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Does Laboratory Matters in Today's High School Learning Environment?

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ABSTRACT

The study focused into the relationship between laboratory importance perceptions and academic performance in biology among private and public school students. Study sample involving 165 students from 5 private and 6 public senior high school across South Sulawesi, Indonesia. All private school only possessed an integrated science lab, while all public school owned at least 3 science labs (biology, chemistry, and physics). Evaluation on laboratory importance and biology test results proceed to reveal the importance of having designed laboratory to enhance biology learning outcome in the middle of technological advancement, where learning resource vary across platforms. Surprisingly, private schools, despite having lower scores in laboratory importance perception, achieved superior results in biology tests compared to public schools. This suggests that while laboratory experiences are valuable, they may not be the sole determinants of academic success. Other factors like teaching methods, curriculum depth, and student motivation likely contribute significantly. These findings highlight the complexity of factors influencing student performance in biology and the need for a comprehensive approach to education. Understanding these dynamics can inform educational policies including funds allocation in a school and practices to optimize learning outcomes in biology subjects.

Keywords: Laboratory; senior high school; biology learning; school management.

INTRODUCTION

School facilities or specifically the laboratory(es) where applicable science theories demonstrated and being taught to the student (secondary high school) is a crucial component of a school to help improve and enhance the overall learning experience. These spaces serve as practical hubs where students can apply theoretical knowledge, conduct experiments, and develop crucial scientific skills. A well-equipped and organized laboratory environment not only reinforces classroom learning but also fosters a deeper understanding of complex scientific concepts (Ali & Ullah, 2020; Shahzadi, 2023). Students benefit immensely from hands-on

experiences in laboratories, as these experiences bridge the gap between theory and practice, allowing them to connect abstract concepts with real-world applications.

Laboratory(es) plays a significantly impactful role in learning process by enabling students to develop objective skills such as data collection methods, measurement techniques, and data analysis. Furthermore, it fosters the development of skills in data interpretation, drawing conclusions, formulating hypotheses, and making inferences. Students' attitudes towards scientific thinking, honesty, and acceptance of new knowledge truths are also crucial aspects. By the pedagogical-psychological perspective, laboratories (Biology – Physics – Chemistry or integrated science lab) provides students with the opportunity to actively engage in actions related to the material being studied, thus capturing their attention and involvement.

However, laboratory(es) are expensive to be managed. The education budget allocation in Indonesia's national budget has seen significant growth over the years, with the largest portion allocated through TKDD (transfers to rural and village funds), followed by BPP (central government expenditures) and Budget Financing. From IDR370,810.2 billion in 2016, the education budget increased to IDR460,316.8 billion in 2019, representing an average annual increase of 7.5%. In 2020, the education budget outlook rose significantly to IDR547,833.2 billion, marking a 19.0% increase from the previous year, driven mainly by adjustments due to the Covid-19 pandemic's impact. This increase reflects efforts to maintain the education budget at 20% of the national expenditure, requiring adjustments to accommodate the educational needs. In 2021, the central government's education budget totals IDR184,535.6 billion, allocated for various purposes including implementing policies like KIP, BOS, and KIP (subsidy for academically promising high school graduates with economic limitations). The Pre-work card program remains a priority, with an allocation of IDR10.0 trillion in the 2021 budget aimed at economic recovery post-pandemic. The government also focuses on vocational strengthening through industry partnerships, revitalizing 895 vocational schools, 52 vocational and professional study programs, and 8 polytechnics (Faranto, 2020; Hastuti, 2019; Kurba, n.d.).

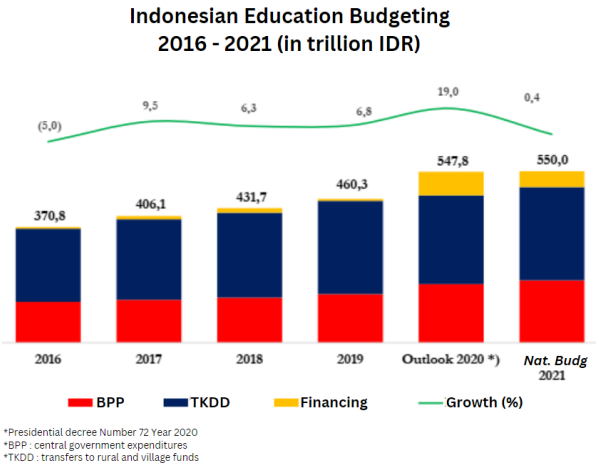

Figure 1. Indonesian national budgeting for education (edited from Ministry of Finance website : Kurba, n.d.)

The increasing rate of educational funding is an indicator of improving effort to deliver better education landscape in Indonesia. However, effectivity – efficiency of the money allocation needs to be evaluated. All government school (public school) in Indonesia get BOS funding (School Operational Aid) as a subsidy for the students also to maintain any processes in the school. Survey from +30 public schools across South Sulawesi, Indonesia revealed that more than 20% of BOS allocated to support the laboratory (varied across schools, depends on location [rural/urban] and student ratio). Moreover, our prelim survey found that many private owned secondary high schools doing science lab practice in one room of integrated laboratory. Different as the private, public high schools mostly separate their laboratory depending on the subject such as biology, physics, and chemistry laboratory, which means more budget allocation needed (Mulya, 2019; Pontoh et al., n.d.).

With the growing market for educational business and the more liberated learning atmosphere, evaluating the effectiveness of having sufficient and proper laboratory to help improve learning outcomes is crucial, especially to shape the financial structure and school administration both technically and curriculum-based. Main question raised in this research is the importance between old-style laboratory or upgrading the learning environment into IT-integrated activities which both served "real-life evidence" testing to the student, which still can be done in regular class (Doruk & Sarikaya, 2023; Okebukola et al., 2020). This research covers the pedagogical aspects modern learning in biological field by evaluating the current needs of learning facilities such as biology laboratory to help improve students' learning outcome. The research helps to shape the insight for future school management, especially classroom administration and funding allocations.

METHOD

We survey 11 schools across South Sulawesi Province in Indonesia, consisting of 5 private schools and 6 public schools. Private school chosen to fulfil the school lab criteria, which mostly merge the science lab in one room, while public schools meets our criteria of separated science laboratory. Survey covers the school budget allocation for laboratory (private schools – interview with the school treasurer; public schools – BOS allocation) and learning outcomes (test grade). We are focusing only on biology subject as it requires most activities in laboratory.

Biology test given to the 12^{th} grade students (Indonesian curricula – last year for secondary high school). Clustered sampling were applied by choosing the 5 highest rank students in 3 best class according to the biology teacher evaluation (can be 12^{th} class 1 to 3 or 12^{th} class A to C). A set of multiple choice of 30 questions covering 10^{th} to 12^{th} grade bio – subject matters. All questions specifically chosen from the past national examination questions and specifically pick only questions with practical requirements in class (see attached files).

Mix method data analysis done by combining descriptive data from the lab survey and inferential analysis of students test grade. Descriptive data covers the lab evaluation by the students (see table), while private and public school group test grade differences will be analyzed both using descriptive and inferential approach using T-test.

Table 1
Laboratory importance evaluation by students

Dimension	Statement Items	Code
Practical Activities	Through practical activities in the laboratory, students can provide scientific work skills and increase their skills in using practical tools/media.	**X11**
	Biology learning is enriched by incorporating practical activities in a laboratory.	**X12**
	Laboratory activities complement both theoretical and practical lessons.	**X13**
	Biology practicum sessions are conducted frequently.	**X14**
Laboratory Conditions	The biology laboratory at this school has its own dedicated space.	**X21**
	Rules and regulations are in place within the biology laboratory.	**X22**
	Tools and materials in the laboratory are organized according to their functions.	**X23**
	The presence of damaged equipment at the start of a practicum is acknowledged and never changed (at least in this last one year).	**X24**
	The availability of all necessary tools is not guaranteed at the beginning of a practicum and booked just a moment before doing practicum.	**X25**
Practicum Scheduling	Practical sessions are scheduled concurrently with theory sessions.	**X31**
	It is preferred to conduct practicum sessions multiple times per week.	**X32**
	If impractical during regular hours, conducting practicums in the afternoon after classes is acceptable.	**X33**
	Agreeing to repeat failed practicums outside of class hours is beneficial.	**X34**
	Teachers may provide guidance on certain material before practicum (instead of just looking at the inquiry activities on the book).	**X35**
	During practicum, supervision by an assistant without a teacher is acceptable.	**X36**
Report and Evaluation	Every practicum requires a corresponding report.	**X41**
	Agreeing to an oral or written test before or after practicum is necessary.	**X42**
	Practicum grade should be major, than theoretical assessment.	**X43**

RESULT AND DISCUSSION

Result

Laboratory Importance Domains Evaluation

Practical activities, being a cornerstone of hands-on learning, receive acknowledgment from both groups, although with varying degrees of enthusiasm. Private school students, with a mean

score indicating a moderate perception (around 2.97 out of 5), express a desire for more extensive or diverse practical engagements to enhance their understanding of scientific concepts. In contrast, public school students exhibit a significantly positive view (around 3.98 out of 5) towards practical activities, indicating a strong appreciation for the experiential learning provided in their laboratory experiences.

The assessment of laboratory conditions reflects similar trends, with private school students indicating a somewhat positive perception (around 3.05 out of 5), acknowledging the quality of facilities while also identifying areas for improvement. Conversely, public school students demonstrate a highly positive view (around 3.97 out of 5) of laboratory conditions, reflecting satisfaction with well-equipped and organized laboratory spaces that facilitate effective learning and experimentation.

When evaluating practicum scheduling, both private and public school students generally agree with the timing and frequency of practical sessions, albeit with slight variations. Private school students show a slightly higher level of agreement (around 3.17 out of 5), suggesting relative satisfaction with the current schedule but also room for optimization. Public school students express overall satisfaction (around 3.49 out of 5) with practicum scheduling, indicating that the timing and frequency of practical sessions meet their expectations while also recognizing opportunities for further enhancement.

In terms of report and evaluation processes, private school students exhibit a moderate perception (around 3.00 out of 5), indicating value in the reporting and evaluation of their practical work but also a desire for more comprehensive feedback or assessment methods. Conversely, public school students hold a positive view (around 3.56 out of 5), suggesting that they feel their practical work is adequately assessed and valued, contributing significantly to their learning outcomes.

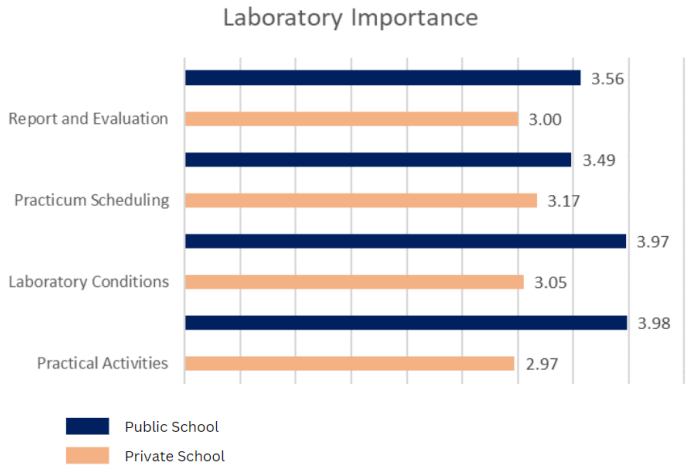

Figure 2. Summary of student perception towards laboratory importance

In examining the data for Practical Activities, significant differences in mean scores were observed between private and public school students across various statement items. For instance, private school students showed lower mean scores compared to public school students in several areas. Notably, public school students demonstrated a significantly more positive

perception ($p < 0.000$) regarding the enrichment of biology learning through practical activities (statement X12) and the complementarity of laboratory activities with theoretical and practical lessons (statement X13). This indicates a higher level of confidence and appreciation among public school students for hands-on learning experiences and their integration with classroom teachings. However, both groups generally agreed on the frequency of biology practicum sessions (statement X14), with public school students expressing slightly higher agreement. These findings suggest a potential disparity in the perceived benefits and engagement levels related to practical activities between private and public school settings.

There were significant variations in the mean scores between students from private and public schools when the data for Laboratory Conditions was analyzed. Public school students consistently demonstrated higher mean scores compared to their private school counterparts across various statement items within this domain. Specifically, public school students exhibited significantly more positive perceptions ($p < 0.000$) regarding the presence of rules and regulations in the biology laboratory (statement X22) and the organization of tools and materials based on their functions (statement X23). This suggests a higher level of satisfaction and adherence to established protocols and practices within the laboratory setting among public school students. Moreover, public school students also indicated a stronger acknowledgment ($p < 0.000$) of damaged equipment at the start of a practicum and its unchanged status (statement X24), as well as the availability of all necessary tools before a practicum (statement X25). These findings imply a greater sense of preparedness and reliability in laboratory resources and maintenance within public school environments compared to private schools. Data highlights significant differences in perceptions regarding laboratory conditions between private and public school students, with public school students consistently expressing more positive views and confidence in the organizational aspects and functionality of their biology laboratories.

When analyzing the data regarding Practicum Scheduling, distinct variations in mean scores emerged among private and public school students. Public school students generally demonstrated slightly higher mean scores compared to private school students across statement items within this domain. For instance, public school students indicated a higher level of agreement ($p < 0.05$) regarding the preference for multiple practicum sessions per week (statement X32) compared to private school students. This suggests that public school students may value more frequent practical engagements to reinforce their learning compared to their private school counterparts. Additionally, although not statistically significant, public school students also expressed a slightly higher acceptance of conducting practicum sessions in the afternoon after regular classes (statement X33) and agreeing to repeat failed practicums outside of class hours (statement X34) compared to private school students. These findings indicate a potential difference in flexibility and adaptation to scheduling challenges among public school students in the context of practical learning experiences. Furthermore, both private and public school students generally agreed on the importance of teacher guidance on certain subject matter before practicum sessions (statement X35), although public school students showed a slightly higher mean score. However, there was no significant difference between the two groups regarding supervision during practicum sessions (statement X36).

The data analysis of Report and Evaluation domain revealed interesting insights into the perceptions of private and public school students. Public school students tended to show slightly higher mean scores compared to private school students across statement items within this domain. This suggests a general positive outlook among public school students regarding the

reporting and evaluation processes associated with practicum sessions. Specifically, public school students demonstrated a slightly higher level of agreement (although not statistically significant) with the requirement for a report for every practicum (statement X41) and the necessity of an oral or written test before or after the practicum (statement X42) compared to private school students. This indicates that public school students may perceive these assessment components as integral to their learning and skill development in practical settings. Additionally, while both private and public school students generally agreed on the importance of practical work being majorly assessed compared to theoretical evaluations (statement X43), public school students exhibited a slightly higher mean score in this aspect. Although not reaching statistical significance, this trend suggests a greater emphasis on practical skills assessment among public school students.

Table 2
Statement item responses mean difference

Statement Items	Mean score (Private School)	Mean score (Public school)
X11***	2.76	4.00
X12***	2.79	3.92
X13***	3.15	4.04
X14***	3.19	3.97
X21***	2.92	3.97
X22***	3.03	3.77
X23***	3.11	4.17
X24***	3.19	3.92
X25***	3.01	4.04
X31	3.12	3.44
X32	3.37	3.63
X33*	2.96	3.63
X34	3.25	3.33
X35	3.44	3.51
X36**	2.89	3.36
X41	3.05	3.50
X42	2.92	3.66
X43	3.03	3.53

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.000$; Xs coded as
Table 1

Biology Test Result

Mean scores of the biology test given shown that private school students achieved an average score of 65.6, while public school students had a slightly lower mean score of 62.85. This indicates that, on average, private school students performed slightly better in the biology test compared to their counterparts in public schools. Looking at the standard deviation, both groups had similar variability in their scores, with private school students having a standard deviation of 18.9 and public school students at 18.92. This suggests that the spread of scores within each group was relatively consistent. The upper quartile and lower quartile values provide insights into the distribution of scores. Private school students had higher upper and

lower quartile scores (83.3 and 46.67, respectively) compared to public school students (73.33 and 46.67, respectively). This indicates that a larger proportion of private school students scored higher marks in the biology test compared to public school students. Examining the kurtosis and skewness values provides information about the shape and symmetry of the score distribution. Both private and public school students' score distributions showed negative kurtosis, indicating a relatively flat shape with less extreme scores compared to a normal distribution. Additionally, the skewness values close to zero suggest a near symmetrical distribution of scores for both groups, with no significant skew towards higher or lower scores.

Table 3
Biology test result

Biology Test Result	Private School	Public School
Mean	65.6	62.85
St. Dev	18.9	18.92
Upper Quartile	83.3	73.33
Lower Quartile	46.67	46.67
Kurtosis	-1.39	-0.721
Skewness	0.050	0.388

Interaction of Student's Lab Importance Perception to Bio-Test Results

The regression analysis results reveal important insights into the relationship between certain domains and student grades in Biology test questions, particularly within private and public school settings. One significant finding is related to Practicum Activity, where a notable positive relationship was observed for public school students ($\beta = 9.055$, $p = 0.053$). This indicates that increased involvement in practicum activities is associated with higher grades among public school students, although the level of significance is slightly above the conventional threshold of $p < 0.05$. Another significant finding pertains to Report and Evaluation processes, notably impacting public school students. Here, a significant negative relationship was found ($\beta = -6.97$, $p = 0.007$), suggesting that factors related to reporting and evaluation practices may have an adverse effect on student performance in Biology test questions among public school students.

Table 4
Regression analysis of laboratory importance

		unstd. β	S.E.	β	T-value	P-value
Practicum Activity	Private School	-1.868	3.083	-0.073	-0.606	0.546
	Public School	9.055	4.606	0.2	1.966	0.053
Laboratory Condition	Private School	-0.346	4.413	-0.01	-0.078	0.938
	Public School	0.839	4.931	0.017	0.17	0.865
Practicum Scheduling	Private School	1.302	4.48	0.035	0.291	0.772

	Public School	1.518	2.758	0.056	0.551	0.583
Report and Evaluation	Private School	3.254	2.875	0.138	1.132	0.262
	Public School	-6.97	2.527	-0.282	-2.758	**0.007**

The F-test results provide valuable insights into the relationship between the mean scores of Laboratory Importance domains and students' Biology test grades, categorized by private and public school settings. For private school students, the F-value of 0.464 with a corresponding p-value of 0.762 suggests a lack of significant relationship between the mean scores of Laboratory Importance domains and their biology test grades. This indicates that variations in how private school students perceive the importance of laboratory aspects do not have a substantial impact on their actual performance in the biology test. In contrast, for public school students, the F-value of 3.142 with a p-value of 0.018 indicates a statistically significant relationship between the mean scores of Laboratory Importance domains and their biology test grades. This suggests that how public school students perceive the importance of laboratory conditions, scheduling, and evaluation processes can significantly influence their performance in the biology test.

Table 5
Multiple regression analysis result

	F-value	**P-value**
Private School	0.464	0.762
Public School	3.142	0.018

Discussion

Factor Influencing Students Performance

Various elements play a crucial role in shaping how students engage with and comprehend the subject matter. One key aspect is the diversity in teaching methods employed across private and public schools. For example, private schools may often adopt innovative teaching strategies such as project-based learning or collaborative group activities, which can encourage a deeper understanding of biology concepts and encourage critical thinking skills. Thus, students in private schools may get higher test results. On the teacher side, our note revealed that the pressure given by extensive evaluation by peer, headmaster, or the curricula administrative is another driving factor to improve their capability in teaching (Poster, 2005). In addition, some expressed that they would improve their self as a token of appreciation to the school administration that allow them to pursue their carrier. School strict administration may influence a subconscious encouragement to the teacher in order to meet the expected criteria lined by the upper administrative person. However, in management field, this may sound unrelated with common knowledge, as excessive burden might bring bad influence to the employee (in this case, teachers) (Heath & McCann, 2021; Milligan et al., 2022; Milosevic et al., 2020)

On the other hand, public schools might rely more on traditional lecture-based approaches, potentially impacting students' ability to apply theoretical knowledge to practical scenarios tested (Elfaki et al., 2019), especially in the biology test. Our observation and note from teachers' response revealed that due to the teaching experience, many express that their main achievement is to earn the certification or work experience as the basic requirement of public

service registration. Additionally, some express that the salary was not enough to meet their expectations. Instead of improving their self by attending workshops or to take additional lessons about teaching, the money they earn just enough to support their day-to-day needs. In fact, most of the teacher we interacted are honorary employee. Moreover, differences in curriculum content and depth of coverage between private and public schools can significantly influence student performance. Private schools may have more resources to offer comprehensive and in-depth lessons on various biology topics, while public schools may face constraints that limit the breadth and depth of curriculum delivery which also related to their funds limit and allocations restrictions due to administrative factors. However, the fact that teachers in public schools often be trained by education-trainers, arranged by The Education Quality Assurance Agency (LPMP) under the Ministry of Education of Indonesia is another issue regarding our findings of the way of teaching in public schools.

Our findings align with the understanding that the diversity in teaching methods between private and public schools significantly impacts student performance in biology. Data reveal that private schools often employ innovative teaching strategies such as project-based learning and collaborative group activities, leading to a deeper comprehension of biology concepts and the development of critical thinking skills among students as it widely known in educational field (Bishop et al., 2020; McMahon, 2009). Conversely, public schools tend to rely more on traditional lecture-based approaches, potentially hindering students' ability to apply theoretical knowledge practically, as assessed in the biology test.

Factors such as teacher-student interactions, classroom environment, and motivation levels also contribute to student performance. For instance, supportive and engaging teachers who provide personalized attention and meaningful feedback can positively impact students' confidence and motivation to learn. Similarly, a positive classroom environment that promotes active learning, encourages curiosity, and fosters collaboration among students can enhance their overall learning experience and performance on assessments (Sugita & Takeuchi, 2010).

Importance of Having Laboratory in Biology Teaching and Learning

Our data strongly suggest that laboratory experiences doesn’t play a crucial role in enhancing students' understanding and application of biology concepts. Private schools, as highlighted in our data, often provide well-equipped laboratories but supported with innovative teaching methods, focusing on other learning experiences that significantly contribute to students' knowledge assimilation and accommodation (Bishop et al., 2020). Practical activities supplemented with various and much updated learning sources and experiences, such as IT-integrated experiments and group projects, not only reinforce theoretical knowledge but also develop critical thinking skills, problem-solving abilities, and scientific inquiry among students in private school, where the laboratory importance is not in a very well acknowledged by the students (Mohd Elmagzoub Babiker, 2015; Scherer et al., 2019; York-Barr & Duke, 2004).

In contrast, public schools face challenges in providing comprehensive laboratory experiences even with better acknowledged by the students, as indicated by our findings. Efforts are made to optimize laboratory conditions, organize practical sessions, and integrate hands-on activities into the curriculum, though to a lesser extent compared to private schools. The significance of laboratory experiences extends beyond the assimilation and accommodation of theoretical knowledge. Our findings suggest that laboratory activities should promote deeper conceptual understanding, foster scientific skills development, and encourage active

engagement in the learning process (Riswanto et al., 2019), but somehow failed to be meaningful to the student as seen on the bio-test.

Moreover, the positive impact of laboratories on students' knowledge is further amplified when combined with effective teaching methods, supportive classroom environments, and motivated educators (Broom, 2015; Solari et al., 2023; Tang et al., 2023). Our data point out the dependency of laboratory in public school as the one of the learning source and facility especially for biology in secondary high school.

Educational Policy Implications

Our findings have important implications for educational policy that should be considered in order to maximize resources and enhance student learning, especially when it comes to funding, particularly laboratory importance to support learning assimilation and accommodation in biology subject. Our findings demonstrate how inconsequential of having laboratories in school. As the learning world developed with better IT infrastructure and various learning source and method, the importance of having a physical and separated laboratory is questioned. Thus, proper funding for laboratory facilities, supplies, and equipment should be less priority in educational programs, at least in a public school (Cheng, 2022).

In private schools, where resources are relatively abundant, the challenge lies in ensuring efficient funds allocation to maintain the quality of laboratory facilities and activities without unnecessary overspending, or to improve the existing class with better IT-integrated learning facilities. Our findings suggest that private schools with worse laboratory perception by their students, resulted in better test result than the students in public school where they perceive better the lab importance (Poster, 2005). However, educational policies in private schools should emphasize strategic budget management to minimize unnecessary expenses while maximizing the impact of existing laboratory. Some subject matters might require physical activity such as traditional biotechnology (making tempeh, yogurt, scooby for kombucha, or other products).

One way to minimize funds allocation without compromising the quality of laboratory education is through effective education administrative practices. This includes regular assessment and evaluation of laboratory resources, maintenance plans for equipment, and optimizing the use of existing resources through collaborations with external partners or shared facilities (Pekkolay, 2021). Educational policies should also encourage innovative cost-saving measures, such as digital simulations or virtual laboratories, to supplement hands-on experiences where feasible (Grace, 1995).

CONCLUSION

Private schools, despite scoring lower in their perception of laboratory importance compared to public schools, achieved better results in the biology test. This discrepancy suggests that laboratory experiences, while undoubtedly important, may not be the sole determinant of academic performance in biology. Other factors such as teaching methods, curriculum depth, teacher-student interactions, and student motivation likely play significant roles in influencing students' understanding and performance in the subject. While laboratories remain valuable educational assets, contribute to students' hands-on learning experiences, the impact may be influenced by various contextual and instructional factors within the educational environment, including teacher's hands-on influence on their students. However, the analysis did not include

the socio-economic status of the students, as it may influence the way students learn and school resources quality.

REFERENCES

Ali, N., & Ullah, S. (2020). Review to Analyze and Compare Virtual Chemistry Laboratories for Their Use in Education. *Journal of Chemical Education*, *97*(10), 3563–3574. https://doi.org/10.1021/acs.jchemed.0c00185

Bishop, P. A., Downes, J. M., Netcoh, S., Farber, K., DeMink-Carthew, J., Brown, T., & Mark, R. (2020). Teacher Roles in Personalized Learning Environments. *The Elementary School Journal*, *121*(2), 311–336. https://doi.org/10.1086/711079

Broom, C. (2015). Empowering students: Pedagogy that benefits educators and learners. *Citizenship, Social and Economics Education*, *14*(2), 79–86. https://doi.org/10.1177/2047173415597142

Cheng, Y. C. (2022). *School Effectiveness and School-Based Management*. Routledge. https://doi.org/10.4324/9781003267980

Doruk, O., & Sarikaya, R. (2023). An Examination of the Studies Between 2013-2022 on the Use of Virtual Laboratories in Science Education. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *43*(3), 1451–1485. https://doi.org/10.17152/gefad.1264589

Elfaki, N. K., Abdulraheem, I., & Abdulrahim, R. (2019). Impact of E-learning vs Traditional Learning on Student's Performance and Attitude. *International Medical Journal*, *24*(3), 225–233.

Faranto, A. S. D. (2020, February 18). *Penyaluran Dana BOS 2020: Wujudkan Merdeka Belajar!* . Ombudsman Republik Indonesia. https://ombudsman.go.id/artikel/r/artikel--penyaluran-dana-bos-2020-wujudkan-merdeka-belajar

Grace, G. (1995). *School Leadership: Beyond Education Management - An Essay in Policy Scholarship*. UK The Falmer Press.

Hastuti, R. K. (2019, August 19). *Sasar 271 Ribu Sekolah, Dana BOS 2020 Tembus Rp 54,3 T*. CNBC Indonesia. https://www.cnbcindonesia.com/news/20190819190242-4-93121/sasar-271-ribu-sekolah-dana-bos-2020-tembus-rp-543-t

Heath, J. R., & McCann, L. (2021). Leadership lessons untold: A new history of Robert McNamara's World Bank. *Leadership*, *17*(5), 606–627. https://doi.org/10.1177/17427150211010600

Kurba, M. I. H. (n.d). Menyoal Anggaran Pendidikan. Ministry of Finance Indonesia. Accessed through https://anggaran.kemenkeu.go.id/in/post/menyoal-anggaran-pendidikan.

Kurba, M. I. H. (n.d.). *Menyoal Anggaran Pendidikan*. Indonesian Ministry of Finance.

McMahon, G. (2009). Critical Thinking and ICT Integration in a Western Australian Secondary School. *Educational Technology and Society*, *12*(4), 269–281.

Milligan, M., Mankelwicz, J., & See, H. P. (2022). Narcissism as a global barrier to education for sustainable development. *Perspectives in Education*, *40*(3). https://doi.org/10.18820/2519593X/pie.v40.i3.3

Milosevic, I., Maric, S., & Lončar, D. (2020). Defeating the Toxic Boss: The Nature of Toxic Leadership and the Role of Followers. *Journal of Leadership & Organizational Studies*, *27*(2), 117–137. https://doi.org/10.1177/1548051819833374

Mohd Elmagzoub Babiker, A. A. (2015). For Effective Use of Multimedia in Education, Teachers Must Develop their Own Educational Multimedia Applications. In *TOJET: The Turkish Online Journal of Educational Technology* (Vol. 14, Issue 4).

Mulya, C. (2019). Implementasi Pembiayaan Pendidikan Melalui Pengelolaan Dana BOS dalam Meningkatkan Mutu Pendidikan. *Indonesian Journal of Education Management and Administration Review*, *3*.

Okebukola, P. A., Suwadu, B., Oladejo, A., Nyandwi, R., Ademola, I., Okorie, H., & Awaah, F. (2020). Delivering High School Chemistry During COVID-19 Lockdown: Voices from Africa. *Journal of Chemical Education*, *97*(9), 3285–3289. https://doi.org/10.1021/acs.jchemed.0c00725

Pekkolay, S. (2021). Effective School Management. *Journal of Advances in Education and Philosophy* , *5*(8), 231–235.

Pontoh, J., Ilat, V., Manossoh, H., Magister Akuntansi, P., & Ekonomi dan Bisnis Universitas Sam Ratulangi, F. (n.d.). Analisis Pengelolaan Dana Bantuan Operasional Sekolah (BOS) pada Satuan Pendidikan Dasar di Kota Kotamobagu. *E-Journal UNSRAT*, 223–232.

Poster, C. (2005). *Restructuring: The Key to Effective School Management* (S. Blandford & J. Welton, Eds.). Routledge.

Riswanto, Suseno, N., Partono, Harjati, P., & Dedy, H. (2019). School Laboratory Management Information System. *Journal of Physics: Conference Series*, *1361*(1), 012068. https://doi.org/10.1088/1742-6596/1361/1/012068

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, *128*, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

Shahzadi, I. (2023). Role of Laboratories and Science Teaching Material in Science Teaching and Students Learning at Secondary Level in Public Schools. *Journal of Development and Social Sciences*, *4*(II). https://doi.org/10.47205/jdss.2023(4-II)23

Solari, M., Vizquerra, M. I., & Engel, A. (2023). Students' interests for personalized learning: an analysis guide. *European Journal of Psychology of Education*, *38*(3), 1073–1109. https://doi.org/10.1007/s10212-022-00656-3

Sugita, M., & Takeuchi, O. (2010). What can teachers do to motivate their students? A classroom research on motivational strategy use in the Japanese EFL context. *Innovation in Language Learning and Teaching*, *4*(1), 21–35. https://doi.org/10.1080/17501220802450470

Tang, Q., Zhang, T., & Jiang, L. (2023). Influence of blended instruction on students' learning effectiveness: the role of Flow. *Education and Information Technologies*, *28*(2), 1891–1909. https://doi.org/10.1007/s10639-022-11224-z

York-Barr, J., & Duke, K. (2004). What Do We Know About Teacher Leadership? Findings From Two Decades of Scholarship. *Review of Educational Research*, *74*(3), 255–316. https://doi.org/10.3102/00346543074003255