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Quality of Discovery Learning-Based Chemistry Learning Tools Developed by Chemistry Teacher Candidates

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Abstract: Prospective chemistry teachers play an important role in implementing Discovery Learning through the learning tools they develop. It is important to evaluate the quality of discovery learning-based learning tools utilised by prospective chemistry teachers in order to provide constructive feedback and improve their competence. This study aims to describe the quality of learning tools in the form of teaching materials and Learner Worksheets that have been prepared by prospective chemistry teachers. This research is a quantitative descriptive research. The population of this study were all students majoring in chemistry class of 2021. This study used purposive sampling technique. The sample of this study was prospective teacher students from the 2021 class B chemistry education study programme, totalling 23 people. Data collection techniques in the form of portfolio/document evaluation in the form of learning devices made by prospective chemistry teacher students. The learning tools collected by prospective teacher students are in the form of teaching materials and student worksheets based on Discovery learning. The learning devices that have been collected are then assessed using validated instruments and assessment rubrics and then scored to determine the ability category of prospective teacher students. The results showed that the quality of discovery learning-based teaching materials prepared by Chemistry teacher candidates in the construction component is categorized as Good, content/material is categorized as Very Good, learning assessment is categorized as Quite Good and discovery learning orientation is categorized as Good. The quality of discovery learning-based student worksheets prepared by prospective chemistry teachers in terms of the construction component is categorized as Very Good, learning activities are categorized as Very Good, learning assessment is categorized as Good and discovery learning orientation is categorized as Very Good.

Keywords: Chemistry teacher candidates; Descriptive quantitative; Discovery learning; Learning tools; Student worksheets

Introduction

Effective chemistry learning plays an important role in improving students' concept understanding and critical thinking skills. Research shows a variety of approaches to achieve this goal. Research has shown that understanding the Nature of Science (NoS) can help improve critical thinking skills among chemistry pre-service teachers, highlighting the importance of interpreting, inferring, and self-regulating skills (Suwahono & Zulfirman, 2023). In addition, utilizing learning media such as interactive web modules and videos based on phenomenon-based learning can significantly improve students' critical thinking skills in chemistry subjects (Febliza et al., 2023). Efforts to develop critical thinking skills in chemistry learning

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include project-based learning (PjBL), Discovery Learning, problem-based learning (PBL), guided inquiry, and other innovative models that focus on real problems and local wisdom (Rushiana et al., 2023).

Discovery Learning is an approach that emphasizes the process of exploration, investigation, and discovery by students. This method is expected to increase student engagement and make learning more meaningful. Several studies have investigated the effectiveness of implementing Discovery Learning in chemistry education. Darwis et al. (2019) showed the positive effect of Discovery Learning on students' chemical literacy in the topic of buffer solution. Amini et al. (2018) highlighted the effectiveness of Discovery Learning in improving students' inferential ability and mastery of chemical equilibrium concepts. Furthermore, Noormaliana (2023) emphasized that Discovery Learning involves students in the process of observation, analysis, and conclusion making, which leads to the development of new concepts and principles that are aligned with the curriculum. The use of Discovery Learning in chemistry education not only improves students' conceptual understanding but also increases their engagement and motivation. By encouraging students to explore and discover chemical phenomena on their own, educators can instill curiosity and passion for learning in chemistry (Amini et al., 2018). Prospective chemistry teachers play an important role in implementing Discovery Learning through the learning tools they develop. By creating and implementing engaging learning tools such as Discovery Learning-based modules and interactive experiments, prospective chemistry teachers can effectively promote active learning and improve students' understanding of complex chemical concepts (Medina & Baraquia, 2023; Istiqomah, 2022; Rolanda et al., 2020).

The quality of the learning tools prepared by these prospective teachers determines the success of the application of the method in the classroom. Therefore, it is important to evaluate the quality of discovery learning-based learning tools prepared by prospective chemistry teachers in order to provide constructive feedback and improve their competence. The development of high-quality teaching materials is essential for effective chemistry education. Assessment of the quality of teaching materials based on the Discovery Learning approach for chemistry education can be guided by various criteria. These criteria include conformity with curriculum standards, clarity of learning objectives, incorporation of interactive elements, relevance to student learning needs, and provision of opportunities for direct exploration and inquiry (Medina & Baraquia, 2023). Quality assessment of teaching materials based on the Discovery Learning approach is essential to ensure effective chemistry education. By incorporating interactive and engaging elements into these materials, prospective chemistry teachers can create dynamic learning experiences that encourage student curiosity, critical thinking, and conceptual understanding in chemistry (Ardila et al., 2022; Fitria et al., 2023; Nasution et al., 2020).

This study aims to describe the quality of learning tools in the form of teaching materials and Learner Worksheets that have been prepared by prospective chemistry teachers. The quality of discovery learning-based learning tools prepared by prospective chemistry teachers has been widely studied in various studies. The results showed that the development and validation of discovery learning-based modules in chemistry learning were rated very well and highly approved by chemistry teacher experts and prospective chemistry teacher students, highlighting their interactive and outcome-based characteristics (Medina & Baraquia, 2023). In addition, e-modules based on the guided Discovery Learning model have proven to be very valid and practical for learning chemistry in high schools, with very high construct and media validity, as well as high practicality ratings from teachers and students (Permatasari et al., 2022; Yerimadesi et al., 2022). Furthermore, learning tools on acid-base material in the discovery learning model have been assessed as valid, practical, and effective, meeting the criteria of validity, practicality, and effectiveness, as evidenced by positive teacher and student responses and improved learning outcomes. Similarly, discovery learning-based junior high school science learning tools have been validated by experts and proven practical and effective in improving student motivation and learning outcomes, which further emphasizes the value of the approach in educational settings (Kasim et al., 2022). From several relevant studies that have been conducted, no research has conducted case studies on several learning tools produced by prospective teachers to assess innovation and creativity in their design and implementation.

The novelty of this research is the conduct of case studies on several learning tools produced by prospective teachers to assess the ability of chemistry teacher candidates in developing discovery learning-based learning tools. The implications of this research can improve the quality of chemistry learning in schools through better designed learning tools based on the principles of discovery learning. In addition, this research can provide empirical data that can be used by teacher education curriculum developers to design more effective training programs.

Method

This research is a quantitative descriptive research. The population of this study were all students majoring

in chemistry class of 2021. This study used purposive sampling technique. The sample of this study was prospective teacher students who came from the class B chemistry education study program class of 2021, totaling 23 people. Data collection techniques in the form of portfolio/document evaluation in the form of learning devices made by prospective chemistry teacher students. The learning tools collected by prospective teacher students are in the form of teaching materials and student worksheets based on Discovery learning. The learning devices that have been collected are then assessed using instruments and assessment rubrics that have been validated and then scored to determine the ability category of prospective teacher students.

The steps taken in this research include several stages. First, developing the assessment instrument to be used. After that, the assessment instrument was validated by chemistry education lecturers at FMIPA UNM. The next stage is to collect data in the form of learning device documents prepared by student teachers. After the data is collected, an assessment or scoring of the aspects of the documents that have been collected is carried out. Then, the average value of each component assessed was calculated. Finally, the ability of prospective teachers is categorized based on the results of the assessment. The formula for the criteria for categorizing the quality of learning tools prepared by prospective teacher students is as follows:

Table 1. Criteria for Categorizing the Quality of Learning Devices Prepared by Prospective Teacher Students (Theis & Junita, 2019)

Criteria	Score Formula
Very good	X > Xi + 1.80 Sbi
Good	Xi + 0.60 Sbi < X ≤ Xi + 1.80 Sbi
Fair	Xi – 0.60 Sbi < X ≤ Xi + 0.60 Sbi
Deficient	Xi – 1.80 Sbi < X ≤ Xi – 1.80 Sbi
Very Poor	X ≤ Xi – 1.80 Sbi

Description:
Ideal Highest Score = Σ criteria items x highest score
Ideal Lowest Score = Σ criteria items x lowest score
X = Actual Score
Xi = Average ideal score
= ½ (Ideal maximum score + ideal minimum score)
Sbi = Standard deviation of ideal score
= 1/6 (ideal maximum score - ideal minimum score)

Result and Discussion

The first stage in this study was preparation. At this stage, the purpose and scope of the assessment criteria are established. Assessors need to understand the learning context, curriculum objectives, and standards that will be used in the assessment. At this stage, validated assessment instruments and rubrics are prepared which are used as guidelines for assessing learning devices. The next stage is to collect data in the form of learning device portfolio documents prepared by prospective teacher students. The portfolio documents are in the form of teaching materials and students worksheet based on discovery learning. Portfolio documents prepared by prospective student teachers are then analyzed and assessed using validated assessment instruments and rubrics. The components or criteria assessed in the portfolio document can be seen in Table 2.

The next stage is data analysis. At this stage, the data that has been collected is analyzed to assess the quality of the learning devices prepared by student teachers. This analysis includes checking whether the teaching materials compiled meet the criteria compiled by the assessor. The analysis is carried out by scoring each component, then calculating the average and ideal percentage of each component and ending with the categorization of the quality of learning tools prepared by prospective teacher students. The assessor looks for the strengths and weaknesses of the learning tools and their suitability for curriculum objectives. The percentage of the results of the assessment of teaching materials that have been carried out can be seen in Figure 1.

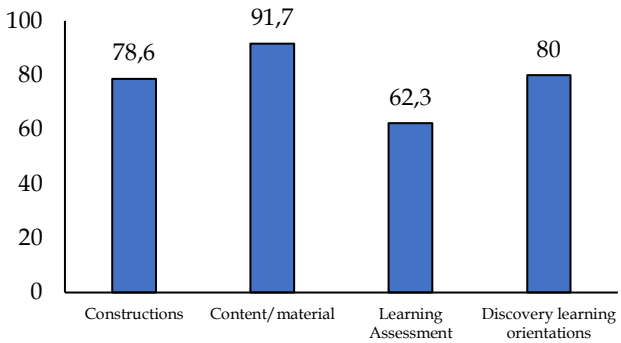

Figure 1. Percentage of ideality in the teaching material component

Figure 1 is a diagram of the percentage of ideality of the assessment results on teaching materials. This percentage is used to determine the extent to which the learning device meets the standards set by the assessor.

In Figure 1, it can be seen that the highest percentage of ideality is in the content/material component which is 91.7%. The percentage of ideality in the discovery learning orientation component reached 80%, in the construction component 78.6% and the lowest percentage of ideality was in the learning assessment component which was 62.3%.

Table 2. Learning Tool Evaluation Criteria

Learning Tools	Component	Number of criteria	Criteria
Teaching Material	Construction	7	There is a title, compiler identity, table of contents, glossary, concept map, subject matter, practice questions and answer keys; The glossary is arranged alphabetically and is in the form of basic words not derivative words; The glossary compiled is representative of the content of teaching materials; The concept map is concise and easy to understand; Correctness in connecting concepts in the concept map; Include the identity of teaching materials, learning outcomes and instructions for using teaching materials; Instructions for using teaching materials are easy to understand.
	Content/material	7	The learning objectives that are prepared can measure student achievements; systematic presentation of material; Recency/recent data on the material presented; Correct concept of the material presented; Correctness of the definition presented; Accuracy of foreign terms and scientific names; there is a summary of the material
	Learning Assessment	3	The questions prepared are representative; The questions in the competency test and final test can measure the achievement of learning objectives; The answer key contains a brief discussion along with the score for each question
	Discovery Learning Orientation	1	Compliance with the stages of Discovery learning, which includes simulation, problem identification, data collection, data processing; proof, drawing conclusions
Student Worksheet	Content/Material	5	Conformity with learning outcomes; Conceptual truth; Presentation requires students to learn actively; Emphasis on the Discovery Learning model; The steps/stages include simulation, problem identification, data collection, data processing, verification, drawing conclusions
	Construction	6	Clear learning objectives; accuracy in the use of appropriate language and sentences; the questions in the LKPD are relevant; there is space for students to write down the results of activities/experiments and there is student identity in the LKPD to make administration easier.
	Technical	3	Appearance; Consistency of writing and appropriate use of images
	Discovery Learning Orientation	6	Conformity with the Discovery learning stages, namely containing simulations, problem identification, data collection, data processing; proof, draw conclusions

The Quality of Discovery Learning-Based Teaching Materials Prepared by Prospective Chemistry Teacher Students

Construction components

In the construction component there are 7 assessment criteria. The focus of the assessment in this component is related to the arrangement of components and layout in ideal teaching materials, such as there is a title, compiler identity, table of contents, glossary, concept map, subject matter, practice questions and answer keys; The glossary is arranged alphabetically and in the form of basic words not derivative words; The glossary is compiled representative of the content of teaching materials; The concept map is concise and easy to understand; Correctness in connecting concepts in the concept map; Including the identity of teaching materials, learning outcomes and instructions for using teaching materials and teaching materials and instructions for using teaching materials are easy to understand. In this component the highest score is ideally 35, the lowest score is ideally 7, Xi value is 21, Sbi value is 4.67 and X value (average) is 27.5.

Table 3. Criteria for Assessing the Construction Component of Teaching Materials

Criteria	Score Formula
Very good	$X > 29.4$
Good	$23.8 < X \leq 29.4$
Fair	$18.2 < X \leq 23.8$
Deficient	$12.6 < X \leq 18.2$
Very Poor	$X \leq 12.6$

The average score of the construction component is 27.5 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students on the general information component can be categorized as good. Based on the results of the review of the assessment of discovery learning-based

teaching materials in the construction component compiled by prospective chemistry teacher students, all of them have a title, author's identity, table of contents, subject matter and have included the identity of teaching materials and learning outcomes. However, many prospective chemistry teacher students have not included a glossary, concept map, practice questions, answer keys and instructions for using teaching materials.

The incorporation of glossaries in educational materials is essential for improving learning outcomes. The importance of a glossary as a collection of words and their meanings is underscored in aiding students' understanding of complex subject terminology (Larasati, 2023; Septian & Burhendi, 2022).

The use of concept maps in teaching materials is also important, this is in line with the research conducted Andriani et al. (2023), incorporating concept maps into educational materials is a powerful instructional strategy that enhances learning outcomes, fosters critical thinking, facilitates knowledge organization, and improves student engagement. By leveraging the visual and organizational features of concept maps, educators can create dynamic learning experiences that cater to diverse learning styles and promote deeper understanding among students.

The use of guidelines for the use of teaching materials is also important, as it not only helps in developing more meaningful and effective materials, but can also affect the overall quality of learning. With clear guidelines in place, teachers can be more effective in delivering materials, students can more easily understand the content being taught, and the overall learning process can be improved (Edelson et al., 2021; Pribadi & Chung, 2023).

Content/material components

The focus of the assessment in this component is related to the suitability of the content / material in ideal teaching materials, such as learning objectives that are prepared to measure the achievements of students; systematic presentation of material; Newness / up-to-date data on the material presented; Correctness of concepts about the material presented; Correctness of definitions presented; Accuracy of foreign terms and scientific names; there is a summary of the material. In this component the highest score is ideally 35, the lowest score is ideally 7, the Xi value is 21, the Sbi value is 4.67 and the X value (average) is 32.1.

The average score of the content/material component is 32.1 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students on the content/material component can be categorized as very good. This means that all content/material criteria are met, prospective teachers have been able to develop teaching materials according to the material presented, the correctness of definitions, the accuracy of foreign terms and scientific names and the presence of a summary of the material so that important information from a text or topic can be presented briefly and concisely. This helps the reader to get a quick understanding without having to read the entire original text.

Table 4. Criteria for Assessing the Content/Material Component of Teaching Materials

Criteria	Score Formula
Very good	$X > 29.4$
Good	$23.8 < X \leq 29.4$
Fair	$18.2 < X \leq 23.8$
Deficient	$12.6 < X \leq 18.2$
Very Poor	$X \leq 12.6$

Educators can develop teaching materials that are not only clear and systematic, but also logical, efficient, and understandable but the material is also accessible, interesting and effective in facilitating student learning (Zaid & Wafi, 2019). Content or materials in chemistry education is based on correct scientific concepts and principles, and updated with the latest findings, is essential for effective learning. updating the content/materials of chemistry education can be done through the application of digital technology and providing sample problems to assist in understanding and applying the latest scientific findings in a real-world context (Hatta et al., 2021; Volkova & Tarakanova, 2017).

Learning Assessment components

In the learning assessment component, there are 3 assessment criteria. The focus of assessment in this component is related to the suitability of questions in ideal teaching materials, such as questions that are compiled representative; questions on competency tests and final tests can measure the achievement of learning objectives; the answer key contains a brief discussion along with the score on each question. In this component, the highest score is ideally 15, the lowest score is ideally 3, Xi value is 9, Sbi value is 2 and X value (average) is 9.3.

Table 5. Criteria for Assessment of Learning Assessment on Teaching Materials

Criteria	Score Formula
Very good	$X > 12.6$
Good	$10.2 < X \leq 12.6$
Fair	$7.8 < X \leq 10.2$
Deficient	$5.4 < X \leq 7.8$
Very Poor	$X \leq 5.4$

The average score of the learning assessment component is 9.3 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students in the learning assessment component can be categorized as sufficient. This is due to the large number of prospective teacher students who do not include practice questions and answer keys in teaching materials.

Designing learning materials that incorporate evaluation tools to measure student understanding and progress, as well as provide constructive feedback, is essential for effective teaching and learning. Utilizing formative assessment strategies can improve the quality of classroom instruction by empowering teachers to receive feedback that aligns with learning standards and objectives (Wilfredi & Wachira, 2024). This approach encourages increased dedication and creativity compared to traditional assessment methods, as well as fostering an environment where teachers can adjust their teaching based on feedback from students (Pat-El et al., 2015).

Evaluation tools are essential in the educational process as they allow students and teachers to effectively measure understanding and progress. Effective teaching involves not only disseminating knowledge, but also ensuring that students can relate new information to prior knowledge and apply it practically. This can be achieved through assessments such as written tests, oral tests, and assignments, to evaluate cognitive aspects such as recognizing, remembering, creating, and understanding the material (Lumpkin, 2022; Maharani et al., 2023).

Discovery Learning Orientation components

The focus of the assessment in this component is related to the suitability of teaching materials with discovery learning stages, namely containing simulations, problem identification, data collection, data processing; proof, and drawing conclusions. In this component the highest score is ideally 5, the lowest score is ideally 1, the Xi value is 3, the Sbi value is 0.67 and the X value (average) is 4.

Table 6. Criteria for Assessing the Components of discovery learning orientation in Teaching Materials

Criteria	Score Formula
Very good	X > 4.2
Good	3.4 < X ≤ 4.2
Fair	7.8 < X ≤ 10.2
Deficient	5.4 < X ≤ 7.8
Very Poor	X ≤ 5.4

The average score of the discovery learning orientation component is 4 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students on the discovery learning orientation component can be categorized as good. This means that prospective teacher students are able to develop discovery learning-based teaching materials.

Designing educational materials to encourage students to make their own discoveries involves integrating various elements such as simulation, problem identification, data collection, data processing, proof, and conclusion drawing. Simulation plays an important role in this process by providing a dynamic and interactive environment where students can experiment and observe the results. In discovery learning, simulations should be supported by interpretive, experimental and reflective aids to enhance intuitive understanding and knowledge integration. By integrating these elements, educational materials can effectively engage students in the discovery process, allowing them to identify problems, collect and process data, validate their findings, and draw meaningful conclusions, thus fostering deeper understanding and knowledge retention (Petrovaa et al., 2013; Reid et al., 2003).

The Quality of Discovery Learning-Based Student Worksheets Prepared by Chemistry Teacher Candidates

At this stage, the students' worksheets that have been assessed are then categorized for quality analysis. Categorization is carried out using the formula for categorizing the quality of learning tools prepared by prospective teacher students which can be seen in Table 1. The quality of discovery learning-based learner worksheets prepared by prospective teacher students was assessed and analyzed from 4 components, namely the construction component, learning activities, learning assessment and discovery learning orientation.

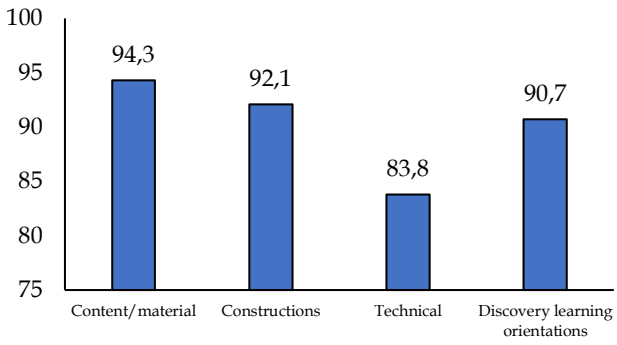

Figure 2. Percentage of ideality on the learner worksheet component

Figure 2 is a diagram of the percentage of idealized assessment results on student worksheets. This percentage is used to determine the extent to which the

student worksheets that has been prepared by prospective teachers meets the standards set by the assessor. In Figure 2, it can be seen that the highest percentage of ideality is found in the content/material component, which is 94.3%. The percentage of ideality in the discovery learning orientation component reached 92.1%, in the construction component 90.7% and the lowest percentage of ideality was in the learning assessment component which was 83.8%.

Content/Material Components

The focus of the assessment in this component is the suitability of the material / content of based student worksheets with the 2013 curriculum, namely the suitability of learning objectives with learning outcomes; The correctness of the concept; Presentation requires students to learn actively; Emphasis on the Discovery Learning model, which contains simulations, problem identification, data collection, data processing, proof, drawing conclusions. In this component the highest score is ideally 25, the lowest score is ideally 5, the Xi value is 15, the Sbi value is 3.33 and the X value (average) is 23.6.

Table 7. Assessment Criteria for the Content/Material Component on the Student Worksheet

Criteria	Score Formula
Very good	X > 21
Good	17 < X ≤ 21
Fair	13 < X ≤ 17
Deficient	9 < X ≤ 13
Very Poor	X ≤ 9

The average score of the Content/Material component is 23.6 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students in the Content / Material component can be categorized as very good. This means that prospective chemistry teacher students are very good at compiling student worksheets in terms of material / content components that are in accordance with the 2013 curriculum. student worksheets that are prepared are in accordance with the learning objectives, the correctness of the concept, the presentation requires students to learn actively, the emphasis on the Discovery Learning model which contains simulation, problem identification, data collection, data processing, proof, drawing conclusions.

Learner worksheets, both electronic and traditional, play an important role in facilitating learning by providing guidance and structured material for students (Amthari et al., 2021). Such learner worksheets should be aligned with the curriculum and meet specific student learning needs. The materials should be designed to support clear and in-depth learning objectives, which can be achieved by incorporating a scientific approach that encourages problem solving and the application of knowledge in everyday life. Materials should be relevant to students' field of study to maintain their interest and motivation. Materials should be inclusive and accessible to all students, including students with disabilities (Mamlok-Naaman et al., 2015; Munzil & Mentari, 2021; Scanlon et al., 2018).

Construction Components

The focus of the assessment on this component is related to the completeness of the components of the ideal student worksheet, such as clear learning objectives; accuracy in the use of language and appropriate sentences; questions in the student worksheet are relevant; there is space for students to write the results of activities/experiments and the identity of students in the student worksheet to facilitate administration. In this component the highest score is ideally 30, the lowest score is ideally 6, the Xi value is 18, the Sbi value is 4 and the X value (average) is 27.6.

Table 8. Criteria for Evaluating the Construction Component of the student worksheet

Criteria	Score Formula
Very good	X > 25.2
Good	20.4 < X ≤ 25.2
Fair	15.6 < X ≤ 20.4
Deficient	10.8 < X ≤ 15.6
Very Poor	X ≤ 10.8

The average score of the construction component is 27.6 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students in the construction component can be categorized as very good. This shows that the learner worksheets prepared have clear learning objectives, accuracy in the use of language and appropriate sentences, questions in the learner worksheets are relevant, there is space for learners to write the results of activities/experiments and the identity of learners in the learner worksheets to facilitate administration.

The development of learner worksheets is very important to improve the learning process by providing clear learning objectives, accurate language, relevant questions, and space for learners to document their activities and identity. Student worksheet should be tailored to the needs of learners to encourage active and independent learning. The questions in the worksheet should be relevant and the language used should be appropriate. The development of learners' worksheets should also pay attention to the relevance of the questions and the need for space where students can

record their findings and personal information (Azizah et al., 2023; Farisma et al., 2023; Rahayu et al., 2023).

Technical Components

The focus of the assessment in this component is related to the appearance of the ideal's student worksheet, the appearance of the student worksheet; consistency of writing and the use of appropriate images. In this component the highest score is ideally 15, the lowest score is ideally 3, the Xi value is 9, the Sbi value is 2 and the X value (average) is 12.6.

Table 9. Technical Component Assessment Criteria on Student Worksheets

Criteria	Score Formula
Very good	X > 12.6
Good	10.2 < X ≤ 12.6
Fair	7.8 < X ≤ 1.,2
Deficient	5.4 < X ≤ 7.8
Very Poor	X ≤ 5.4

The average score of the learning assessment component is 12.6 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students in the learning assessment component can be categorized as good. This shows that the learner worksheets have a good appearance, consistency of writing and the use of images that are appropriate.

Consistency in writing in the learner worksheet is very important for clarity and coherence. Incorporating visuals such as images and videos into learners' worksheets can enhance learners' understanding of the content and improve their learning experience. In terms of the use of appropriate images, the development of learner e-worksheets rich in scientific inquiry-based multimedia has proven to be very beneficial for learners, as it can stimulate their interest and aid understanding through real images, animations, audio, and video links (Andriana et al., 2022).

Discovery Learning Orientation Components

In the discovery learning orientation component, there are 6 criteria. The focus of assessment in this component is related to the suitability of teaching materials with discovery learning stages, namely containing simulations, problem identification, data collection, data processing; proof, drawing conclusions. In this component the highest score is ideally 30, the lowest score is ideally 6, the Xi value is 18, the Sbi value is 4 and the X value (average) is 27.2.

The average score of the discovery learning orientation component is 27.2 so that the quality of discovery learning-based teaching materials prepared by prospective chemistry teacher students on the discovery learning orientation component can be categorized as very good. Chemistry teacher candidates have been able to develop student worksheets that are in accordance with the stages of discovery learning, namely containing simulations, problem identification, data collection, data processing; proof, drawing conclusions.

Table 10. Assessment Criteria for the Discovery Learning Orientation Component of the Student Worksheet

Criteria	Score Formula
Very good	X > 25.2
Good	20.4 < X ≤ 25.2
Fair	15.6 < X ≤ 20.4
Deficient	10.8 < X ≤ 15.6
Very Poor	X ≤ 10.8

The importance of planning chemistry worksheets to encourage the development of creative and skills, in line with the objectives of discovery learning (Utami et al., 2016). Student worksheets should not only consist of questions but also include a collection of activities to enrich the learning process, encouraging active engagement and exploration among students (Nasution et al., 2021). Incorporating multimedia elements in student worksheet, as highlighted by, can help improve critical thinking skills (Wahyuni et al., 2021). Worksheets accompanied by interactive activities to make learning more meaningful and enjoyable (Haerani et al., 2023).

Conclusion

The results showed that the quality of discovery learning-based teaching materials prepared by Chemistry teacher candidates in the construction component is categorized as Good, content/material is categorized as Very Good, learning assessment is categorized as Quite Good and discovery learning orientation is categorized as Good. The quality of discovery learning-based student worksheets prepared by prospective chemistry teachers in terms of the construction component is categorized as Very Good, learning activities are categorized as Very Good, learning assessment is categorized as Good and discovery learning orientation is categorized as Very Good.

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hopefully providing benefits for the progress of the Nation and State.

Author Contributions
Designed the research concept, drafted the methodology, analysedthe data, wrote the article, and carried out the research activities, reviewing and evaluating every progress in article writing and research implementation.

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Conflicts of Interest
The authors declare no conflict of interest.

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