PRACTICAL WORK ASSESMENT AT BIOLOGY EDUCATION PROGRAM IN DISTANCE EDUCATION

A. Sapriati*
Faculty of Education and Teacher Training, Universitas Terbuka, Indonesia

M. Sekarwinahyu
Faculty of Education and Teacher Training, Universitas Terbuka, Indonesia

U. Rahayu
Faculty of Education and Teacher Training, Universitas Terbuka, Indonesia

S. Suroyo
Faculty of Education and Teacher Training, Universitas Terbuka, Indonesia

*Correspondence: lia@ecampus.ut.ac.id

ABSTRACT: This paper analyzes the results of a descriptive study of practical work at the Biology Education Program. It was based on distance learning and showed the student's perception of biology practical. Data were collected using document analysis sheets, observations, and questionnaires. The results of the study indicated that assessment is conducted before, during, and after practical work by instructors, lab assistants, or lecturers. The assessment of the skills and abilities was carried out using an observation sheet and document analyses form. Also, an assessment of readiness to carry out the practicum examined the purpose of lab work, description or explanation of equipment and materials used, and work procedures or steps. This study showed that students had positive attitudes towards practical and assumed that all the activities involved, as well as writing reports, were easy, enjoyable, and useful. In general, practical works enhance science knowledge and improve skills.

Keywords: *practical work, assessment, biology education, distance education*

1 INTRODUCTION

Practical work is an integral part of science education, especially for theoretical verification and for inquiry activities (Abrahams & Millar, 2008; Abrahams & Reiss, 2012; Almroth, 2015; A. Hofstein, 2017; Mamlok-Naaman & Barnea, 2012). As part of the curriculum, practical confirm and illustrate the theories, developing students' knowledge and skills (Ferreira & Morais, 2013; Katchevich, Holfstein, & Malok-Naaman, 2013; Sapriati, Rahayu, & Kurniawati, 2013). Without exception, the significance of practical also applies even to in-service training biology education in the distance learning context (Kennepohl, 2010).

In supporting education activities, including distance learning, the implementation of practical work faces several obstacles, including type and tasks involved, conformity of the learning objective with the assessment, time adequacy and supporting facilities, etc. (A Hofstein, 2004; A Hofstein & Lunetta, 2004; Jordan, Ruibal-Villasenor, Hmelo-Silver, & Etkina, 2011; Kennepohl, 2010; Shaw & Carmichael, 2010). For this reason, it is necessary to understand and explore the implementation of practical works and how students perceive them. A teaching-learning program needs to ensure that students gain both practical and non-practical experience and confidence in a lab (Abrahams & Reiss, 2012; Roberts & Reading, 2015). The program has to determine the time to be spent on practical work in order to develop and formally assess the skills gained. In this context, practical work refers to a type of science teaching and learning activities in which students work, either individually or in small groups using real or virtual objects and materials. The virtual tools could be obtained from a DVD, a computer simulation, or a text-based account (Abrahams & Reiss, 2012; Hofstein, 2017). Through practical work, lecturers teach and demonstrate various abilities and skills which need to be implemented in further education and daily life (Hofstein, 2015; Pellegrino, 2013). Therefore, it is vital to identify the skills that are more important and worthy of assessment.

Science practical skills might be direct through the manipulation of real objects to demonstrate skills, or indirect with data and reports assessed (Abrahams, Reiss, & Sharpe, 2013). A framework of the process of design and evaluation of a practical task showed the analytical framework offered a means of assessing the learning demand of practical tasks. It also helped in identifying tasks that require specific support for students' thinking and learning to be effective.

Generally, practical work was effective in providing students with physical objects but ineffective in the use of scientific ideas for actions and reflected upon the collected data (Abrahams & Millar, 2008; Abrahams & Reiss, 2012). The types of skills developed and assessed in science practical work include working according to procedure, formulating research questions and/or make a hypothesis, designing and conducting an experiment, performing various science process skills, taking and recording information and data, analyzing the results, making a conclusion, and writing a summary (Chabalengula, Mumba, & Mbewe, 2012; Ferreira & Morais, 2013; A Hofstein, 2004; Hofstein, 2015; Hofstein, 2017; Lee & Sulaiman, 2018; Liew, Lim, Saleh, & Ong, 2019).

Assessment is critical in students' learning experiences and is an essential part of an aligned curriculum (Biggs & Tang, 2007; Boud & Falchikov, 2006; Care, Kim, Vista, & Anderson, 2018; Guerrero-Roldán & Noguera, 2018). Science assessment uses the system approach designed to support and monitor learning, and to evaluate the effectiveness of science education, using indicators to track education opportunities (Pellegrino, 2016). Additionally, framework-aligned assessments meet the key design elements, valuation variety, multicomponent tasks, and connections among scientific concepts, thus provide an avenue for measuring students’ capacity and progress in this regard (Pellegrino, 2013, 2016).

The assessment should be carried out on both the practical work skills and lab reports (Fadzil & Saat, 2018; A Hofstein, 2004). It should evaluate the understanding of work procedures and safety, practicum readiness and ability (practice skills/ process performance), observational outcomes, attitudes and behavior, and results, including practicum reports (Abrahams et al., 2013; Gobaw & Atagana, 2016; Reiss & Abrahams, 2015; Sapriati et al., 2013).

How to assess practical work skills is an essential component in teaching science, including in teaching biology, how to understand and explore practical work, and how students' perceptions and attitudes toward practical work help to achieve learning objectives properly. The research contributes to the literature providing information of practical work assessment on biology courses in open and distance education, as well as in presenting student’s abilities, skills, attitudes, and perceptions toward biology education programs in open and distance education

2 METHODOLOGY

This was descriptive research on the implementation of practical work assessment of the Biology Practicum Course at Biology Education Program in Universitas Terbuka. The study used a purposive data collection sampling method, with a sample of 52 students, in 2017 from July to October.

The data was collected using document analysis sheets and questionnaires and included student perceptions of readiness and performance and profile of practical work learning assessment and report. The valid data is 45 of 52 students and were analyzed descriptively and quantitatively. Quantitative analysis was performed by calculating the percentage of student responses.

The purpose of the study is to explore the implementation of practical work assessment and analyze how students perceive and carry out practical. On this basis, research questions include (a) the description of practical work biology assessment, (b) students' perceptions of practical work, and (c) how students in their practical work show self-confidence

3 FINDINGS AND DISCUSSION

3.1 *Skills and Abilities in Practical Work*

Assessment is conducted before, during, and after practical work (Practicum Report) by instructors, lab assistants, or lecturers. These individuals provide technical assistance to students during practical sessions. The assessment of the skills and abilities is carried out using an observation sheet and document analyses form. The study showed that assessment of readiness to carry out the practicum involves pre-test about the purpose of lab work, description or explanation equipment as well as the materials used, and work procedures or steps. Importantly, student's abilities assessed in science practical work consist of readiness, manipulating and using the tools/materials, conducting an experiment, improvisation, observing accurately, recording data/information, reporting the result, cleanliness, neatness, and work safety (Sapriati, et al., 2013).

In this case, the score for student performance in the practical process used a scale between 0 (very bad) and 4 (very good). Moreover, assessment aspects of student practical report include (a) Recording of observations (40-60% from total score), (b) Discussion (20-30% from total score), (c) Formulating appropriate conclusions to the objectives and observation (20-15% from total score), and (d) description/explanation of answers to the given questions (20-15% from total score). The skills and abilities are assessed during preparation, and before, during, and after practical work through the session reports.

The assessment involves the analysis of performance in order to demonstrate skills (to plan, implement, and deliver practical results) and knowledge (Hofstein & Mamlok-Naaman, 2007). Therefore, the variables to be assessed include physical skills such as measuring, observing, experimental design, (b) thinking skills, and logic, for instance, formulating conclusions and choosing the method and (c) knowledge of science concepts and materials. Other essential elements include the skills to plan, implement, and deliver practical results (Hofstein & Mamlok-Naaman, 2007). The assessment might be carried out for learning outcomes during practice and practicum products (e.g., observations and reports, or both). In more detail, it might be performed on (1) the understanding of work procedures and safety, (2) the students' readiness for the practicum, (3) work process during the lab sessions, (4) the result of observation, (5) behavior, and (6) practical reports. According to experts, almost all practicum activities (95%) need to assess the results of work processes, or observations, and reports.

3.2 *Student's Perception of Practical Work*

The results showed that the students conducted hands-on labs and practical works to confirm and illustrate the theory of science and use and present their experiences for future teaching. Additionally, the results also indicated that facilities, materials, and instructors were available during the practical sessions.

Moreover, the students had positive attitudes towards practical works and assumed that the activities involved and writing report was easy, enjoyable and useful for them. Consequently, they acknowledge the fact that practical works could enhance their science knowledge and improve their practical work skills. According to students, practical work develops their understanding of scientific concepts, skills, curiosity, and ability to work carefully and systematically (Sapriati et al., 2013). Therefore, practical work attempts to develop students' understanding of concepts, skills, attitudes, and interest in science (Sapriati et al., 2013).

Furthermore, the students felt they were confident in preparing practical work, using online and physical learning materials, conducting observation and experiment, measuring and recording data, drawing conclusions, writing reports, and carrying out lab work. However, they reported that they were less confident in working using the Guidelines independently, conducting multiple experiments, making accurate measurement, performing accurate calculation, analyzing data or information, making a hypothesis, planning the experiment, using a microscope, monitoring biological processes, calculating the concentration of a particular solution, and recognizing bacteria accurately. Moreover, they felt that they have valuable experience after participating in the practicum. These experiences help them obtain additional knowledge and skills, reminding and strengthening biological practices. Besides, they are useful in supporting school learning and career development, providing inspiration in daily life, and improve understanding by being practical, experiencing, or proving themselves. Additionally, students gained experience in supporting the implementation of work; being able to carry out practical activities smoothly with complete facilities, tools and materials, and instructors who assist in practicum; writing practicum reports; obtaining a satisfactory grade, and building networks, cooperation, and excellent partnerships among fellow professionals in future.

4 CONCLUSIONS

The assessments were conducted on skills and behavior of students on readiness, using the tool, and making observation, data/information recording and communicating, and work safety, accuracy, cleanliness, and neatness. The students had positive attitudes towards practical works and assumed that the activities involved, including writing reports, were easy, enjoyable, and useful. The practical works could enhance their science knowledge and improve practical work skills. Therefore, practical works help to develop students' understanding of concepts, skills, attitudes, and interest in science.

5 REFERENCES

Abrahams, I., & Millar, M. 2008. Does Practical Work Really Work? A study of the effectiveness of practical work as a teaching and learning method in school science. *International Journal of Science Education*, 30(14):1945-1969. doi: 10.1080/09500690701749305

Abrahams, I., & Reiss, M. 2012. Practical work: Its effectiveness in primary and secondary schools in England. Journal of Research in Science Teaching, 49(8): 1035-1055.

Abrahams, I., Reiss, M., & Sharpe, R. 2013. The assessment of practical work in school science. *Studies in Science Education*, 49(2): 209-251. doi: 10.1080/03057267.2013.858496

Almroth, B. C. 2015. The importance of laboratory exercises in biology teaching; case study in an ecotoxicology course. *Pedagogical Development and Interactive Learning*, (September), 1-11.

Biggs, J., & Tang, C. 2007. Teaching for Quality Learning at University. Berkshire, UK: Open University Press.

Boud, D., & Falchikov, N. 2006. Aligning assessment with long-term learning. *Assessment & Evaluation in Higher Education*, 31(4): 399–413. doi: 10.1080/02602930600679050

Care, E., Kim, H., Vista, A., & Anderson, K. 2018. *Education System Alignment for 21st Century Skills: Focus on Assessment*.

Chabalengula, V. M., Mumba, F., & Mbewe, S. 2012. How Pre-service Teachers' Understand and Perform Science Process Skills. *Eurasia Journal of Mathematics, Science & Technology Education*, 8(3): 167-176. doi: 10.12973/eurasia.2012.832a

Fadzil, H. M., & Saat, R. M. 2018. Development of Instrument in Assessing Students' Science Manipulative Skills. *MOJES: Malaysian Online Journal of Educational Sciences*, 7(1), 47-57.

Ferreira, S., & Morais, A. M. 2013. *Conceptual Demand of Practical Work in Science Curricula Research in Science Education*, 44(1), 53-80. doi: DOI 10.1007/s11165-013-9377-7

Gobaw, G. F., & Atagana, H. I. 2016. Assessing Laboratory Skills Performance in Undergraduate Biology Students. *Academic Journal of Interdisciplinary Studies*, 5(3), 113-121. doi: Doi:10.5901/ajis.2016.v5n3p113

Guerrero-Roldán, A.-E., & Noguera, I. 2018. A model for aligning assessment with competences and learning activities in online courses. *The Internet and Higher Education*, 38(36-46). doi: 10.1016/j.iheduc.2018.04.005

Hofstein, A. 2004. The laboratory in chemistry education: Thirty years of experience with developments, implementation, and research. *Chemistry Education Research and Practice*, 5(3), 247-264.

Hofstein, A. 2015. The Development of High-Order Learning Skills in High School Chemistry Laboratory:"Skills for Life. *Chemistry Education*, 517-538.

Hofstein, A. 2017. The Role of Laboratory in Science Teaching and Learning. *Science Education*.

Hofstein, A., & Lunetta, V. N. 2004. The laboratory in science education: Foundations for the twenty-first century. *Science education*, 88(1), 28-54.

Hofstein, A., & Mamlok-Naaman, R. 2007. The laboratory in science education: the state of the art. *Chemistry Education Research and Practice*, 8(2), 105-107.

Jordan, R. C., Ruibal-Villasenor, M., Hmelo-Silver, C. E., & Etkina, E. 2011. Laboratory materials: Affordances or constraints? *Journal of Research in Science Teaching*, 48(9), 1010-1025.

Katchevich, D., Holfstein, A., & Malok-Naaman, R. 2013. Argumentation in the chemistry laboratory: Inquiry and confirmatory experiments. *Res Sci Educ*, 43, 317–345. doi: 10.1007/s11165-011-9267-9

Kennepohl, D. 2010. Remote control teaching laboratories and practicals. In D. Kennepohl, & L. Shaw (Eds). Accessible elements: teaching science online and at a distance. Chapter 9. Edmonton, Canada: AU Press, Athabasca University.

Lee, M., & Sulaiman, F. 2018. The Effectiveness of Practical Work in Physics to Improve Students' Academic Performances. *PEOPLE: International Journal of Social Sciences*, 3(3), 1404-1419. doi: 10.20319/pijss.2018.33.14041419

Liew, S. S., Lim, H. L., Saleh, S., & Ong, S. L. 2019. Development of Scoring Rubrics to Assess Physics Practical Skills. *EURASIA Journal of Mathematics, Science and Technology Education*, 15(4). doi: 10.29333/ejmste/103074

Mamlok-Naaman, R., & Barnea, N. 2012. Laboratory Activities in Israel. *Eurasia Journal of Mathematics, Science & Technology Education*, 8(1), 49-57. doi: 10.12973/eurasia.2012.816a

Pellegrino, J. W. 2013. Proficiency in science: Assessment challenges and opportunities. *Science education*, 340(6130), 320-323.

Pellegrino, J. W. 2016. 21st Century science assessment. The future is now. education, 1, 859-2000.

Reiss, M. J., & Abrahams, I. 2015. *The assessment of practical skills. School science review*, 96(357), 40-44.

Roberts, R., & Reading, C. 2015. The practical work challenge: incorporating the explicit teaching of evidence in subject content. *School science review*, 96(357), 31-39.

Sapriati, A., Rahayu, U., & Kurniawati, Y. 2013. Implementation of Science *Practical Work at Faculty of Teacher Training and Educational Science, Universitas Terbuka, Indonesia. In International Conference on Education and Language (ICEL),* 2, 345-350.

Shaw, L., & Carmichael, R. 2010. Needs, costs, and accessibility of the science lab programs. In D. Kennepohl & L. Shaw (Eds). *Accessible elements: teaching science online and at a distance*. Chapter 10.