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A Case Study in West Nusa Tenggara for Automated Feedback of Performance Assessment on Science Practicum to Measure Science Process Skills in University

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Abstract: This study examines respondent and university type responses to science process skills instruments integrated with automated feedback on science practicum performance assessments at 2 state college and 2 private college in West Nusa Tenggara Province. A Kruskal-Wallis test was performed utilizing case study and cluster random sampling. Data was collected using online survey, interviews, and direct observations. Three hundred seventy-six university students and teachers from four universities were studied. Since there was no standard instrument, science process skills performance was not assessed. The assessment results show no statistically significant difference ($p > 0.05$) between state and private college in measuring science process skills integrated with real-time feedback on science practicum. This suggests that neither university has conducted such an assessment. No significant difference in responses between university students and lecturers regarding the measurement of science process skills on performance assessments integrated with real-time feedback in science practicum ($p > 0.05$), implying that university students and lecturers have the same experience. This study advises developing science process skills measurement on performance assessment for real-time science practicum feedback.

Keywords: Performance Assessment; Science Practicum; Automated Feedback; Science Process Skills

Introduction

Science process skills is necessary for information-driven engagement and academic success. Thus, helping students with science process skills acquisition quickly is crucial. While the agenda may seem simple, effective and valid evaluation methods are needed to help students recognize and improve errors and provide lecturers with vital information for necessary interventions.

Performance assessment uses observational data to evaluate student conduct (Ronau et al., 2011; Zhao et al., 2018). The process under consideration is lengthy and uses several instruments and methods, including firsthand observation. Performance assessment involves multiple criteria, predetermined quality standards, and subjective evaluation (Montenegro-Rueda et al., 2021; Wiethe-Körprich and Bley, 2017; Sudirman, 2020). Portfolios, work sample evaluations, and progress charts are some of the tools that are utilized throughout the intensive process (Saleh & Salama, 2018). Observation, testimony, authentic work papers, oral inquiries, written evaluations, project work, case studies, and field assignments are all components of performance-based education systems (Saqr et al., 2017). The process of performance evaluations involves a lot of

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phases. To begin, determine the objective of the evaluation. For this reason, it is necessary to make the purpose of the review more clear (Sudirman et al., 2022; Yan, 2022). Determine the concepts, knowledge, and abilities that are going to be reviewed in the second step. These factors will assess the individual's performance (Dhina et al., 2021). Third, set the individual's target level of achievement. This establishes their performance standard (Tseng, 2016). Finally, the performance review activity or evaluation method must be chosen. These stages help create a successful performance evaluation process (Kruit et al., 2018).

Definition provides a complete knowledge of performance assessment: It involves collecting activity-based data from an evaluated person using many methods and instruments (Bensley et al., 2021). The process of evaluating a performance is typically drawn out and time-consuming. It is widespread practice in the field of education to evaluate students' performance using methods such as portfolios, work sample evaluations, and progress charts (Riantini et al., 2018; Yan, 2022). It is common practice for progress reports to include graphs that display daily activities, success scores, and student names. Students' abilities cannot be directly assessed using this graphical progress record. The recording helps educators assess learning progress (Saqr et al., 2017).

Work sample tests need real-world job duties. Portfolios include student work across time. This portfolio helps teachers track students' aptitude progress (Zhao et al., 2018; 2022). proficiency-based education systems demand many proofs to ensure a student attained proficiency levels on time. According to Walters et al. (2017), competency-based education evidence includes observation, witness testimony, authentic work papers or outcomes, oral questions, written assessments, project work, case studies, and field assignments.

Evaluation and timely feedback on performance or progress in a given situation. Data is collected using rapid and continuous assessment procedures. Online evaluations give students rapid, automatic feedback, improving comprehension and communication. According to Chafiq et al. (2018), this feedback may help students who struggle with course content or are hesitant to contact professors. Online feedback improves group comprehension and makes learning more interactive. Students' learning outcomes depend on feedback quality and detail. High-quality and thorough feedback improves and consolidates student learning (Kruit et al., 2018; Tseng, 2016).

Digital technology may improve teaching materials, empower students, and transform education. Dhina et al. (2021) state that this technology has the potential to enhance adaptive learning, recommend student-centered learning materials, and detect areas of learning deficiency. Education may also be influenced by technology, knowledge delivery medium, and instructor-student interactions. Nevertheless, as stated by Wiethe-Körprich and Bley (2017), a comprehensive scientific education necessitates meticulous examination of intricate social, pedagogical, and environmental elements. It is challenging to select and incorporate digital technology into scientific education to meet various situations. This extensive investigation investigates the utilization of digital technology in several fields of higher education, including e-learning, mathematics, language, medical, programming, and special education (Yan, 2022; Zhao et al., 2018).

Digital technology is utilized in higher education tutoring, as well as in mathematics and science training. This method is employed in several domains, including feedback-driven programming instruction, intelligent guidance systems, profiling and forecasting, as well as adaptive and personalized systems (Montenegro-Rueda et al., 2021; Saleh and Salama, 2018; Saqr et al., 2017; Sudirman, 2021). According to Zhao et al. (2018) and Zhao et al. (2022), there are few literature reviews on digital technology in science education. Digital technology automates student performance ratings and generates lecture questions and assignments. Automated assessments can make scientific study easier for teachers and students. Automation of scoring, argument grading, and question generation could reduce scientific educators' pedagogical burden.

Science education has improved instructional design, implementation, and evaluation with digital technologies. Technology in real-time science education involves developing and implementing initiatives, such as Android platforms, to improve teaching and learning. Digital technology's automated evaluation and learning analysis have improved scientific education instruction and learning (Kruit et al., 2018; Zheng et al., 2019; Tseng, 2016). Educational research shows that performance assessment can support science process skills teaching and learning (Walters et al., 2017). (Hattie and Timperley, 2007) also stress the value of quick feedback in education, stating that it can improve learning. Technology-based assessment and automated text scoring have made feedback faster and reduced human bias, teachers and university students can be automatically receive science process skills assessment feedback. The following study topics will need to be tested by online surveys, in-depth interviews, and laboratory observations at four universities:

1. How are science process skills being assessed in science practicum at the four university?
2. Is there a significantly difference in science process skills are assessed based on the opinions of lecturers and students as well as the cluster of university?

Method

Designing Research

This case study uses cluster random sampling and quantitative and qualitative methods.

Sample and Population

This research included a representative sample of all state and private College in Nusa Tenggara Barat Province. The participants from four College were selected using either cluster or random sampling methods. The selected university consisted of 2 state college, namely Universitas Mataram and Universitas Islam Negeri Mataram, and 2 private college, namely Universitas Pendidikan Mandalika and Universitas Qamarul Huda Badaruddin Bagu. The study cohort consists of 376 individuals, comprising 261 university students and 115 teachers. There is a total of 376 individuals, consisting of 101 men and 275 women. According to Table 1, the majority of participants are 21 years old. A total of 4 academic vice deans, 4 study program heads, 4 laboratory heads, and 4 assistant lecturers were subjected to comprehensive interviews. The discussions corroborated and broadened the findings of the online poll.

Study Instruments.

A total of three components make up the instrument. The first one discusses the characteristics of the participants. There are participants from a variety of demographics, including gender, age, university cluster, and university students and teachers. A total of eighteen questions are posed in the following section in order to collect evidence for the purpose of evaluating the science process skills toward the science practicum. Both yes/no questions and a Likert scale are utilized in the measurement.

Instruments Validity and Reliability

Two hundred and five lecturers and students from University of Qamarul Huda Badaruddin Bagu participated in the instruments testing. Using the Pearson correlation test with a significance level of $p < 0.05$, the item validity study found that three items did not meet the criteria for validity. Thus, these elements were excluded from the subsequent investigation. All question items with a validity score of 0.8 or higher were classified as high validity, indicating they are acceptable for investigation. Cronbach's Alpha and its conclusions corroborate this notion after reliability study on all items. The mean alpha test scale value is greater than this value, indicating good internal consistency and reliability. This makes studying with this instrument possible.

Data Collection.

Data was gathered using a combination of in-depth interviews, direct observation during practicum, and an online Google form questionnaire.

Data analysis.

Kruskal-Wallis statistical technique was used since it works for unpaired categorical data. It was used to evaluate dependent variable categorical data with more than two categories.

Result and Discussion

The initial inquiry is: How are science process skills being assessed in science practicum at the four university?

The study aimed to examine scientific practicum activities by conducting in-depth interviews with key informants. Academic deans, heads of study program, and lab heads from four different college served as informants. The results showed that both public and private institutions used comparable assessment criteria for their practical training programs.

Table 1. Science Practicum Assessment at four university

Data description	N	%	Mean (M)	SD
There has been no real-time feedback on the practicum assessment.	260	73.2	0.23	0.41
Reach a consensus on whether or not performance attainment is the basis for the assessment practicum procedure.	261	70.1	3.01	0.53
Accept that the science practicum should be used to evaluate science process skils.	259	68.3	3.15	0.50

Based on the information presented in Table 1. The present assessment method for the science practicum is mainly done manually (73.2%, M = 0.23, SD = 0.41), it mean that the assessment is not real time and lacks feedback. Furthermore, the majority of respondents (7-.1%, M = 3.01, SD = 0.53) agree that the assessment of the practicum should be determined by performance assessment and majority of participants (68.3%, M = 3.15, SD = 0.50) agreed that the assessment of science process skills should be incorporated into the practicum of science. The findings are consistent with the information that was acquired throughout the practicum period and through in-depth interviews conducted with 4 academic deans, 4 heads of study programs, 4 heads of laboratories, and 4 assistant lecturers from 4 college. More precisely, the results suggest that there was no evaluation of performance during the practice, which also included a deficiency in assessing science process skills. Furthermore, there was a lack of feedback provided alongside the assessments. The evaluation process comprised a pre-test administered before to the commencement of the practice and a final response assessment done upon the conclusion of the practice. The lack of a validated and tested standardized assessment instrument is the reason why assessment is not undertaken during practice.

Is there a significantly difference in science process skills are assessed based on the opinions of lecturers and students as well as the cluster of university?

The statistical analysis conducted using the Kruskal-Wallis test (Table 2) found no statistically significant difference ($p > 0.05$) in the ways in which teacher in university and students rated their proficiency in the science process skills. Both groups agreed that the majority of science process skills tests were not used during the science practicum (n=265). The lack of suitable and dependable instruments for assessing science process skills during the duration of the study is the reason behind this. This conclusion was confirmed by the results of comprehensive interviews carried out with the academic dean, study program heads, laboratory heads, and assistant lecturer. These interviews showed that the individuals stated earlier only had non-standardized instruments for assessing the practicum.

Table 2. Science process skills measurement based on respondent and university variables

Variables	Category	N	Mean (M)	SD	Sig
Respondent	Never	265	1.72	0.44	0.15
	Seldom	98	1.63	0.48	
	Often	13	1.54	0.52	
University	Never	267	5.42	0.50	0.13
	Seldom	99	5.56	0.49	
	Often	12	5.46	0.51	

The similar thing for university type, findings of a statistical test (Table 2) provide additional evidence that no statistically significant relationship ($p > 0.05$) exists between the various types of universities. and the measurement of science process skills. they had not yet conducted measurements of science process skill (n=267) during the practice with real-time feedback not only for public university but also in private university. The use of practicum observations is necessary due to the lack of assessment instruments available during the practice. In order to provide additional data, indept interviews was carried out with individuals from four different colleges. These interviews uncovered the importance of measuring science process skills. However, it was observed that there was a shortage of standardized and validated instruments to ensure both validity and reliability. Therefore, the lack of these instruments presents difficulties in guaranteeing responsibility for the achieved outcomes.

The assessment of the scientific practicum is impeded by a notable constraint, as evidenced by the use of questionnaires, in-depth interviews, and observations. This constraint is due to the lack of a full performance assessment, which is caused by the unavailability of measurement devices that have both validity and reliability. It is best to restrict access to just authorized personnel in order to supervise the performance assessment utilizing the Android platform, which includes smartphones as well as personal computers.

The practicum assessment was conducted by teaching assistants who evaluated the pre-test, post-test, and final report. Prior to presenting them to the course lecturer, the laboratory heads reviews and endorses the evaluation findings manually (Csapó & Molnár, 2019). Empirical evidence indicates that the assessment process is now conducted manually, and no tool for assessing performance has been discovered. Hence, it is imperative to provide accurate and dependable performance evaluation tools for assessing the implementation process of the practicum. The results align with the findings from the in-depth interview conducted with management level. However, it should be noted that a performance assessment has not been conducted as valid standardized instruments were not utilized.

According to the findings from interviews conducted at the four tertiary institutions, the lack of a performance assessment mechanism has hindered the effectiveness of the practicum implementation (Bensley et al., 2021; Kruit et al., 2018; Riantini et al., 2018). Skills, which are crucial components of practicum activities that lack monitoring or measurement, are typically assessed through reports conducted one week after the practicum concludes. Hence, it is imperative to utilize digital performance evaluation tools that can be accessed easily and evaluated rapidly, while ensuring their validity, consistency, and reliability. This approach will effectively minimize the requirement for excessive effort, time, and expenses (Tseng, 2016). According to Dhina et al. (2021), it is advisable for lecturer assistants to create a performance assessment tool during the practicum, as they often rely on their recollection while doing assessments.

Kruit et al. (2018) found that most instructors evaluate student practicums thereafter. The assessment should include the complete practicum, from start to finish. This complete practical evaluation should cover cognitive, psychomotor, and emotional dimensions (Bensley et al., 2021; Yan, 2020). According to Kruit et al. (2018), performance assessment evaluates students' cognitive ability, skills, and attitudes. This measurement requires a simple, valid, and reliable performance evaluation tool.

The choice stems from the aspiration to improve the availability of science process skills exams, as well as the convenience of receiving results and feedback without any limitations on time or location. Tai et al. (2018) found that a mobile application may be used to analyze assessment outcomes in real-time. The program allows teachers to choose from many levels and styles of analysis, such as numerical, descriptive, or dual approaches (Hume & Coll, 2009). In addition, the application generates Descriptive Assessment Reports automatically to analyze student performance and is specifically tailored for evaluating science process abilities. The application provides educators with extensive and organized data, allowing them to clarify instructional and learning objectives, assess student grades using specific criteria and competencies, accurately summarize student performance, and identify patterns of proficiency and weaknesses in student work (Bensley et al., 2021; Yan, 2020). The purpose of developing the descriptive Rubric Score application was to use it in the educational setting, namely for assessing student performance by elementary and secondary school teachers (Valero & Cárdenas, 2017). The tool does real-time analysis of assessment outcomes at many levels, as specified by the teacher (e.g., student, department, class, school). The results are given in numerical or quantitative form (Leber, et.al., 2017). Various formats, including descriptive ones or a combination of them, are used based on the teacher's preferences (Yan, 2020). The Stratified Criteria Scale is employed to define evaluative criteria and evaluate students based on six specific attributes, namely reading comprehension, writing, science process abilities, participation-collaboration, perseverance, and computational thinking (Kruit et al., 2018).

Mobile technology offers several benefits to consumers, such as the convenience of portable devices, the efficiency of operating systems and applications, the ability to connect users in various time zones and places, and the promotion of social engagement (Poce, et.al., 2017). The widespread adoption of technology and mobile applications in the realm of education is a worldwide occurrence (Tseng, 201. Academics, especially those in the field of education, are greatly drawn to mobile technology. Mobile learning encompasses the use of various mobile technologies such as computers, laptops, mobile phones, audio players, and electronic books for the goal of electronic learning (Wiethe-Körprich, et.al., 2017). Mobile learning enables students to collaborate and share ideas via internet-based platforms and technological breakthroughs, thereby circumventing limitations of physical location and time (Yan, 2020). The widespread presence of mobile devices with continuous internet access allows students to easily reach course materials and actively interact with educational content in a dynamic and engaging way (Boone, 2016).

The task of maintaining student engagement and involvement in effective learning via mobile devices is a considerable obstacle in the modern era (Riantini, et.al., 2018). The recognition of the significance of developing sophisticated cognitive talents, such as problem-solving and science process skills, in pupils is widely acknowledged (Zhao, et.al., 2022). Mobile learning has been recognized as a cutting-edge educational alternative. Mobile learning has been proven to benefit both students and teachers by aiding in the understanding of educational content and improving cognitive skills such as communication, problem-solving, creativity, and higher-level thinking abilities.

Technology is sometimes described as a set of tools that provide various solutions to the problems faced in the field of education (Chafiq, et.al, 2018). The goal of education is to develop individuals who have a wide range of knowledge, show creativity, display competency in using digital technologies, and have the capacity to adapt to changing conditions. Furthermore, the incorporation of information technology, such as the internet and multimedia systems, in educational environments has been designed to improve the caliber of learning by enabling students to easily access necessary resources and services (Sudirman, 2021).

The statistical study indicated that there was no statistically significant correlation between the evaluations conducted by teachers and the performance of students. Comparable results were noted in the statistical analysis of academic performance at both public and private universities (Alharbi, 2022). The performance assessment was completed without any feedback being provided. This claim was supported by conducting comprehensive interviews with management staff and practicum helpers, as well as making direct observations of the practicum (Leber, et.al., 2018). Utilizing a digital application is considered highly beneficial for improving performance evaluation and providing automatic feedback that can be easily accessed by both students and teachers. As per the findings of Zhang and Li (2022) and Zhao et al. (2018), an automated program is used to generate Descriptive Assessment Reports. These reports are used by researchers to evaluate student performance and measure their proficiency in science process skills. The researchers introduced an extra variable into the standard analytics framework of the application (Harsch, et.al., 2021). Assessment involves evaluating students' performance in relation to a certain purpose, while formative guidance is offering comments and recommendations on how the work can be improved to meet the essential requirements (Sun, et.al., 2021). Feedback is the difference between the actual values and the desired values of the system's parameters, which is then used to adjust the difference in a specific way.

Conclusion

The current evaluation throughout the practicum was not utilize standardized instruments to test science process skills on performance assessment, and lacks feedback. Consequently, the assessment is restricted to general evaluations conducted manually at the end of the practicum. There are no differences between public and private universities when it comes to evaluating performance in science practicum. Both universities type lack reliable instruments for measuring science processes skills. Therefore, it is recommended to develop instruments that can accurately assess students' in science process skills during practicum along with providing real-time feedback.

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Conflicts of Interest
It is declared by the authors that there is no conflict of interest.

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