

Strengthening the Role of Laboratories with Authentic Assessment of Student Life Skills

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ABSTRACT

The practicum experience in laboratory settings plays a pivotal role in cultivating essential life skills among students. This study investigates the efficacy of laboratory-based practicums in fostering students' life skills through the utilization of authentic assessment methods. Employing a pre-experimental approach with a one-shot case study design, the research focuses on 5th-semester Physics students engaged in practicum activities, totaling 26 participants. Purposive sampling was employed to determine the research sample. Data collection involved observation techniques, life skills questionnaires, and interviews to evaluate laboratory utilization. Descriptive statistics were employed for data analysis. Findings reveal that practicum-based authentic assessments yield commendable results in students' life skills development, with an average score of 3.73, indicating proficiency. The practicum experience in the laboratory setting facilitates the cultivation of these skills, positioning students to excel in the contemporary industrial landscape characterized by technological advancements. Beyond mere swiftness, individuals in this era must possess adaptable life skills to effectively fulfill their responsibilities, confront challenges with confidence, and adeptly resolve encountered issues.

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1. INTRODUCTION

Education is the government's effort to improve the quality of Indonesia's human resources. National education functions to develop abilities and shape the character and civilization of a dignified nation in order to make the nation's life more intelligent, aimed at developing the potential of students to become human beings who have faith and are devoted to God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens (Indonesian national education system law number 20 of 2003). To create quality human resources in accordance with national education goals, it is necessary to involve all educational actors who are responsible and know the direction and goals of education. Skills and life skills are an absolute provision

for facing the challenges of life in the millennial era. The process of forming life skills is not instant, it requires a gradual process so that it becomes a habit, and character is formed through continuous education.

The core of science education encompasses three fundamental elements: the scientific process, the products of science, and the cultivation of a scientific attitude. The products of natural science include facts, concepts, principles, laws, and theories, while the learning process primarily involves discovery. Essential scientific attitudes that students are encouraged to develop include curiosity, critical thinking, openness, objectivity, respect for others' work, courage in defending truths, honesty, thoroughness, optimism, cooperativeness, full responsibility, and sensitivity to societal and environmental concerns (Jumini, 2016). This educational approach aligns with governmental efforts to enhance educational quality through the implementation of a scientifically based curriculum, as emphasized by the Minister of National Education Regulation No. 22 of 2006. This regulation defines science not merely as the mastery of a body of knowledge but as a systematic process for understanding nature, highlighting discovery as a key component. Effective science learning necessitates the optimal use of laboratory facilities to foster these scientific attitudes. However, various factors impede the readiness of all students to utilize laboratory resources effectively in their educational journey. This challenge underscores the need for adaptive strategies to ensure that all students can benefit from hands-on scientific learning experiences.

Based on the results of the survey conducted by Novianti (2011) of several junior high school laboratories indicating that science laboratories are not managed well in accordance with laboratory management standards. Besides the results of the 2019 physics education study program Faculty of Tarbiyah and Education Sciences, University of Al Qur'an Sciences student internship program evaluation, there are still many laboratory facilities that have not been utilized properly, one of which is because teacher resources have not yet mastered the use of several laboratory facilities. Besides, there is no special time for laboratory managers at schools to use the laboratory, so there are several laboratory facilities and infrastructures that are still neglected. For this reason, comprehensive and systematic systems and efforts need to be implemented so that the use of laboratories can truly be done to improve the quality of science learning. Quality education management cannot be separated from good classroom learning management, from planning to assessment. Abdul Majid said that assessment aims to measure the effectiveness of a learning process (Sani, 2015). An educator can evaluate and analyze the quality of learning that has been carried out from the assessment results. The results of this analysis are used as a basis for carrying out further learning programs.

Current learning requires authentic assessment, which not only assesses aspects of knowledge but also integrates a balance between knowledge, attitudes, and skills. Authentic assessment is a form of assessment that requires students to display attitudes, use knowledge and skills obtained from learning in carrying out tasks in real situations. (Fityana et al., 2017). Authentic assessment in a scientific-based curriculum is expected to record validly and reliably the competence of students in terms of knowledge, attitudes and skills. Teachers do not have to wait for learning to finish to be able to carry out assessments, or wait for all the material to be delivered and then carry out assessments at the end of the semester. Each teacher's lesson can pocket the value for their respective students (Muslimin & Amran, 2019).

The results of research conducted by Giyarti, (2015); Rahmawati & Fatimah, (2015); Sani, (2015), that there are still many educators who experience difficulties in implementing authentic assessment in learning due to several reasons, including: 1) educators' understanding of authentic assessment is still lacking; 2) low teacher creativity; 3) f students who are less supportive; 4) lack of authentic assessment training; and 5) insufficient learning time. The obstacle in carrying out authentic assessment in science learning is time management, assessment requires time in planning, implementing and reporting results both technically and administratively (Giyatri, 2015). Besides, the lack of adequate guidelines regarding authentic assessment is an obstacle to the implementation of authentic assessment. Authentic assessment requires students to perform or work on a task or project, while conventional assessment requires students to choose responses from those provided in the assessment tool (Rahmawati & Fatimah, 2015).

So authentic assessment requires quite a lot of time in planning, implementing and reporting assessment results.

A scientific attitude, which is one of the essences of science learning is an important aspect of life skills (Muslimin & Amran, 2019). The formation of a scientific attitude is very appropriate if it is formed and accustomed to learning by optimizing the role of the science laboratory. Learning in the laboratory trains students to be diligent, creative, thorough, careful, curious, critical, open, objective, respectful of others, honest, optimistic, concerned about the environment, able to work together, and responsible (Sani, 2015). Forming this scientific attitude is a process, so the assessment must be authentic. Continuous science learning with correct assessments will be able to accustom students to behave well so that they have a scientific attitude that is able to realize superior life skills.

Based on the description above, it can be concluded that quality science learning needs to be supported by effective management of adequate laboratory facilities and infrastructure, to meet the demands of 21st century learning by maximizing authentic assessment. What is the influence of laboratory-based learning and authentic assessment on student life skills? The aim of this research is to analyze the impact of laboratory learning and authentic assessment on student life skills.

2. METHODS

This research was conducted using a descriptive quantitative approach (Bungin, 2021; Creswell, 2017). The sampling technique was saturated sampling, where one class was taken as the research subject, namely 3rd-semester physics students with a basic physics practicum course totaling 26 students. Data about students' life skills is collected through observation and questionnaires. The questionnaire instrument for measuring life skills is prepared based on several aspects of social life skills (Latisma et al., 2008) and work skills according to Suyono & Hariyanto (Haryanto, 2006), which consists of several indicators, namely: communication, cooperation, self-confidence, maximizing ability direction, working on time, understanding standard procedures, using tools, work safety, productivity, work attitude. This indicator was developed in 40 questions. Questionnaire data were summarized and analyzed using descriptive statistics, reinforced by observation results. The classification of students' life skills assessment in the Basic Physics practicum is determined as follows: this instrument has 40 questions/statements with a minimum score of 1, and a maximum score of 5. So the answer from a respondent has a minimum value of $1 \times 40 = 40$, and a maximum value of $5 \times 40 = 200$, then the class interval distance is $(200 - 40) / 5 = 32$ (Sudaryono et al., 2013). The instrument was distributed to 26 respondents. So the total number of answers from the 26 respondents has a minimum value of $26 \times 40 = 1040$, and a maximum value of $26 \times 200 = 5200$, so the interval is $(5200 - 1040) / 5 = 832$.

Table 1. Student Life Skill Assessment Category

Total score	Average Score	Assessment Classification
172.0 – 200.0	4.3 – 5.0	Very good
139.0 – 171.0	3.5 – 4.2	Good
106.0 – 138.0	2.7 – 3.4	Adequate
73.0 – 105.0	1.9 – 2.6	Not good
40.0 – 72.0	1.0 – 1.8	Very Not Good

Source : (Sudaryono et al., 2013).

3. FINDINGS AND DISCUSSION

Basic Physics Practicum in the physics education study program is held every odd semester for one semester, with a total of around 8-10 practicum titles. Before the practicum, students who participate carry out a pretest, and if they pass, they can continue to the practicum implementation stage. After the practicum, students are required to make a report on the results of their practicum. In

the process of carrying out practicum, several things are observed, including: preparing tools and materials, carrying out practicum, describing observations, interpreting observation results, and reporting practicum results in an interim report. In observing the process of carrying out this practicum, we can see how persistent, tenacity, thoroughness, self-confidence, communication, and responsibility are. Then, at the end of the overall practical implementation, students are given a questionnaire to measure their life skills. A recap of the questionnaire is presented in Table 1 below.

Table 2. Student Life Skills

No.	Question	Amount	Average	Category
1.	I always speak politely to anyone.	106	4.24	Good
2.	I don't want to share the information I got from my practicum results	86	3.44	Adequate
3.	I like to ask teachers or friends if I don't understand the material/how to work in the practicum.	110	4.40	Very good
4.	I'm happy if there is a group assignment, because I don't have to do it.	87	3.48	Adequate
5.	Every time there is a group assignment, I always contribute to my group. (Empathy)	108	4.32	Very good
6.	If there is a group assignment, I will do it optimally.	108	4.32	Very good
7.	I always complete assignments often faster than the specified time.	83	3.32	Adequate
8.	Before the practicum, I prepared the tools and materials that would be used for the practicum.	83	3.32	Adequate
9.	I use the tools in the laboratory according to their use.	108	4.32	Very good
10.	I never use work safety equipment such as masks and gloves when in the laboratory.	63	2.52	Adequate
11.	I often make mistakes during practicum.	83	3.32	Adequate
12.	I shared assignments with a group of friends during practicum. (cooperate).	108	4.32	Very good
13.	I know how to put myself in different situations with other people I am communicating with. (Communication).	105	4.20	Very good
14.	If I receive information that is useful for other people, I try to disseminate it. (Empathy).	105	3.68	Good
15.	I am very confident when presenting the results of my work/group in front of the class.	92	4.24	Good
16.	If there is a group assignment, I always complete the group assignment together. (Cooperate).	106	3.76	Good
17.	I prefer individual assignments to group assignments, so if there is a group assignment I don't contribute.	94	3.4	Adequate
18.	I prioritize completing group assignments first, then completing individual assignments.	85	3.04	Adequate
19.	I am often late in submitting assignments before the specified time.	76	3.04	Adequate
20.	I did the practicum according to my own wishes.	91	3.64	Good
21.	Sometimes I use a dropper to stir.	103	4.12	Good
22.	I enjoy joking with my group of friends during practicum.	71	2.84	Adequate
23.	During practicum, no material is ever wasted.	95	3.80	Good
24.	After completing the practicum, I left the practicum tools and materials on the practice table.	90	3.60	Good
25.	I like to interrupt when my friends are talking.	94	3.76	Good

26.	I didn't have the courage to speak in front of the class.	90	360	Good
27.	I have never been late to school.	82	3.28	Adequate
28.	I did the practicum according to the procedure.	109	4.36	Very good
29.	After completing the practicum, I always clean and return the tools and materials to their original place.	97	3.88	Good
30.	When a friend was presenting his work in front of the class, I told my classmate about it.	99	3.96	Good
31.	I enjoy providing information to friends who need help.	106	4.24	Good
32.	I tend to keep quiet when I have problems.	68	2.72	Adequate
33.	I am not responsible for the assignments given by my group, because I was not involved in making them.	106	4.24	Good
34.	I prioritize completing individual assignments rather than group assignments.	82	3.28	Adequate
35.	Coming late to school is normal for me.	106	4.24	Good
36.	If there are procedural errors in the practicum, I will ask the teacher.	107	4.28	Good
37.	When taking the solution from the container, I immediately poured it into a beaker.	84	3.36	Good
38.	I prefer not to wear shoes during practicum.	71	2.84	Adequate
39.	I always repeat practical work because I always make mistakes.	83	3.32	Adequate
40.	I always plan the work I will do to avoid mistakes at work.	104	4.16	Good
			3.73	Good
Average Score				

According to the data summarized in Table 1, students demonstrated an average life skill score of 3.73, which falls within the good category. Particularly notable is their performance in communication, where they achieved an average score of 4.09, also classified as good. This suggests that students excel in maintaining politeness, appropriately positioning themselves in social interactions, and effectively conveying information. They are adept at respecting conversational norms, such as not interrupting while others speak and paying attention during both formal presentations and casual discussions. These skills indicate a high level of communicative competence, essential for successful interpersonal engagement and collaboration.

The ability to collaborate among students is rated in the good category, with an average score of 4.04. This rating reflects the students' proficiency in contributing effectively to group work, completing tasks collaboratively, actively engaging with their peers, and taking responsibility for shared assignments. Moreover, student self-confidence is exceptionally high, falling into the very good category with an impressive score of 4.32. Students exhibit this confidence by actively participating in discussions, where they readily ask questions, express their opinions, and effectively present their work. They also demonstrate resilience and proactivity when confronted with challenges, ensuring they are neither passive nor silent in problem-solving scenarios. These attributes are indicative of well-developed interpersonal skills and a robust sense of self-assurance, which are crucial for academic and personal success.

Students demonstrate a strong capability to maximize their potential, as reflected in a commendable score of 3.68, categorizing this ability as good. They effectively utilize their skills in completing assignments, whether working individually or collaboratively in groups, showcasing adaptability and competence in diverse work settings. Additionally, their ability to adhere to deadlines is also rated as good, with a score of 3.51. However, while students generally manage to complete

practical assignments, there is room for improvement in timely completion. Many students still require structured guidance to enhance their time management skills, suggesting that targeted support could help them meet deadlines more consistently. Enhancing these skills is crucial for fostering independence and ensuring their readiness for more rigorous academic and professional environments.

Student competency in understanding standard procedures is in a good category, with a score of 3.9. Students can prepare all tools and materials before the practicum is carried out, and carry out the practicum according to the existing stages. If there are errors or doubts, students do not hesitate to consult. This trains students to understand established rules and procedures, thereby minimizing errors. Procedures are created so that the results of a process are in line with expectations. If expectations do not occur or an error occurs, there is a possibility that the procedure will be missed.

The ability to proficiently use tools in the laboratory is rated in the good category, with a score of 3.93. Students demonstrate a clear understanding of the utility and proper handling of various tools, which significantly facilitates their work and contributes to achieving their academic and future career goals. Continuous training in these skills is essential; it ensures that upon graduation, students are well-prepared, not overwhelmed, and can smoothly transition and adapt to new environments in society.

However, in terms of job safety, there is a notable concern as students scored only 2.73. Observations indicate that some students compromise their safety by opting to work without essential protective gear such as shoes and masks. Additionally, despite a focused approach during practicums—evidenced by their seriousness and minimal joking with peers—there remains a need to reinforce the importance of maintaining a safe working environment consistently. Enhancing students' awareness and adherence to safety protocols is crucial for preventing accidents and ensuring a secure learning environment.

Student work productivity is in the quite good category with a score of 3.48. Students are able to make the best use of the available time. Do not use practical tools and materials at will. If what is needed is enough, if there is any remaining it is returned. In this process it appears that students use materials and tools as effectively and efficiently as possible. Likewise during practicum time, if they have finished one stage they immediately move on to the next stage. If this competency is frequently practiced, students will have the character to complete assignments and work as quickly as possible with maximum results, and always think that the next one must be better than the previous one, so that their life can truly be productive.

Student work attitudes have been positively evaluated, receiving a score of 3.88 in the good category. This rating reflects their meticulous planning and execution of tasks, aimed at minimizing errors. They approach their responsibilities with seriousness and diligence. Observations have shown that upon completion of their tasks, students consistently clean and return tools and materials to their designated places, and thoroughly check their work to ensure that everything has been completed to standard. If these competencies are continuously cultivated, they are likely to evolve into habitual practices that foster a responsible character marked by excellent work ethics. Such responsibility, once ingrained, transcends academic environments, equipping students to excel and be reliable in various future settings, reducing concerns about their performance regardless of where they are.

In general, student life skills that can be trained through practicum in the laboratory with authentic assessment are summarized in the diagram in Figure 1 as follows.

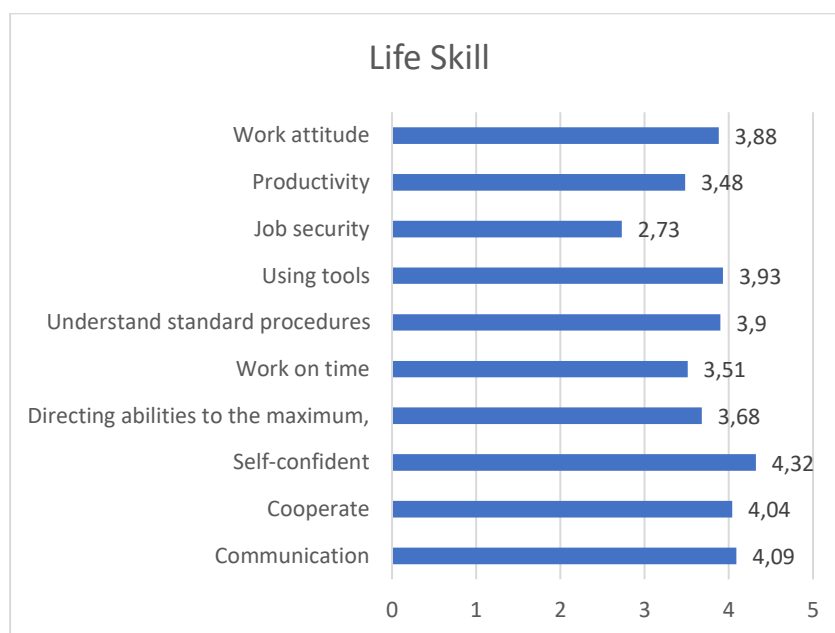


Figure 1. Student Life Skills

Life skills are indispensable in navigating the complexities of daily life and are crucial for effectively managing and resolving various challenges. In the current era of globalization, where global competition intensifies, technological advancements accelerate, and societal issues become increasingly complex, these skills are more vital than ever. The rapid progress in information and communication technology demands that individuals not only adapt quickly but also maintain a competitive edge in a swiftly evolving world.

However, merely possessing the ability to act swiftly does not guarantee success. Comprehensive life skills such as critical thinking, problem-solving, effective communication, and adaptability enable individuals to analyze situations thoughtfully and make informed decisions. These skills empower individuals to excel beyond ordinary levels, handle stress, collaborate effectively, and lead initiatives. Therefore, integrating strong life skills is essential for anyone aiming to thrive rather than just survive in this fast-paced, globalized society. This integration ensures that individuals are well-equipped to meet the demands of modern life and contribute meaningfully to their communities.

Success in the industrial era hinges not only on the ability to act swiftly but also on effective communication, ensuring that one's actions and intentions are clearly understood by others. It is equally crucial to possess strong collaborative skills. In today's interconnected world, individual efforts are often not enough; success frequently depends on our ability to work cohesively with others. Moreover, self-confidence plays a pivotal role, empowering us to face challenges head-on and fully realize our potential.

Discipline is another essential component, guiding us to adhere to plans and meet expectations efficiently. This disciplined approach enables the optimal use of time, energy, and thought, enhancing work productivity and ensuring the achievement of goals. A responsible attitude amplifies this effect, fostering trust and reliability among peers and collaborators. Thus, to truly excel and guarantee success in this fast-paced era, one must combine quick action with a robust set of life skills, crafting a comprehensive approach to personal and professional challenges.

A person's life skills cannot appear suddenly, and are not something instantaneous. It needs to be honed and used. So, there is a need for life skills education. Life skills need to be trained in every lesson, and assessed directly and indirectly. Direct assessment can be carried out by means of authentic assessment when students carry out practicums in the laboratory. Practicum in the laboratory is an

effective way to train students' life skills. Apart from school, parents also need to train their child's life skills. Someone who has life skills will find it easier to adapt to the environment so that they can carry out tasks optimally.

Laboratory activities play a pivotal role in fostering students' life skills, enabling them to achieve a deeper understanding through investigative and explorative tasks. According to Sudarmin et al. (2019), these activities encourage students to engage more actively in exploration, thereby enhancing their grasp of complex concepts. Ramadhani (2017) further emphasizes that laboratory activities are instrumental in implementing Student-Centered Learning (SCL) strategies, which promote independence and allow students to explore knowledge on their own terms.

Additionally, Setiawan (2018) notes that the use of discovery learning models in conjunction with laboratory work significantly advances students' mastery of essential life and career skills. Inquiry-based learning methods, as highlighted by Herman and Yusuf (2016), are particularly effective in laboratory settings. These methods involve students actively in stating problems, formulating hypotheses, designing experiments, and collecting and analyzing data to draw conclusions. Such activities not only enhance cognitive skills but also encourage creativity, critical thinking, and problem-solving.

Moreover, practical laboratory activities, as Fawaida (2019) points out, are vital for training students in independence, hard work, and collaboration. These skills are crucial as they prepare students to handle future challenges effectively, making laboratory work an indispensable part of modern education that equips students with the tools they need to succeed both in life and in their future careers.

The findings of this research are corroborated by Croker's study (2010), which observed that laboratory practice significantly enhances student engagement. Students participating in lab activities were noted for their active involvement, ability to work independently, and increased propensity to ask questions and seek confirmations. Similarly, Wu's research points out that practicums not only allocate more time to discussing experimental results but also emphasize work safety and meticulous data recording during experimental activities, effectively eliminating instances of plagiarism in practicum reports. Further enriching our understanding, Spell et al. (2014) identified a series of skills that students develop in laboratory settings, including experimental design, data collection, data analysis, presentation or publication of findings, hypothesis proposal, generalization of questions, and the initiation of new inquiries. These skills are critical for fostering a comprehensive scientific mindset among students. Moreover, the integration of the STEAM-based Project-Based Learning (PjBL) model in specific contexts like Batik-making practicums has shown a positive impact on students' life skills (Ngatijo, Bemis, R., & Pupitasari, R., 2022; Spell, R.M., 2014). This approach not only enhances technical competencies but also cultivates a richer set of soft skills, preparing students for diverse challenges beyond the academic sphere.

4. CONCLUSION

Laboratory practicums play a crucial role in developing essential life skills, proving instrumental in shaping students' capabilities to high standards, as evidenced by an average life skills score of 3.73. In today's rapidly advancing industrial era, characterized by significant technological advancements, mere quickness is insufficient. Individuals must also possess robust life skills that facilitate adaptability, allowing them to perform optimally. These skills enable individuals to navigate contemporary challenges and effectively address problems they encounter confidently. Thus, the laboratory practicum is not only a foundational academic activity but also a vital training ground for preparing students to thrive in dynamic and complex environments.

Despite these findings, this study acknowledges certain limitations. The assessment of life skills was confined to self-reported measures, which might not fully capture the depth of students' skills and their practical application. Furthermore, the study was limited to a specific academic setting, which

may not be representative of other educational contexts. Future research should consider employing a mixed-methods approach, integrating both qualitative and quantitative data to gain a more comprehensive understanding of how laboratory practicums influence life skills across diverse educational settings. Additionally, longitudinal studies could provide insights into the long-term impact of these practicums on students' professional success and adaptability in the workforce. Investigating different types of laboratory settings and their specific contributions to life skills development would also enrich our understanding of optimal educational practices.

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