory at SMA Negeri 1 Pangandaran did not collaborate with related agencies related to the laboratory. In addition, in laboratory management, teachers were given equal opportunities to participate in practicum activities in the laboratory. However, in operational services, the role of the laboratory worker was replaced by a biology teacher who wants to carry out the practicum with preparation one day before the practicum by depositing the tools and materials needed to the physics and biology laboratory coordinator. Maintenance was carried out after completing the practicum, assisted by students in cleanliness and tidiness. The tools and materials used were stored back in their original place. In addition, the laboratory availability schedule did not conflict because the MGMP team coordinated it by considering the material that required the space. Biology teachers have five hours of teaching every week: two hours of lessons and three hours of lessons. Teachers scheduled and arranged the practicum on student worksheets to allocate time for each practicum stage.

c. Monitoring/Evaluation of Biology Laboratory Optimization (Check)

Based on in-depth interviews, observations, and documentation studies, the principal supervised the use of laboratories through reports from the head of the laboratory. The head of the laboratory and all managers conducted the program for one year. Reporting to the principal is mandatory at the school year's end. The supervised content is related to laboratory activity programs, tools and materials inventory lists, laboratory availability schedules, logs, equipment requests, loan books, and stock cards. The principal must know the substance.

Monitoring and evaluation activities are formally programmed and scheduled from the curriculum section in one year, carried out twice. Informal monitoring is carried out outside the schedule determined by the curriculum section. The principal travels to every classroom and laboratory daily to supervise learning implementation. The principal provides support for the laboratory activities. Formal monitoring activities are carried out based on the schedule determined by the curriculum by paying attention to the substance under supervision, including supervision of the head of the laboratory, laboratory managers, and biology teachers.

Laboratory management evaluations include the lack of human resources (HR), which means that inventory takes a long time and the absence of special laboratories and technicians to prepare teachers for practicum activities. The difficulty during the practicum implementation process is that students are difficult to condition and require a long time in practicum. The evaluation is followed up by a discussion about improving the biology laboratory in an educator meeting.

Practicum activities are critical in developing science education skills, which can be achieved with laboratory facilities and equipment. Therefore, the goal of science education will never be realized if the laboratory building is not provided or is not well equipped and underutilized. Therefore, a secure building where facilities and equipment can be stored should be available in every school for the success of a science education program (Ibrahim et al., 2021).

d. Follow-up of Quality Management of Biology Laboratory (Act)

Based on observations, documentation, field notes, and interviews with the principal, improvements were carried out on a scheduled basis following the School Activity and Budget Plan. The process included data collection, analysis, problem identification, and reporting. Minor repairs were initiated independently, while major repairs required formal procedures.

Biology teachers used evaluation data to improve learning effectiveness and provide options for students whose practicum results were unsatisfactory to repeat or add assignments. The principal provided continuous training to create innovative practicums. The head of the laboratory participated in the training to focus on developing students' competencies. Biology teachers maintain continuity and update teaching methods, while students intend to apply practicum daily and appreciate the benefits of practicum experience.

The school integrated ICT in laboratories to improve the skills of teachers and students. ICT facilitates interactive learning, improves administrative efficiency, and facilitates communication between students and teachers. Teachers use educational applications and online groups to help with the learning process. Students feel that updating laboratory facilities with ICT makes learning more engaging and improves their understanding of the material.

a. Planning of Optimization of Biology Laboratories Quality Management in Improving Students' Competencies

George R. Terry in Principles of Management (Patriah et al., 2022) suggests that planning is a selector of facts, linking facts, and making and using estimates or assumptions for the future by describing and formulating the activities needed to achieve the desired results.

The planning of biology laboratory management in two schools has been running, starting from planning infrastructure facilities, activity programs, and the procurement of tools and materials, and planning on Biology learning and practicum activities from the syllabus, lesson plans, and student worksheet materials. The facilities and infrastructure in the two schools are representative. The laboratories in the two schools are separated into two rooms: the physics and biology laboratories. Thus, the biology laboratories in the two schools still refer to the standards of infrastructure facilities Permendiknas No. 24 tahun 2007.

According to Ali et al. (2021), school facilities and infrastructure planning must meet the following principles: 1) school facilities and infrastructure planning must be an intellectual process, 2) planning is based on needs analysis, 3) school facilities and infrastructure planning must be realistic, under the budget, 4) visualization of school facilities and infrastructure planning results must be clear and detailed, both in number, types, brands, and prices.

Both schools have implemented these principles. The planned facilities and infrastructure are part of intellectual interests, especially in learning biology practicum. Needs analysis was also carried out by biology teachers based on the curriculum and the budget. The results of the facility and infrastructure planning are also visualized and detailed in the inventory data compiled by the two schools, following Malik and Ubaidillah (2021), revealing that laboratory facilities and infrastructure management planning in improving the quality of learning in schools must be done by looking at existing needs, both office needs and learning needs.

Both schools still have damaged or incomplete tools and materials that need to be repaired and improved, and the product inventory data from student activities is unavailable. Therefore, product specification data generated from practicum activities is not documented. Two schools also do not have a picket cleaning schedule for maintenance in the laboratory, so hygiene maintenance is carried out by security or office assistants at school. Therefore, regular coordination is needed from various parties, both between managers and Biology MGMP and managers with principals, to formulate laboratory equipment that supports practicum activities. Maintenance activities can be arranged based on practicum schedules so users can better maintain laboratory rooms.

According to Nurabadi et al. (2019), planning is carefully determined by everything that will be implemented and what resources must be provided to support it (humans, laboratory materials and equipment, and budget). These activity schedules include the target time needed to carry out all processes.

Human resource planning in the biology laboratory's quality management includes the biology laboratory's head, coordinators, laboratories, technicians, and biology teachers. The biology laboratory personnel in the two schools cannot be said to be complete. Both schools do not even have professional human resources, such as laboratory technicians, so these roles are replaced by other laboratory personnel, such as laboratory heads, coordinators, and biology teachers. However, in Minister of National Education Regulation No. 26 of 2008 Article 1 paragraph 1, it has been explained that the standards for school/madrasah laboratory personnel should include the head of the school/madrasah laboratory, the school/madrasah laboratory technician, and the school/madrasah laboratory worker.

The most important requirement for the success of a quality system is to perform high-quality work through competent and dedicated employees and intellectual honesty in communicating the results obtained. The leading principle is to perform corrective actions whenever substandard results are detected. It, therefore, becomes natural that an approach based on monitoring, correction, and improvement (dictated by the protocols of standardized procedures) can become a philosophy of life within the laboratory (La Verde et al., 2019).

According to Messaoud and Messaoud (2014), in the operation of Total Quality Management in education, several main things need to be considered, including first, continuous improvement; second, determining quality standards (Quality Assurance); third, changing culture (Change of Culture), fourth, organizational change (Upside-down Organization), and fifth, maintaining relationships with customers (keeping close to the customer).

Planning can be seen from the activity program, Standard Operating Procedures, and laboratory availability schedule in both schools that have been arranged and constantly updated continuously every year, referring to standards and adjusting to the culture in their respective regions, which describe aspects of continual improving, quality assurance and change of culture.

Laboratory availability schedules can also be used to determine the frequency and intensity of practicum learning activities between biology teachers and students. The effectiveness and efficiency of using facilities and infrastructure, as well as tools and materials, are ensured so there are no clashes during practicum. This is in line with Najemah (2020), who said that planning the use of biology laboratories can minimize time conflicts between teachers and each other when using biology laboratories. The program's planning is expected to achieve the learning objectives of biology until students' competencies are improved. Implementing laboratory planning activities, including planning laboratory activities, planning in addition, and procuring laboratory facilities, can improve the quality of biology learning. Biology is an experimental subject; government and parents should work hand in hand to build appropriate laboratories for effective learning, and these laboratories should be adequately equipped with necessary equipment and materials for instruction so that empirically related concepts are better taught and better understood by the students (Musa, 2019).

b. Implementation of Optimization of Biology Laboratories Quality Management in Improving Students' Competencies

Implementation is an important management function. According to Tery (Mulyadi., 2020), implementation is the effort of all group members in such a way as to desire and strive hard to achieve goals that are in harmony with planning and organizing efforts from the leadership. Laboratory management needs to be carried out according to plan; in this case, the leader can motivate laboratory managers to work voluntarily and harmoniously to achieve goals. The implementation has been quite good in the two schools, as seen from the suitability of activities with the planned program. However, both

schools have constraints on human resources and biology laboratory infrastructure. However, these obstacles can still be overcome by biology teachers, who must be more creative so that practicum activities are still carried out. Implementing practicum activities is also adjusted to the weight of the material taught because not all material can be done in practicum.

According to Rahmadhani et al. (2022), laboratory management includes the effectiveness of using the laboratory, work safety, and carrying out discipline. In general, students of both schools seem enthusiastic about practicum activities. Some students already know things that must be considered in practicum activities, such as rules in the laboratory. The teacher's instructions are clear so students can master the tools and materials. In addition, some students can conclude the practicum activities. With practicum activities, students find it helpful to understand biology material. This aligns with Loughran and Hamilton (2016); practicum is a place to find experience. The practicum aims to provide training on tools requiring skills, techniques, instructions, laboratory management, and proficiency. With practicum activities in the laboratory, it can make real and vital theoretical instruction, knowledge of the subject matter, and educational principles. Similar to what was expressed by Ilma et al. (2021), students with motivation and interest in biology, especially in practicum activities, will comfortably carry out practicum activities so that learning activities are more meaningful and conducive.

Services in both schools also look quite good. The services were still carried out even though, in practice, there were obstacles, such as human resources, especially in the qualifications of laboratory personnel. Even in the field, laboratory personnel are needed to ensure the continuity of practicum activities and assist teachers and students in implementing practicum. This aligns with Permendiknas No. 26 of 2008 concerning Laboratory Personnel Standards School/Madrasah. Even so, both schools can overcome these obstacles. In carrying out the role, laboratory personnel are replaced by biology teachers who carry out practicum activities and sometimes involve students. However, it is necessary to have laboratory personnel who focus on serving laboratory activities, especially regarding preparation. The Biology MGMP team proposes it for the holding of special laboratories that help prepare laboratory activities.

Permendiknas No. 26 tahun 2008 Regarding the competence of laboratory managers, repair and maintenance are carried out periodically, and at least technicians are needed who master the principles and tools, mechanical and electrical systems. However, in both schools, laboratory equipment maintenance is carried out after practicum by students and teachers concerned both cleanliness and tidiness.

Laboratory services are provided to students. Laboratory services for students in both schools include in terms of practicum forms, which are carried out mainly to make it easier for students to understand the biology material learned so students can achieve learning goals optimally. This can affect competencies or ability in biology subjects so that students can contribute to competitive science activities outside of school at the Regency/City, provincial, national, and international levels. Of the several services carried out in the implementation of laboratory quality management, it is a need that must be met so that it is expected to improve students' competencies.

c. Monitoring/Evaluation of Optimization of Biology Laboratories Quality Management in Improving Students' Competencies

Supervision, according to Huda et al. (2019), can be formulated as a process of determining what must be achieved: standards, what is being done, namely implementation, assessing implementation, and when necessary, making improvements so that implementation is following the plan, which is in line with standards (measures).

The two schools have similarities in supervisory activities. The principal holds the highest authority in all management aspects, especially supervision. Supervision activities are carried out over one year twice, with a schedule determined by the school program. Supervision is also carried out indirectly/informally based on the report of the head of the laboratory. Not only that, supervision is also carried out in learning activities in the laboratory. This is so that what is planned can be achieved.

Students' achievements can be seen in the national examination scores for 2022. The two schools are among the schools that achieve the highest scores in their respective regions. The national test score of Biology SMA Negeri 1 Ciamis was 68.63, while the national test score of Biology SMA Negeri 1 Pangandaran was 63.79. The score indicates that the school already has quality biology learning, including laboratory quality management to achieve learning objectives. This is supported by Janssen et al. (2014), who reviewed prospective teachers who innovated practi-

cum learning in the laboratory by developing a heuristic learning objective system and teaching impact analysis. The explanation is as follows: the heuristic goal system is a procedure that allows teachers to define current practicum activities as a set of lesson segments and then connect these segments to a hierarchy of objectives and expected scores. Teaching impact analysis allows teachers to compare current lesson segments with lesson segments representing the target practice framework to estimate the desirability and probability of each lesson segment sequence. This analysis provides information on how the gap between current and desired practices can be bridged.

CONCLUSION

The researcher obtained the results of the analysis and description of implementing the PDCA cycle in the quality management of biology laboratories at SMA Negeri 1 Ciamis and SMA Negeri 1 Pangandaran. Both schools carried out planning, implementation, evaluation, and follow-up in the quality management of biology laboratories. Schools can systematically improve practicum quality and students' competencies by implementing the PDCA.

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