

## **Analysis of Pre-Service Biology Teachers' Assessment Skills in Preparation of Assessment Planning and Assessment Instruments: A Descriptive Study in Higher Education**

### **Analisis Kemampuan Asesmen Guru Biologi Pra-Jabatan dalam Penyusunan Perencanaan Penilaian dan Instrumen Penilaian: Studi Deskriptif di Perguruan Tinggi**

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#### **Abstract**

*This study was motivated by the importance of assessment skills in measuring students' cognitive, affective, and psychomotor achievements in biology subjects. The main reasons for conducting this study are gaps in competency-based training, such as the lack of practical experience in developing valid assessment instruments and understanding supporting technology. This study aims to identify the strengths and weaknesses of prospective biology teachers in assessment planning and question formulation skills. The study used a descriptive approach involving 66 students who had completed the internship program. Data were obtained by analysing lesson plan documents, question items, and Likert scale-based closed questionnaires. The research instrument was expert-validated and tested for reliability. The results showed that the average score of assessment planning reached 77.83% (good category), but significant weaknesses were seen in formulating competency indicators with a score of 67.10% (fair category). Intensive training on developing measurable indicators and using question analysis software is recommended to improve these skills. The study also suggests integrating competency-based training in the teacher education curriculum to strengthen assessment skills.*

**Keywords:** *Assessment skills, pre-service biology teachers, assessment planning.*

#### **Abstrak**

Penelitian ini dilatarbelakangi oleh pentingnya keterampilan penilaian dalam mengukur pencapaian kognitif, afektif, dan psikomotorik siswa dalam mata pelajaran biologi. Kesenjangan dalam pelatihan berbasis kompetensi, seperti kurangnya pengalaman praktis menyusun instrumen asesmen yang valid dan pemahaman teknologi pendukung, menjadi alasan utama dilaksanakannya studi ini. Penelitian ini bertujuan untuk mengidentifikasi kekuatan dan kelemahan calon guru biologi dalam perencanaan penilaian dan keterampilan merumuskan soal. Penelitian menggunakan pendekatan deskriptif dengan melibatkan 66 mahasiswa yang telah menyelesaikan program magang. Data diperoleh melalui analisis dokumen rencana pembelajaran, butir soal, dan kuesioner tertutup berbasis skala Likert. Instrumen penelitian divalidasi pakar dan diuji reliabilitasnya. Hasil menunjukkan rata-rata skor perencanaan penilaian mencapai 77,83% (kategori baik), tetapi kelemahan signifikan terlihat pada formulasi indikator kompetensi dengan skor 67,10% (kategori cukup). Pelatihan intensif tentang penyusunan indikator terukur dan penggunaan perangkat lunak analisis soal direkomendasikan untuk meningkatkan keterampilan ini. Studi juga menyarankan integrasi pelatihan berbasis kompetensi dalam kurikulum pendidikan guru untuk memperkuat kemampuan asesmen.

**Kata Kunci:** Kemampuan asesmen, guru biologi pra-jabatan, perencanaan penilaian.

## 1. Introduction

Multilingualism in the era of globalization plays an important role in encouraging competitiveness between people or countries worldwide in terms of economy, trade, policy, culture, and education. Multilingual is usually defined as the ability to speak or communicate using three or more languages (Ardianta, 2019). The multilingual phenomenon usually arises when speakers of various languages unite in one community so that it can give colour and have implications for ethnic and cultural diversity in the community (Batrisyia et al., 2024).

Assessment is an integral component of learning that ensures that educational goals are optimally achieved (Arta, 2024). In modern education, assessment serves as a tool to measure student abilities and becomes the basis for mapping learning achievements and providing constructive feedback to learners (Karaman, 2021). This is increasingly relevant in teaching biology subjects that require measurements of the cognitive, affective, and psychomotor aspects of students, given the complexity of the material and the accompanying laboratory activities (Solihin, 2022).

Prospective teachers play a strategic role as pioneers in achieving the expected educational goals. One of the main competencies that must be possessed is assessment ability, which includes skills in preparing, implementing, and analyzing assessment results. Assessment is a pedagogical competency that is crucial to assess prospective teachers' ability to recognise learners' characteristics and manage effective learning processes (Kuntarto, 2020). This competency is important to ensure that assessments are valid, reliable, and by learning objectives (Suryani et al., 2022).

However, practice shows that many prospective teachers face significant challenges in understanding the techniques for developing valid and reliable assessment instruments. Research by Chotimah et al. (2023) shows that student teachers have difficulties determining the type of affective assessment that is in accordance with the learning objectives and developing assessment instruments. This is due to the lack of assessment training during teacher education and the lack of mastery of supporting technology such as item analysis software (Rahayu, 2024).

The urgency of this research lies in the pressing need to design relevant and competency-based assessment training, especially for biology subjects (GH & Irfan, 2024). This study aims to analyze the assessment skills possessed by prospective teachers and identify areas that need improvement, hoping to increase the effectiveness of learning mechanisms and student learning outcomes. Thus, the results of this study are expected to contribute to formulating more comprehensive assessment training programs that meet the needs of prospective teachers.

## 2. Literature Review

Assessment is an important tool in creating an effective learning environment. Karaman (2021) notes that assessment serves not only to measure students' abilities but also to provide constructive feedback. Black & Wiliam (Arta, 2024) explain that assessment is a continuous activity throughout the learning process to observe student development and provide constructive feedback. (Laila et al, 2024) added that assessment is a series of systematic activities to collect information related to student learning outcomes and their achievements to support preparation for future tasks. Cronbach (Bhakti et al., 2022) prioritizes evaluation as a means to improve, while Scriven divides the evaluation function into formative and summative. The formative function focuses on improving certain aspects of the learning evaluation or curriculum being designed. In

contrast, the summative function is used to assess the quality of the whole system and is conducted after the program is considered complete.

In biology education, prospective teachers must integrate critical thinking and science process skills in their assessments. As [Paraniti et al., 2021](#) suggest, developing assessment tools that focus on science process skills is significant, considering that biology as an experimental science requires students to understand the theory and make observations, analyze, and interpret data appropriately. This suggests that prospective teachers should be trained to design assessment instruments that are valid and reliable and can also comprehensively measure students' practical skills in biology. However, many prospective teachers struggle to develop valid and reliable assessment instruments. Purnama highlighted that the lack of adequate assessment training during teacher education causes several teachers to be incompetent in developing grids and items; the lack of practice-based learning in the field of assessment can cause the lack of training in teacher education programs ([Purnama, 2022](#)). Many prospective teachers face significant challenges in understanding the techniques for developing valid and reliable assessment instruments. Research ([Purnama, 2022](#)) also reported the results of academic supervision at SMA Negeri 1 Kalasan; there were still 10 out of 53 teachers (18.89%) who were not competent in preparing grids and items according to the correct writing rules.

Mariah states that evaluation activities include developing assessment instruments, assessing the process and learning outcomes, and analyzing these results ([Zaenudin, 2021](#)). Effective learning is the key to achieving maximum learning outcomes. This gap creates an urgent need to design relevant and competency-based assessment training, especially for biology subjects closely related to the scientific approach ([GH & Irfan, 2024](#)).

This gap in assessment skills indicates the urgency to design competency-based assessment training. The utilization of technology to support a more efficient assessment design ([Kuntarto et al., 2020](#)). This research is expected to share contributions to the development of assessment training programs that are relevant to the actual needs of prospective teachers and curriculum developments, both nationally and globally ([Jeffrey et al., 2024](#)).

Thus, this study strengthens existing theories regarding assessment in education and significantly contributes to relevant science, both now and in the future. The study results are expected to serve as a basis for educational institutions in designing assessment training programs that suit the needs of prospective teachers.

### **3. Methods**

This study uses a descriptive approach to evaluate the assessment skills of prospective biology teachers in developing assessment plans and question items. ([Verma et al., 2024](#)) the descriptive method as a scientific approach by observing and describing the subject's behaviour without influence. The research was conducted from July to September 2018 on students of class 2014 who had completed the Internship 3 Program at a private university in Jakarta. The research participants involved 66 students willing to submit lesson plans, which were selected through a saturated sampling technique. This study was conducted in compliance with the principles of research ethics. Before data collection, each participant was informed about the purpose of the study, its methods, and its benefits. They also signed a consent form to participate voluntarily. The identity of the participants was kept confidential to avoid disclosing personal data. This research has also received guidance from the supervising designer to ensure the implementation of the research according to procedures. The research instrument used was document analysis to examine lesson plans and questions prepared by students using a Likert scale-based closed

questionnaire to measure skills in preparing items. Experts have validated the research instrument to ensure coverage of relevant aspects based on the literature used. Furthermore, the instrument was tested on a group of students outside the research sample to test each item's clarity and reliability. The data collected were then analyzed using descriptive statistics with the percentage formula to provide an overview of students' use in assessment planning and question-making. The percentage criteria (Nadia et al., 2022) are presented in the following table.

**Table.1.** Percentage Criteria

No.	Percentage	Criteria
1.	86% - 100%	Very good
2.	76% - 85%	Good
3.	60% - 75%	Simply
4.	55% - 59%	Less
5.	≤54%	Not at all

## 4. Result and Discussion

### 4.1. Research Result

#### Assessment Planning Ability

The DDC program is a collaboration between the religious division and the LIC (Language Improvement Center) division at Madrasah Ibtidaiyah Sunan Pandanaran Yogyakarta. The religious division manages religious activities, such as prayer and Dhuha, while the LIC division manages language-related activities, like this program's "Conversation" activity. Conversation activities are carried out after prayer, and Dhuha prayer activities are in the morning before class.

The research results on the ability to prepare assessment planning for prospective biology teachers show that the average percentage of assessment planning is 77.83% and is categorized as good. However, significant weakness is seen in the indicator "formulating indicators of competency achievement," with achievement of only 67.10%, and is categorized as sufficient. Weaknesses in this indicator can result in unclear learning objectives and inaccurate assessments, negatively impacting curriculum development and student learning outcomes. Factors influencing this low achievement include lack of training, practical experience, and not understanding the correct operational verbs. The indicators assessed consist of "designing assessments", "formulating indicators of competency achievement", "determining assessment techniques and instruments", and "making instrument processing procedures". Each indicator's percentage achievement and category can be observed through the table below.

**Table.2.** Percentage of Assessment Planning Ability Indicators

No.	Indicator	% Achievement	Category
1.	Designing the Assessment	98,94	Very good
2.	Formulate Indicators of Competency Achievement	67,10	Simply
3.	Determine Assessment Techniques and Instruments	74,03	Good
4.	Making Instrument Processing Procedures	71,72	Simply
<b>Average</b>		<b>77,83</b>	<b>Good</b>

The table shows that the highest achievement is in the indicator "designing assessments" (98.94%, very good); this success can be explained by several factors. First, prospective teachers may have received adequate training in designing assessment instruments during their education,

so they understand the basic principles of creating practical assessments well. This success also reflects their awareness of the importance of proper assessment to improve the quality of learning.

This was followed by "determining assessment techniques and instruments" (74.03%, good). However, the result is good. This achievement shows that prospective teachers still need to improve their understanding of the variety of assessment techniques appropriate to different contexts and learning objectives.

Meanwhile, the indicator "making instrument processing procedures" scored 71.72%, included in the sufficient category. This shows that although prospective teachers can design assessment instruments, they may not fully understand or apply the procedures for correctly analyzing and processing the assessment data. Lack of practical experience in using analysis software or basic statistical techniques may be the cause.

The lowest achievement was in the indicator "formulating indicators of competency achievement", with a percentage of 67.10%, also categorized as sufficient. This gap indicates prospective teachers may have difficulty setting clear and measurable indicators. This could be due to a lack of understanding of the appropriate use of operational verbs in formulating indicators, an important aspect of defining learning objectives and evaluation.

Overall, these differences in achievement across indicators reflect the quality of training received by prospective teachers and the challenges they face in applying this knowledge in practice. Therefore, it is important to provide additional training that focuses on aspects that still require improvement, especially in formulating indicators of competency achievement.

### Qualitative Item Preparation Skills

Based on the results of the study, the ability of biology education students when compiling question items qualitatively, the average percentage of the ability of biology education students when compiling question items qualitatively obtained a total of 60.25%, including the sufficient category. The aspects examined in the preparation of qualitative items are "material", "construction", and "language". The percentage of achievement and category for each aspect can be observed in the table below:

**Table.3.** Percentage of Qualitative Question Item Preparation Ability Aspects

No.	Aspects Examined	% Achievement	Category
1.	Material	90,24	Very good
2.	Construction	89,57	Very good
3.	Language	100	Very good
<b>Average</b>		<b>93,27</b>	<b>Very good</b>

Based on the table above, the "language" aspect receives the highest percentage of achievement, 100%, through the excellent category. The "material" aspect received a percentage of 90.24% through the category of less. The lowest percentage of achievement is owned by the "construction" aspect, which receives a percentage of 89.57% and is included in the category of less.

## 4.2. Discussion

### Assessment Planning Ability

Based on the results of the study, the ability of biology education students when compiling question items qualitatively, the average percentage of the ability of biology education students when compiling question items qualitatively obtained a total of 60.25%, including the sufficient

category. The aspects examined in the preparation of qualitative items are "material", "construction", and "language". The percentage of achievement and category for each aspect can be observed in the table below:

The results of this study revealed some significant findings related to the assessment skills of prospective biology teachers. From the analysis, their ability to prepare assessment planning reached 77.83%, which is included in the good category. On the other hand, the ability to compile items qualitatively reached 93.27%, which is a very good category. This finding shows that prospective teachers already have quite good skills in designing assessments and compiling questions, which are an integral part of the pedagogical competence expected by Government Regulation No. 19 of 2005. The indicator "designing assessments" obtained the highest percentage, 98.94%. This reflects a strong understanding of the importance of assessment in the learning process. Good assessment serves to measure student learning outcomes and as a tool to improve teaching quality. Learning assessment can provide factual information on the achievement of students' development or learning outcomes (Ginanto et al., 2024).

However, different results emerged in the indicator "formulating indicators of competency achievement," which only reached 67.10%. This percentage shows gaps in prospective teachers' understanding of setting clear and measurable indicators to evaluate learning success. This is important because good indicators of competency achievement will clarify learning objectives and make it easier for teachers to assess student development. On the indicators of "determining assessment techniques and instruments" (74.03%, good) and "making instrument processing procedures" (71.72%, fair), these results reflect that prospective teachers understand the basic techniques of assessment but need further strengthening the procedures for analyzing and processing the results. The choice of techniques and forms of assessment is very important because it will determine how the assessment instrument is (Sari et al., 2021).

According to (Widoyoko, 2020), processing assessment data is a complex skill, involving understanding basic statistics and using data analysis software. In this context, the author argues that strengthening training and guidance for prospective teachers in understanding and formulating indicators of competency achievement is very important. Training programs focusing more on this aspect can help prospective teachers be better prepared to face challenges in the field. The results of this study are also related to the theory proposed by Bloom in the taxonomy of learning objectives, where assessment is a tool to measure students' cognitive achievement. The results showed that prospective teachers had applied some of the principles of the taxonomy in the preparation of questions, especially in the language aspect, which reached 100% in the preparation of qualitative items. This shows they can use clear and understandable language, which is key to developing effective questions.

Thus, this study highlights the need to increase prospective teachers' understanding of formulating indicators of competency achievement to improve the quality of assessment and learning in the classroom.

### **Qualitative Item Preparation Skills**

The 100% mastery of language aspects showed that prospective teachers understood the importance of writing clear, appropriate, and unambiguous questions. Similar findings were reported by Nugroho et al. (2021), where linguists recommended that statements in the instrument be structured so that they do not cause ambiguity. Another study (Purnama & Alfarisa, 2020) also emphasized that language aspects are one of the main factors in determining the validity of good questions, ensuring that examinees understand the questions correctly.

The 90.24% achievement in the material aspect shows that prospective teachers can ensure the suitability of questions with basic competencies and learning indicators. According to research conducted by Resya (2023), the application of appropriate evaluation and the implementation of appropriate recommendations can provide important information to improve the quality of learning and student outcomes. Research (Purnama & Alfarisa, 2020) also supports the idea that planning and selecting materials must consider relevance to educational goals.

Although slightly lower than other aspects, the 89.57% achievement in construction still indicates very good quality. This aspect includes the format and structure of the questions, which must be consistent with the guidelines for writing good questions. Research conducted by (Owon et al., 2021) revealed that it is important to pay attention to the elements of material, structure, and language use in designing questions.

High ability in item preparation reflects the readiness of prospective teachers to support a quality education evaluation process. They can produce valid and reliable evaluation tools by ensuring that material, construction and language aspects are met. However, ongoing training is needed to maintain and improve this quality.

## 5. Conclusion

Based on the results of the description and analysis of the data that has been presented, the following findings were obtained. Overall, the assessment ability of biology teacher candidates in preparing assessment planning is in a good category. The indicator with the highest percentage is the ability to design assessments, which shows the high competence of prospective teachers in preparing assessment designs that are by learning objectives. This is by the theory that suggests the importance of effective assessment planning to achieve the desired learning objectives. In contrast, the indicator with the lowest percentage was the ability to formulate indicators of competency achievement, which only reached the sufficient category. This indicates a need to pay more attention to the development of this aspect, which is related to the importance of formulating clear and measurable indicators of competency achievement in accordance with Bloom's taxonomy, which emphasizes the development of critical and analytical thinking skills.

Based on these findings, it is recommended that prospective biology teachers expand their understanding of developing indicators of competency achievement through learning about Bloom's taxonomy and other literature related to assessment planning. In addition, further research is needed to explore the factors that influence prospective teachers' assessment skills, including pedagogical approaches, technical skills, and relevant socio-cultural factors. This further research is expected to provide new insights that can be used to comprehensively improve the quality of assessment and professional competence of prospective teachers.

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