GUYUB: *Journal of Community Engagement* Vol. 6, No. 1, Januari-Maret 2025
p-ISSN: 2723-1232; e-ISSN: 2723-1224 DOI: http://doi.org/10.33650/guyub.v6i1.10490

Integrated Laboratory-Based Learning in *Pesantren*: A Community Service Initiative at Darul Faqih Islamic Boarding School

Nurul Hidayat[1], Arif Hidayat[2], Ahmad Taufiq[3], Edi Supriana[4], ST Ulfawanti Intan Subadra[5], Lya Rizka Herawati[6], Erni Yulianti[7]

Universitas Negeri Malang, Indonesia[1,2,3,4,5,6,7]
{nurul.hidayat.fmipa@um.ac.id[1], arif.hidayat.fmipa@um.ac.id[2], ahmad.taufiq.fmipa@um.ac.id[3], edi.supriana.fmipa@um.ac.id[4], intansubadra97@gmail.com[5], lyarizka67@gmail.com[6], erni.yulianti.fmipa@um.ac.id[7]}

Submission: 2025-01-01 *Received*: 2025-03-18 *Published*: 2025-03-28

Keywords: *Laboratory-Based Learning; Islamic Boarding School; Science Education.*

Abstract. *Pesantren play a crucial role in shaping a young generation with transdisciplinary capabilities by integrating religious and scientific knowledge. In Islamic boarding schools, science education requires curriculum integration through laboratory-based learning. This community service program was conducted at Pondok Pesantren Darul Faqih, Malang, aiming to improve laboratory facilities and enhance teachers' competence in facilitating experiment-based learning.*

This program involved providing laboratory equipment and teacher training using lecture and practice methods. Three main stages were carried out: (1) providing basic experimental equipment for an integrated laboratory, (2) conducting seminars on Islamic-based practical management and mentoring teachers in developing science experiment modules, and (3) implementing experiments and evaluating the program. A questionnaire was distributed to teachers to assess their views on the importance of laboratories in science education. The results showed an improvement in laboratory facilities with the availability of various experimental tools, such as the Melde Kit, Hooke's Law Kit, Kirchhoff's Law Kit, and Solar Cell Kit. Additionally, the training enhanced teachers' skills in operating the equipment and developing science learning modules. According to the survey, the equipped laboratory contributed to increased student motivation and understanding of science. This program is expected to serve as a model for advancing science education in pesantren.

Katakunci:
Pembelajaran Berbasis Laboratorium; Pondok Pesantren; Pendidikan Sains.

Abstrak. Pesantren berperan penting dalam membentuk generasi muda dengan kemampuan transdisipliner, mengintegrasikan ilmu agama dan sains. Dalam pembelajaran sains di pesantren, diperlukan integrasi kurikulum agama dan sains melalui pembelajaran berbasis laboratorium. Pengabdian kepada masyarakat ini dilakukan di Pondok Pesantren Darul Faqih, Malang, bertujuan meningkatkan fasilitas laboratorium serta kompetensi guru dalam memfasilitasi pembelajaran berbasis eksperimen.

Kegiatan ini meliputi penyediaan peralatan laboratorium dan pelatihan guru menggunakan metode ceramah dan praktik. Tiga tahapan utama dilakukan: (1) penyediaan peralatan praktikum dasar untuk laboratorium terpadu, (2) seminar manajemen praktik berbasis Islam serta pendampingan dalam penyusunan modul percobaan sains, dan (3) pelaksanaan eksperimen serta evaluasi program. Kuesioner diberikan kepada guru untuk mengetahui pandangan mereka terkait pentingnya laboratorium dalam pengajaran sains. Hasil kegiatan ini menunjukkan peningkatan fasilitas laboratorium dengan tersedianya berbagai peralatan eksperimen, seperti Kit Melde, Kit hukum Hooke, Kit hukum Kirchhoff, dan Kit sel surya. Selain itu, pelatihan yang diberikan meningkatkan keterampilan guru dalam mengoperasikan alat dan menyusun modul pembelajaran sains. Berdasarkan survei, laboratorium yang tersedia berkontribusi pada peningkatan motivasi dan pemahaman siswa terhadap sains. Dengan demikian, program ini diharapkan dapat menjadi model dalam pengembangan pendidikan sains di pesantren.

1 Introduction

Under the Anticipated Learning (Merdeka Belajar) reform, students are given the freedom to choose how they want to learn and what they want to study. This educational program is expected to help students learn to be more innovative and collaborative—skills that are essential in the modern era. In this context, a holistic approach integrating religion, science, and character is crucial for transforming this program. This holistic approach can be applied throughout the learning process. In pesantren (Islamic Boarding School), Islamic values and character teaching should be incorporated into classroom learning programs (Albar et al. 2024). If students understand Islamic principles in theoretical and practical scientific contexts, they can transform their thinking in alignment with Islamic values (Islam 2024).

In this community service project, Pesantren Darul Faqih was selected as the collaborative institution. Darul Faqih is an Islamic boarding school located in Wagir, Malang City, which also oversees two educational institutions: SMP and MA Darul Faqih. Darul Faqih offers an academic program based on science and technology, complemented by laboratory experiments. The school has around 170 middle school students and 80 high school students, with a teaching staff of 16. However, Darul Faqih is

still in the process of developing its facilities and infrastructure, and both SMP and MA Darul Faqih face challenges due to limited resources, particularly in supporting practical activities. The school lacks sufficient science experiment equipment and trained educators to incorporate Islamic values into practical activities. This is known based on a survey conducted by the FMIPA UM Community Service Team, Darul Faqih Islamic Boarding School is currently still carrying out laboratory activities in the classroom with simple equipment because the laboratory building is still under construction. This situation affects students' perspectives on their experimental experiences; they focus more on worldly principles and understanding but lack awareness of the grandeur of al-Haqq (the Truth).

Darul Faqih is an integrated Islamic education embedding *pesantren* education, general school education, and out-of-school education systems. In the first stage, the building to be built is for pesantren education. The integrated Islamic boarding school of Darul Faqih was established to respond to the call for the global challenges that are very competitive, accelerative, and massive. This challenge requires the preparation of a generation with Islamic character, having sharp vision, spiritual and intellectual intelligence, social piety, and reliability in the field of technology. Darul Faqih orients students towards mastering and practicing basic Islamic knowledge, worship, and preaching, which upholds Islam rahmatan lil 'alamin, adheres to the teachings of *Ahlussunnah Wal-Jama'ah* and upholds Islamic brotherhood (ukhuwah Islamiyah).

Additionally, the Anticipated Learning Curriculum emphasizes the need for educators capable of guiding practical activities integrated with Islamic values (Tukiyo et al. 2022). Considering these points, a community partnership program especially in terms of improving the quality of laboratory in Darul Faqih schools becomes essential. The goal of this program is to enhance the standards of facilities and human resources for the integrated laboratory at Darul Faqih Malang, supporting Islamic-based practical learning. This community service is to help the partner institution, Darul Faqih, solve the laboratory development challenges. These include a lack of laboratory equipments

especially for science, the absence of experimental modules, and a lack of training for laboratory educators in developing experimental learning media. These three issues directly impact students' experimental motivation and understanding in science.

2 Method

To address the above challenges, this initiative aims to enhance the standards of the integrated laboratory facilities so that students' experimental skills in the three scientific fields can be improved. Additionally, it aims to train the Darul Faqih teachers to effectively guide students in conducting Islamic-based experiments. This will enable students to reinforce the theories they have learned in class and strengthen their faith. As part of the Darul Faqih Islamic Boarding School in Malang, the teaching staff from the two educational institutions—Junior High School (*Sekolah Menengah Pertama*/SMP) and Islamic Senior High School (*Madrasah Aliyah*/MA) Darul Faqih Malang—are located at Jl. Gapura No.198, RT.18/RW.04, Santren, Pandanlandung, Wagir District, Malang Regency, East Java 65158.

Islamic Boarding School Darul Faqih is an excellent educational institution educating qualified, confident, and humble future Islamic-quranic character leaders. Darul Faqih means the house of a fiqh expert. While the etymological meaning of fiqh is broader than the scope of the term's meaning. The meaning of fiqh in terms of scope is narrower, namely "the science of sharia law in the form of practice taken from detailed evidence". While in terms of language the meaning of fiqh includes all religious teachings. This meaning is emphasized by the Qur'an in the use of the word 'fiqh'. Darul Faqih Islamic Boarding School Malang is committed to becoming a crucible for prospective religious experts. They study, understand, and preach the teachings of Islam to humanity.

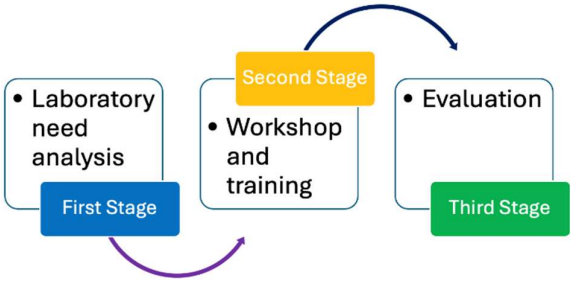

Figure 1. Method of Community Service.

This community service is carried out using lecture and practice methods with three stages as illustrated in Figure 1. The first stage focused on equipping the laboratory with basic science experiment tools for the integrated laboratory at Darul Faqih Malang. The second stage included a seminar on Islamic-based practical management and intensive mentoring for developing plans and modules for science experiments. The third stage involved conducting experiments and evaluating the implementation of these program. Through this program, the integrated laboratory standards are expected to be improved, and the teaching staff are prepared to implement the relevant teaching approaches within the laboratory setting. Additionally, this initiative aims to support SMP and MA Darul Faqih in becoming science-based Islamic educational institutions, equipping students with better research tools.

3 Results

The community service program at Pesantren Darul Faqih has effectively addressed essential needs in laboratory development and teacher support training. Based on the results of the initial survey that has been conducted, on Figure 2, 15 teachers have never used the laboratory for teaching purposes; another 9 teachers reported using it infrequently (Gambar 2 (a)). Only one teacher uses the laboratory quite often, while 3 teachers reported very frequent usage. This would apparently indicate that either the teachers are not well enough prepared for laboratory-based teaching or the lack of resources within the laboratory supports continuous practical work. On the other hand, with respect to the sufficiency of laboratory resources, most of the teachers find the

laboratory "inadequate" to support teaching needs, while only 11 consider it "fairly adequate" (Gambar 2 (b)).

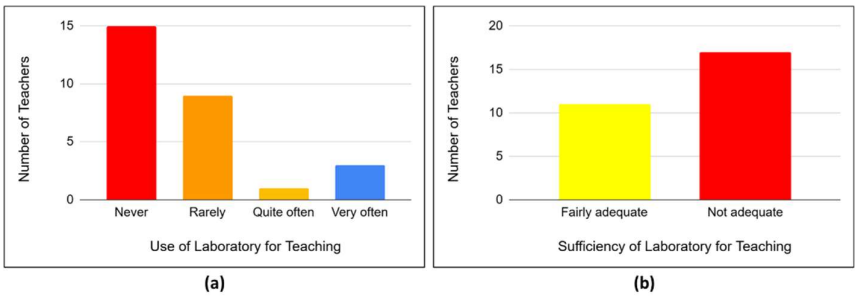

Figure 2. Initial Survey of community service activities.

In the first stage, basic science experiment tools (Melde kit, resonator kit, Hooke's law kit, transformer kit, Faraday's law kit, reflection kit, refraction kit, Ohm's law kit, Kirchhoff's law kit, Archimedes' principal kit, solar cell kit, and Hartl kit) were successfully provided. The equipped laboratory now allows students to learn experiments in science, which will improve their hands-on learning experiences. Seminar and module development: In the second stage, the workshop on Islamic-based practical management was conducted.

A good experimental design for high school students in science should have several important characteristics to help students understand scientific concepts effectively. The characteristics are *Clear Objective, Controllable Variables, Simple and Measurable, Systematic and clear steps, Correct Observation and Recording, Safety, Replication, Data Interpretation, Conclusion Based on Evidence, and Relevance to Science Concepts. Futhermore, clear objective* are the experiment must have a specific and clear purpose, which is to test a hypothesis or understand a concept in science. This objective should be easy for students to understand so that they can focus and know what to expect from the experiment. *Controllable Variables* are the experiment must identify the independent variable, the dependent variable, and the controlled variable. Students must be able to adjust the controlled variable to isolate the effect of the independent variable on the dependent variable. *Simple and Measurable* are the experimental design should be simple and easy to implement with tools and materials available at school. All

measurements in the experiment must be measurable and repeatable, for example using consistent units such as time, temperature, or mass. *Systematic and clear steps* are the experimental procedure must be structured and step-by-step so that it is easy for students to understand. These steps should avoid complexity and allow students to follow the experiment without confusion. *Correct Observation and Recording* are the students should be trained to record data accurately and systematically. Observations can be made by recording quantitative (numerical) or qualitative (visual description) results, and the results must be in accordance with the objectives of the experiment. *Safety* is the experiment must pay attention to the safety of the students by using safe tools and materials. Instructions on safety procedures should be clear and easy to understand. *Replication* is the experiment should be repeatable (replication possible) to ensure that the results are valid and reliable. Repeated experiments also help students understand the importance of consistency in scientific experiments. *Data Interpretation* is used after the experiment is conducted, students should be given the opportunity to analyze and interpret the data that has been obtained. This process teaches students to draw conclusions based on existing evidence and relate the results of the experiment to the theories they have learned. *Conclusion Based on Evidence* is the experiment should allow students to draw conclusions based on the data obtained, either supporting or rejecting the initial hypothesis. It develops critical thinking skills and understanding of scientific concepts. *Relevance to Science Concepts* is the experimental design must be relevant to the science concepts taught in the curriculum. The experiments conducted should provide a deeper understanding of the principles of physics, chemistry, biology, or other sciences. With these characteristics, simple experiments in high school science classes can be effective in guiding students to understand the scientific method and science concepts more deeply and practically.

The workshop was followed by all the teachers in Darul Faqih Malang where the design of this community service was managed by Prof. Dr. Arif Hidayat, M.Si. The workshop focused on integrating Islamic values into scientific experiments that was delivered by Dr. Edi Supriana. The teachers also discussed about the importance of preparing well-

prepared lesson plans, guided by Prof. Dr. Ahmad Taufiq, S.Pd., M.Si.. Also, the importance of using digital technology in pesantren-based learning was delivered by Nurul Hidayat, S.Si., M.Si. and Erni Yulianti, S.Pd., M.Pd. included training on developing science experiment modules that combine Islamic principles with scientific inquiry. Through intensive mentoring sessions, which were assisted by Lya Rizka Herawati, S.Si., M.Si. and ST Ulfawanti Intan Subadra, S.Si., M.Si. the participants gained valuable insights and skills. Teachers discussed about how to develop lesson plans and experimental modules for the integrated laboratory. The photograph during the workshop is given in Figure 3. The teachers were more assured to teach students in these hands-on activities. Teachers pointed out that such methodologies enabled them to integrate scientific ideas and religious teachings, thus providing an enriched learning for students.

Figure 3. Photo Session during the Workshop in Darul Faqih Islamic Boarding School.

The profiles of the teachers were also evaluated, where the results are depicted in Figure 4. Based on Figure 4 (a), it is known that teachers at Darul Faqih Islamic Boarding School in Malang consist of 64.3% men and 35.7% women. The evaluation results show that Male teachers are the majority, covering 64.3% of the teaching staff. This ratio is probably indicative of the surrounding culture and education, as males have historically dominated that profession. These teachers have taught at Darul Faqih Islamic Boarding School Malang with different teaching durations, such as: < 1 year, 1 – 2 years, 3 – 6 years, dan >6 years.

Based on Figure 4 (b) shows an interesting note here is that the majority of teachers (around 43%) have between 3 to 6 years of experience. In addition, just 7% are Darul Faqih teachers who have been in the calling for a long time than six years to show that more often than not they were late from college giving them the scholarly devices yet little significant experience in their multiyear effort. Some of these young teachers have obtained in with master's degrees, thereby deepening their content knowledge and perhaps bringing new pedagogical techniques to their school. The arrival of these exceptionally educated young teachers bodes well for the future progress of Darul Faqih that these types of educators will also be enthusiastic, both are very probably motivation in their work and able to introduce or approximate new teaching methods into their classes.

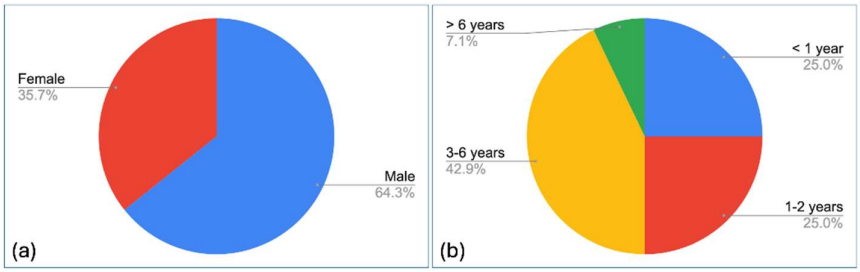

Figure 4. Teacher Classifications in Terms of (a) Gender and (b) Teaching Duration.

The last stage was the carrying out and evaluating of the experiments. In this stage, it was possible for all the science teachers to carry out all the experiments with the help of the new modules. The experiments were further evaluated on their educational importance as well as the extent of inculcation of Islam. Sharing sessions, including developing workshops and modules on the integration of Islamic values into students conceived scientific concepts, made an important contribution to the tools for equipping teachers with this concept and holistic education envisioned by the Anticipated Learning initiative.

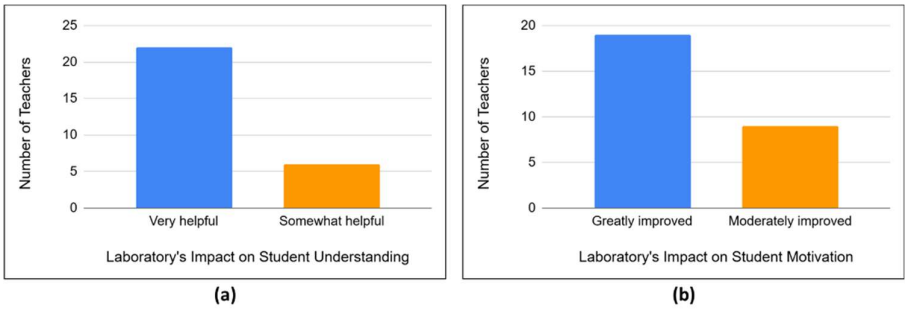

Figure 5. Darul Faqih Teachers' Perspective on (a) Laboratory's Impact on Student Motivation and (b) Laboratory's Impact on Student Understanding.

Further surveys about use of laboratory for teaching, sufficiency of laboratory for teaching, laboratories' impact on student motivation and student understanding in Darul Faqih were also shown in Figure 5. Results from the survey could, henceforth, elaborate on how much the laboratory facilities have been put into use, whether they are satisfactory, and what impacts they have on teaching at Darul Faqih and student engagement. In fact, these findings reflect both the challenges and potential areas of improvement in utilizing laboratory resources effectively in science education.

After the evaluation, the existence of this service has a significant impact on the perspective of Darul Faqih teachers. First, the perspective related to the impact of the laboratory on student motivation. The evaluation results shown in Figure 5 (a) show 19 teachers responded that it "greatly improved" student motivation, while 9 teachers noted a "moderate improvement." This thus evidences that the method of learning at a laboratory not only enhances academic understanding but also provokes interest and enthusiasm to learn in students. Practical activities can raise engagement and make the learning of science more fun and relevant. The motivational effect is very important in this respect, since it may indicate the better-equipped and more frequently used laboratory facilities evoke the students' curiosity and attitude towards science.

Second, according to 22 teachers, the existence of a laboratory has a significant impact on student understanding (Figure 5 (b)). According to

them, with the existence of a laboratory, students will participate in problem-solving activities or can practice directly related to the material given. In addition, with practice, students can connect the concepts that have been taught and the facts obtained so as to gain a deeper understanding.

4 Discussion

The community service at *Pesantren* Darul Faqih, Malang has been successfully conducted. Majority of teachers in *Pesantren* Darul Faqih are still early in their careers, honing instructional practice and adjusting to educational expectations. Teachers who have experience with a variety of teaching methods can create a lively, flexible learning environment in the classroom, as they are generally more open to new approaches (Lucas et al. 2021). The fact that teachers contributed to the development of the modules demonstrates that one of the key ways forward involves training and mentoring younger teachers to build a capable teaching staff for integrated science learning. Coupled with this approach, Anticipated Learning has also founded novel and collaborative learning with the integrated module, which could be expected to cheer students in science learning with a good religious grounding (Zarkasyi, Firmansah, and Rahmadias 2024). This practice will improve the quality of science education in Islamic boarding schools, as the students do not only learn Islamic teaching extensively (Zayyadi et al. 2021), but also science learning via experiement. This will help students be ready to face the 21st century life, where global challenges, for example global warming (Anam, Rufaiqoh, and Sofiah 2024), are inevitable. During the experimental learning, students are encouraged to observe scientific phenomena, record and analyze the data, and finally report their obervation and analysis in a scientific approach (Buzsáki 2025).

Learning through experiment in laboratory is the manifestation of scientific methods. The scientific method is a systems approach used to solve problems or answer scientific questions through study, experimentation, data analysis, and drawing conclusions. In laboratory-based learning, the method provides a basis for students to develop critical thinking skills and solve problems in a structured and accountable manner. The following are the steps of the scientific method applied in

laboratory-based learning: First, *asking questions (problem identification)*. Students see a phenomenon or problem that they want to understand or test. This question often arises from everyday observations or from previously studied material. Example in the Laboratory: Students might ask, "What happens if the air temperature is increased?" or "How does pH affect chemical reactions?". Second, *making hypotheses*. After asking a question, students formulate a hypothesis, which is a temporary guess that can answer the question. The hypothesis should be in the form of a statement that can be tested through experiments. Example in the Laboratory: If the question is, "How does temperature affect chemical reactions?" then the hypothesis could read, "If the air temperature is increased, then the chemical reaction will increase.". Third, *conducting/designing experiments*. *S*tudents conduct/design experiments to test their hypotheses. It involves independent variables, dependent variables, and control variables (which are fixed). Laboratory Example: Students design experiments by heating air to different temperatures (independent variables) and measuring the rate of a reaction (dependent variable). The controlled variables, such as the volume of water or the type of chemical used, remain constant. At this stage, students conduct experiments according to the designed procedures. They must ensure that the experiments are carried out carefully and the data collected accurately. Laboratory Example: Students set up equipment and materials, then heat air to different temperatures, observe the changes, and record the data obtained. Fourth, *recording and analyzing data*. Data obtained during the experiment is recorded systematically. Then, the data is analyzed to see if there is a pattern or relationship between the independent and dependent variables. Laboratory Example: Students record the results of observations, such as the time required for a reaction or color change and organize the data in the form of tables or graphs. After that, they analyze whether the temperature change is related to the reaction rate. Fifth, *drawing conclusions*. Based on the data analysis, students draw conclusions that answer the research question and check whether the proposed hypothesis can be accepted or rejected. Example in the Laboratory: If the data shows that higher temperatures do speed up the reaction, then the hypothesis "If the air temperature is increased, then

the chemical reaction will increase" is accepted. Otherwise, the hypothesis must be rejected or revised. Sixth, *communicating results*. After the conclusion is obtained, students must compile a report that includes the experimental steps, data obtained, analysis, and conclusions. This is an important stage to train students' ability to communicate experimental results scientifically. Example in the Laboratory: Students create an experiment report that includes the purpose, hypothesis, procedure, data, graphs, analysis, conclusions, and possible errors that occurred during the experiment. The last is r*eflection and improvement*. After the experiment is completed, students are invited to reflect on the experiment that has been conducted. They can examine whether there are any improvements that need to be made to the experimental design, or whether the experiment can be repeated in a different way to obtain more valid results. Example in the Laboratory: Students study whether there are variables that are not well controlled or whether there are measurement errors that can affect the results of the experiment.

Experiments with the developed modules showed a remarkable change in attitude in the students, as reported by the teachers. Relating scientific measures to Islamic beliefs, the students sought to sharpen not only their scientific skills but also develop a greater regard for the knowledge of creation and its relation to al-Haqq. This observation is meaningful for indicating that science education can be one of the channels of spiritual development and students may be able to look at science as not only worldly matters but also as a tool with which to search for ultimate divine reality (Hidayah and Az-zafi 2021). Bringing many experiments into the classroom settings, for students to learn science, is the real implementation of science curriculum in Islamic Boarding School. The important of implementation of science curriculum has been elaborated by other researchers, for example (Choeroni et al. 2023; Nuraeni and Irawan 2021;). .

Furthermore, the high percentage of teachers who do not use laboratory for teaching possibly indicates that current teaching practices may rely most on theoretical instruction and limit students in terms of hands-on learning. Indeed, increasing access and familiarity with

laboratory-based teaching could greatly enhance student understanding and engagement (Asmarany et al. 2024; Hidayah and Az-zafi 2021; Syarnubi et al. 2021) . Not only that, researchs have suggested that laboratory-based teaching could also improve students' science process skills (Nurdiansah et al. 2024), performance and perceptions (Shen et al. 2022), attituted towards teamwork (Huitt, Killins, and Brooks 2015), engagement and learning outcomes (Loveys and Riggs 2019) , and confidence and laboratory skills (Beck and Blumer 2012). The benefits of laboratory-based teaching are also reported in many subjects, for example physics (Abdjul, Ntobuo, and Payu 2019), chemistry (Winkelmann et al. 2015),and biology (Fluhler-Thornburg and McKillip 2024).

The survey results, depicted in Figure 4, also pinpoints a clear need to improve the laboratories in terms of infrastructure and equipment. If the resources are not enough, then it would be hard for the teachers to integrate experimental activities that promote active learning, and it may be one of the reasons for the low reported frequency of the use of laboratory facilities. By upgrading the deficiency in facilities at the laboratories, including all the materials needed, the teachers could hold experiments to complement theoretical aspects; thereby, the gap between the theoretical knowledge imparted at classrooms and its practice in the field would be bridged (Mohzana et al. 2023; Wola, Rungkat, and Harindah 2023). Berro et al. (2024) stated that laboratory infrastructures are critical predictors of students' academic performances (Berro et al. 2024). Therefore, laboratory management should be done properly to ensure the high-quality teaching and learning (Devina Istighfarin, Bunga Amarilis Rizky Mauludy, and Farid Setiawan 2024).

Despite limitations in laboratory use and adequacy, most of the teachers responded that the laboratory was "very helpful" in enhancing students' understanding of scientific concepts, while six considered the laboratory "somewhat helpful." This would seem to suggest that when the laboratory is used it actually enhances students' comprehension of subject matter, as mentioned previousely, which is in line with other reported studies (Abdjul et al. 2019; Fluhler-Thornburg and McKillip

2024; Winkelmann et al. 2015) . Practical experiments appear to clarify theoretical concepts as students are allowed to explore scientific phenomena in a more concrete manner. It follows, therefore, that the laboratory could play an increasingly important role in enhancing student understanding in a range of curriculum areas if access to and use of the laboratory were extended (Safkolam et al. 2023).

These findings of the questionnaire reveal that the laboratory is considered a pedagogically important tool for enhancing student understanding and motivation but is presently underutilized and insufficient in its current form. Of interest is the very high rate at which teachers consider the laboratory inadequate and the majority who use it seldom or never, indicative of significant obstacles to the delivery of effective laboratory instruction. The Laboratory facilities in Darul Faqih can be fully utilized to their fullest potential with improvements such as renovation, equipping them, and training teachers in methods of laboratory instruction. This would lead to an active and practical science curriculum that was in line with the mission of the integration of scientific and Islamic education, improvement of the educational experiences, and raising academic performance of students.

5 Conclusion

Community service at Darul Faqih Islamic Boarding School has successfully managed certain priority areas of laboratory development, improvement of resources, and training of teachers. The essential equipment in the laboratory, through the provision of a seminar on Islamic-based management of practical skills and the development of custom-built science experimental modules, has been of major impact to bring improvement in the capacity for practical implementation of science education in the school. The approach of the program in integrating Islamic values into scientific learning effectively nurtures a holistic educational experience, which tallies well with the goals of the Merdeka Belajar curriculum. This was further supported by the evaluation of the teacher profiles and survey results, which was a possible consequence of such developments. Improvement in the resources, training of teachers, and curriculum development will further

equip Darul Faqih with the ability to realize its vision as a science-based Islamic educational institution by establishing an environment that fosters students who possess knowledge in both science and religion. Furthermore, this service makes the integrated laboratory at the Darul Faqih Islamic Boarding School have more complete equipment with the presence of Physics practical tools, namely the Melde Kit, Resonator Kit, Hooke's Law Kit, Transformer Kit, Faraday's Law Kit, Reflection Kit, Refraction Kit, Ohm's Law Kit, Kirchhoff's Law Kit, Archimedes' Principle Kit, Solar Cell Kit, and Hartl Kit. The teachers are also skilled in operating the available tools. This service activity should be continued with the addition of Chemistry and Biology practical tools in order to create a better integrated laboratory.

6 Acknowledgment

We acknowledge Lembaga Penelitian dan Pengabdian kepada Masyarakat Universitas Negeri Malang (LPPM UM) for providing the Community Service Grant No. 4.4.1176/UN32.14.1/PM/2024 in the 2024 fiscal year.

7 Reference

Abdjul, T., N. E. Ntobuo, and C. Payu. 2019. “Development of Virtual Laboratory-Based of Learning to Improve Physics Learning Outcomes of High School Students.” *Jurnal Pendidikan Fisika Indonesia* 15(2):97–106. doi: 10.15294/jpfi.v15i2.12367.

Albar, Mawi Khusni, Tasman Hamami, Sukiman Sukiman, and Akhmad Roja Badrus Z. 2024. “Ecological Pesantren as an Innovation in Islamic Religious Education Curriculum: Is It Feasible?” *Edukasia Islamika* 9(1):17–40. doi: 10.28918/jei.v9i1.8324.

Anam, Nurul, Elok Rufaiqoh, and Sofiah Sofiah. 2024. “Empowering Pesantren as an Anti-Global Climate Change Center in Jember.” *GUYUB: Journal of Community Engagement* 5(3):656–72. doi: 10.33650/guyub.v5i3.8985.

Asmarany, Anugriaty Indah, Djunaedi, Abdul Azizul Hakim, Arif Saefudin, and Loso Judijanto. 2024. “Effective Laboratory Management: Efforts

to Improve Science Education Management in Islamic Boarding Schools." *Jurnal Penelitian Pendidikan IPA* 10(8):5673–80. doi: 10.29303/jppipa.v10i8.8250.

Beck, Christopher W., and Lawrence S. Blumer. 2012. "Inquiry-based Ecology Laboratory Courses Improve Student Confidence and Scientific Reasoning Skills." *Ecosphere* 3(12):1–11. doi: 10.1890/ES12-00280.1.

Berro, Ernesto, Romeo Calonia, Jao Alastra, Justine Asis, Ahleckz Cayao, Ruel Rendon, and Judie Sozalo. 2024. "Laboratory Facilities as Predictors of Academic Performance among Maritime Students." *JPAIR Institutional Research* 22(1):1–25. doi: 10.7719/irj.v22i1.882.

Buzsáki, György. 2025. "From Inhibition to Exciting Science." *Hippocampus* 35(1):e23659. doi: 10.1002/hipo.23659.

Choeroni, Choeroni, Khoirul Anwar, Sarjuni Sarjuni, and Bekti Taufiq Ari Nugroho. 2023. "STEMR as an Integrated Method in Learnings of Religion and Science at Pesantren-Based Madrasa." *Edukasi Islami: Jurnal Pendidikan Islam* 12(02).

Devina Istighfarin, Bunga Amarilis Rizky Mauludy, and Farid Setiawan. 2024. "Management of Facilities and Infrastructure in Teaching and Learning Activities at SMPN 1 Wates." *Beginner: Journal of Teaching and Education Management* 2(1):17–25. doi: 10.61166/bgn.v2i1.45.

Fluhler-Thornburg, Gabriella, and John McKillip. 2024. "Course-Based Undergraduate Research Experiences for Laboratory Learning in the Life Sciences." *Journal of College Science Teaching* 53(1):58–66. doi: 10.1080/0047231X.2023.2292411.

Hidayah, Siti Na'ilul, and Ashif Az-zafi. 2021. "The Role Of The Religious Laboratory In Improving Students 'Understanding Of Fiqh Lessons." *Tafkir: Interdisciplinary Journal of Islamic Education* 2(2):157–74. doi: 10.31538/tijie.v2i2.53.

Huitt, Tiffany W., Anita Killins, and William S. Brooks. 2015. "Team-based Learning in the Gross Anatomy Laboratory Improves Academic

Performance and Students' Attitudes toward Teamwork." *Anatomical Sciences Education* 8(2):95–103. doi: 10.1002/ase.1460.

Islam, Nazmul. 2024. "Synthesizing Sociological Dimensions into Engineering Programs: Challenges for the Sociology Teachers in Bangladesh." *Social Sciences & Humanities Open* 10:101079. doi: 10.1016/j.ssaho.2024.101079.

Loveys, Beth R., and Karina M. Riggs. 2019. "Flipping the Laboratory: Improving Student Engagement and Learning Outcomes in Second Year Science Courses." *International Journal of Science Education* 41(1):64–79. doi: 10.1080/09500693.2018.1533663.

Lucas, Margarida, Pedro Bem-Haja, Fazilat Siddiq, António Moreira, and Christine Redecker. 2021. "The Relation between In-Service Teachers' Digital Competence and Personal and Contextual Factors: What Matters Most?" *Computers & Education* 160:104052. doi: 10.1016/j.compedu.2020.104052.

Mohzana, Mohzana, Hary Murcahyanto, Muh. Fahrurrozi, and Yudi Nur Supriadi. 2023. "Optimization of Management of Laboratory Facilities in the Process of Learning Science at High School." *Jurnal Penelitian Pendidikan IPA* 9(10):8226–34. doi: 10.29303/jppipa.v9i10.5249.

Nuraeni, Reni, and Irawan Irawan. 2021. "Implementation of Scientific Integration Concept Monitoring and Evaluation on The Pesantren Learning Curriculum." *Altanzim: Jurnal Manajemen Pendidikan Islam* 5(2):86–95. https://doi.org/10.33650/al-tanzim.v5i2.2186

Nurdiansah, Ihsan, Endang Surahman, Yanti Sofi Makiyah, and Elis Kurnia. 2024. "The Effect of Laboratory-Based Blended-Project Based Learning Model on The Science Process Skills of Students." *Jurnal Pendidikan Fisika Indonesia* 20(1):74–84. doi: 10.15294/jpfi.v20i1.43491.

Safkolam, Roswanna, Prasart Nuangchalerm, R. Ahmad Zaky El Islami, and Phurkhonni Saleah. 2023. "Students' Understanding of Nature of Science in Islamic Private School." *Jurnal Pendidikan Islam* 9(1):1–14. doi: 10.15575/jpi.v0i0.21308.

Shen, Jing, Hongyan Qi, Yingying Chen, Ruhuan Mei, Cencen Sun, and Zhengyang Wang. 2022. "Incorporating Modified Team-Based Learning into a Flipped Basic Medical Laboratory Course: Impact on Student Performance and Perceptions." *BMC Medical Education* 22(1):608. doi: 10.1186/s12909-022-03676-1.

Syarnubi, Syarnubi, Firman Mansir, Mulyadi Eko Purnomo, Kasinyo Harto, and Akmal Hawi. 2021. "Implementing Character Education in Madrasah." *Jurnal Pendidikan Islam* 7(1):77–94. doi: 10.15575/jpi.v7i1.8449.

Tukiyo, Tukiyo, Purwo Haryono, Syamsul Arifin, Ari Kartiko, and Fahlulia Rahma Shofiana. 2022. "Improving Multiliteracy Ability in the Integration of Islamic and Science Learning." *AL-ISHLAH: Jurnal Pendidikan* 14(4):6025–38. doi: 10.35445/alishlah.v14i4.2433.

Winkelmann, Kurt, Monica Baloga, Tom Marcinkowski, Christos Giannoulis, George Anquandah, and Peter Cohen. 2015. "Improving Students' Inquiry Skills and Self-Efficacy through Research-Inspired Modules in the General Chemistry Laboratory." *Journal of Chemical Education* 92(2):247–55. doi: 10.1021/ed500218d.

Wola, Brian Ricard, Jovialine Albertine Rungkat, and Gerry Michael Donad Harindah. 2023. "Science Process Skills of Prospective Science Teachers' in Practicum Activity at the Laboratory." *Jurnal Inovasi Pendidikan IPA* 9(1):50–61. doi: 10.21831/jipi.v9i1.52974.

Zarkasyi, Azmi, Defi Firmansah, and Thoriq Majid Rahmadias. 2024. "Development of Critical Thinking Skills in Modern Islamic Boarding School." *JIE (Journal of Islamic Education)* 9(2):679–701. doi: 10.52615/jie.v9i2.400.

Zayyadi, Ach., Ruqayyah Miskiyah, Nur Wahyuni Rahmaniyah, Siti Arifah, Wildatul Islamiyah, Nur Aisyah, and Wardani Sholehah. 2021. "Pendampingan Hafalan Al-Qur'an Melalui Metode Finger Qur'an Di Pesantren." *GUYUB: Journal of Community Engagement* 2(1):26–37. doi: 10.33650/guyub.v2i1.1953.