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Analysis of Students' Abilities in Compiling Independent Curriculum Teaching Modules Based on Discovery Learning

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Abstract
The implementation of the Independent Curriculum requires an increase in the need for prospective teachers who are able to design open modules that are in accordance with student needs. The Discovery Learning model can be applied in the open module of the Independent Curriculum because it can improve problem-solving skills, creativity, and student independence and create an interesting and enjoyable learning experience. This study uses an effective qualitative descriptive method to gain in-depth insight into the development of the Independent Curriculum teaching module based on Discovery Learning by prospective chemistry teacher students. The purposive sampling technique ensures that the research subjects are relevant to the focus of the study, namely students taking microteaching courses with a sample size of 21 students. The identity module component obtained very good criteria, the core activity component obtained sufficient criteria, the learning activity component (discovery learning) obtained very good criteria, and the learning assessment component obtained sufficient criteria. The results of the analysis show that although prospective chemistry teacher students have an understanding of the syntactic psychology of Discovery Learning, its application in the Independent Curriculum requires additional expertise. Students need to plan activities that encourage student stimulation and motivation and practice making more holistic assessments, including diagnostic and summative assessments, to ensure that open modules are prepared in accordance with the Independent Curriculum standards.

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INTRODUCTION

Education is the key to producing a generation with strong skills and competitive abilities. The curriculum is one component of education that functions as a roadmap in the teaching and learning process, playing a central role in achieving these educational goals. Law Number 20 of 2003 concerning the National Education System states that the curriculum is a comprehensive design that includes learning objectives, teaching materials, and learning strategies used to achieve the established educational goals. Educators are professional staff whose main role is to educate, teach, train, evaluate and evaluate formal early childhood, elementary and secondary students (Hidayati et al, 2021).

The Ministry of Education and Culture (Kemdikbud) introduced the Independent Curriculum to provide flexibility for educators and students to utilize the latest teaching techniques. According to Miladiah (2023), the Independent Curriculum provides opportunities for students to investigate and communicate their learning interests. The spirit of competence and moral integrity of students must be encouraged through the Independent Curriculum. Through

individualization of learning, development of 21st century skills, empowerment of teachers, encouraging innovation, building student independence, and relevance to the real world, the independent curriculum opens the door to more effective and relevant education (Fitra, 2023).

In line with the development of the Independent Curriculum, prospective teachers are needed who not only master the curriculum material but also have the ability to compile innovative teaching modules that are in accordance with the characteristics and learning needs of students. Teachers must have competency standards in carrying out their duties. These competency standards are pedagogical competency, professional competency, personality competency, and social competency. To help prospective teacher students master the four competency standards and learn basic teaching skills, it is necessary to compile teaching modules (Kurniati, 2022). Teaching modules are one of the learning tools that are compiled systematically and attractively so that the learning process becomes more effective and focused so that learning objectives can be achieved (Rahimah, 2022). The module is designed as an independent learning medium because it is equipped with complete instructions for independent learning (Simangunsong & Pane, 2021).

The Ministry of Education and Culture (2022) emphasized that teaching modules designed in accordance with the Independent Curriculum have integrated all the components contained in the Learning Implementation Plan. Thus, teachers no longer need to create RPPs separately. This teaching module provides teachers with the flexibility to present learning materials in a more innovative and relevant way to the learning situation. One of the learning models that can be applied to optimize the use of teaching modules is the Discovery Learning model, as expressed by Auliah et al. (2023).

The Discovery Learning model provides a learning atmosphere that can improve critical thinking skills, creativity, and independence in solving problems. This study aims to measure the ability of prospective chemistry teachers in developing innovative teaching modules that are in accordance with the Merdeka Curriculum. The results of previous studies (Sunarto, 2022; Fuldiaratman; Pamela, 2023) show that this model encourages students to be more active in asking questions, discussing, and working together, so that their interest in learning increases and their understanding of chemistry material becomes deeper.

This research is very important to do because a well-designed teaching module that follows the Discovery Learning method can improve the quality of teaching in the classroom. In addition, this study will show the difficulties and obstacles faced by prospective chemistry teacher students when creating modules and offer suggestions to improve their skills. This study is expected to gain a comprehensive understanding of the skills possessed by prospective chemistry teacher students in developing teaching modules based on Discovery Learning. In addition, educational institutions will be able to use this information to better prepare future prospective teachers to meet the demands of education in the modern era.

METHOD

This study uses a qualitative descriptive method to analyze the ability of prospective chemistry teacher students in developing Discovery Learning-based teaching modules according to the Independent Curriculum. This method was chosen because it allows researchers to gain an in-depth understanding of the process, obstacles, and quality of developing educational modules that involve students.

The subjects of this study involved prospective chemistry teacher students at one of the higher education institutions located in the city of Makassar. The sampling technique used was purposive sampling, namely by selecting students who were taking microteaching courses. The

number of students who were the subjects of this study was 21 people. The instruments used to collect data in this study include: Documentation, in the form of teaching modules that have been developed by students for further analysis. Structured questionnaires, which function to measure students' perceptions and understanding in compiling Discovery Learning-based Independent Curriculum Teaching Modules.

The learning devices that have been collected are then assessed using an assessment rubric, and scoring is carried out to determine the ability category of prospective chemistry teacher students. For the assessment components in the independent curriculum teaching module questionnaire based on Discovery Learning, a Likert scale is used with a Likert scale range of 4 choices (1 to 4) starting from very poor, poor, good, and very good.

The components of the teaching module assessed in this study include the identity/general information of the module, core activities, learning activities, and learning assessments developed from research (Maulida, 2022), as in Table 1:

Table 1. Components and Indicators of the Independent Curriculum Teaching Module Based on Discovery Learning

Component	Indikator
Identity / General Information Module	1. Identity of compiler and school 2. Learning objectives 3. Profile of Pancasila students 4. Facilities & infrastructure 5. Target students 6. Approach and method
Core Competencies	1. Clarity of learning objectives 2. Operational verbs (Bloom's taxonomy) 3. Keywords 4. Meaningful learning 5. Starter questions 6. Learning preparation
Discovery Learning Activity	1. Clarity of learning steps 2. Initial motivation 3. Clarity of discovery syntax (stimulation, problem statement, data collection, generalization, verification, data procession) 4. Formation of character according to the profile of Pancasila students 5. Reinforcement and reflection
Learning Assesment	1. Diagnostic assessment 2. Formative assessment 3. Summative assessment

Table 2. Assessment Components of the Ability Category of Prospective Chemistry Teacher Students

No.	Component	Scoring Formula
1.	Very Good	$X > Xi + 1{,}80\ Sbi$
2.	Good	$Xi + 0{,}60\ Sbi < X \leq Xi + 1{,}80\ Sbi$
3.	Enough	$Xi - 0{,}60\ Sbi < X \leq Xi + 0{,}60\ Sbi$
4.	Poor	$Xi - 1{,}80\ Sbi < X \leq Xi - 1{,}80\ Sbi$
5.	Very Poor	$X \leq Xi - 1{,}80\ Sbi$

The assessment result components of the ability category of prospective chemistry teacher students in developing independent curriculum teaching modules based on Discovery Learning were adopted from Theis (2019) with description:

Ideal Highest Score = Σ component item x highest score
Ideal Lowest Score = Σ component item 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)

RESULTS AND DISCUSSION

General Identity Components

The results of the assessment of the general identity component of the teaching module produced a very good component (418 > 404.4) because X > Xi + 1.80 Sbi, as shown in Table 3.

Table 3. Results of the Assessment of the General Identity Component of the Teaching Module

Component	Value Score	Description
X (actual score)	418	Very Good (418 > 404,4)
Ideal Maximum Score	504	
Ideal Minimum Score	6	
Xi (mean ideal score)	255	
Sbi (standard deviation ideal score)	83	

Table 3 shows that the actual scores obtained by students in developing teaching modules are higher than the ideal average score. This indicates that students have been able to apply their knowledge well in compiling teaching modules that provide clear and systematic guidance for teachers in implementing the Independent Curriculum learning. The independent curriculum requires teachers to have the ability to compile quality teaching modules. Well-designed teaching modules will be an effective reference for teachers in planning and implementing learning activities that are in accordance with the characteristics of students (Agusty et al, 2023).

One important aspect of the Independent Curriculum is the integration of the six main characteristics of the Pancasila Student Profile. Thus, the teaching modules developed by students have accommodated the development of critical, creative, independent thinking competencies, as well as religious and national values in students, in line with the government's vision to realize an advanced and characterful Indonesia (Ministry of Education and Culture, 2022).

Implementation of the integration of the Pancasila Profile character in the teaching module can be done by adding a special section to the module guide that explains each element of the Pancasila Profile, providing concrete examples of its integration in activities and assessments, including a character assessment rubric, and examples of student character development assignments or projects.

The elements of the Pancasila Student Profile can be integrated into the teaching module in various ways. For example, "Faithful, devoted to God Almighty, and noble" through case studies of religious chemists and experiments related to environmental issues; "Independent" through independent research and simple projects; "Working together" through group work; "Globally diverse" through learning the contributions of scientists from various countries; "Critical reasoning" through data analysis and argument evaluation; and "Creative" through designing innovative molecular models. The teaching module can also include a detailed character assessment rubric and examples of character development assignments/projects.

Core Activity Components

The results of the assessment of the core activity components in the teaching module produced sufficient components (205.2 < 319 ≤ 468.4) because Xi + 0.60 Sbi < X ≤ Xi + 1.80 Sbi are shown in Table 4.

Table 4. Results of the Assessment of the Core Activity Components in the Teaching Module

Component	Value Score	Description
X (actual score)	319	Enough (205,2 < 319 ≤ 468,4)
Ideal Maximum Score	504	
Ideal Minimum Score	6	
Xi (mean ideal score)	255	
Sbi (standard deviation ideal score)	83	

Table 4 shows that the actual scores obtained by students in developing teaching modules are below the ideal average that has been set, even if a tolerance of one standard deviation is given. This indicates that there are still several shortcomings in the teaching modules produced by students. One of the shortcomings commonly found is the lack of inclusion of keywords that are relevant to the learning material. In addition, most students have not been able to explain in detail how the learning achievement indicators are related to the understanding of chemical concepts and the development of chemical skills. Prospective teacher students can use apperception in the form of questions or examples related to the subject matter to find out students' initial knowledge before starting learning in order to obtain learning outcomes (Rusninawiyah et al, 2018). In fact, learning outcomes are a benchmark for learning success that students are expected to achieve (Riyadi, 2023). The implementation of the Independent Curriculum learning outcomes in chemistry learning at the high shcool level emphasizes the importance of developing student competencies holistically, including aspects of knowledge, attitudes, and skills.

Learning modules can support students' use of keywords and learning outcomes by explicitly listing them at the beginning of chapters/units, highlighting them visually, providing concise definitions and examples, and consistently referring to them throughout the module. Learning activities are designed to actively engage students with keywords (e.g., in glossaries, concept maps, case analyses, discussions), and assessments measure mastery of keywords and learning outcomes through a variety of formats with specific feedback.

Discovery Learning Components

The results of the assessment of the learning activity components in the teaching module produced very good components (776 > 742) because X > Xi + 1.80 Sbi are shown in Table 5.

Table 5. Results of the Assessment of Learning Activity Components (Discovery Learning) in the Teaching Module

Component	Value Score	Description
X (actual score)	776	Very good (776 > 742)
Ideal Maximum Score	924	
Ideal Minimum Score	11	
Xi (mean ideal score)	468	
Sbi (standard deviation ideal score)	152,2	

Table 5 shows that the actual score is greater than the ideal average score. This means that through a more active and independent learning process, prospective chemistry teachers can develop Discovery Learning syntax using the Independent Curriculum teaching module. In

addition, students can develop critical and creative thinking skills in line with the values outlined in the Pancasila Student Profile. The Independent Curriculum provides students with the opportunity to learn from creative teachers while discovering learning concepts independently (Nurwahidin, 2023). The design of the teaching module created by prospective chemistry teacher students is integrated with the discovery learning model which includes stimulation syntax, problem statements, data collection, data processing, verification, and generalization (Aliyah et al, 2023).

In this study, the stages of Discovery Learning are operationalized as follows: First, prospective chemistry teacher students provide stimulation through examples of both phenomena and cases in the compiled module. The goal is to arouse curiosity and motivate students. Second, prospective chemistry teacher students guide students to identify problems in designing modules such as how to integrate Discovery Learning principles and how to overcome student difficulties. Third, students collect information from various sources to design the module. Fourth, students analyze and organize the information to design learning activities and assessments. Fifth, students present their module designs to get feedback and make revisions. Sixth, students draw conclusions about their learning and formulate principles for designing effective Discovery Learning modules.

Learning Assessment Components

The assessment results on the learning assessment component of the teaching module produced sufficient components ($103 < 148 \leq 202.4$) because $Xi - 0.60\ Sbi < X \leq Xi + 0.60\ Sbi$, as shown in Table 6.

Table 6. Learning Assessment Results on the Teaching Module

Component	Value Score	Description
X (actual score)	148	Enough ($103 < 148 \leq 202,4$)
Ideal Maximum Score	252	
Ideal Minimum Score	3	
Xi (mean ideal score)	128	
Sbi (standard deviation ideal score)	41,5	

Table 6 shows that the actual score is greater than the average ideal score. Most prospective chemistry teachers only include one assessment, namely formative assessment, in the teaching module, while only a few students include summative assessment. However, none of the prospective chemistry teachers include diagnostic assessments in the teaching modules they have prepared.

Assessment in Discovery Learning is essential not only to measure final results, but also to provide information about students' learning processes and help teachers adjust instruction. Therefore, modules need to include diagnostic assessments (to identify students' prior knowledge and difficulties), formative (to monitor progress and provide feedback), and summative (to evaluate achievement at the end of learning). To increase motivation and stimulation, diagnostic assessments can include challenging pre-tests, interactive concept maps, dynamic class discussions, and curiosity-provoking surveys. Formative assessments can include observations that track student engagement, motivating class discussions, short tasks that provide a sense of accomplishment, personalized written feedback, and self- and peer-assessments that foster intrinsic motivation. Summative assessments can include rewarding final tests, innovative projects, confidence-boosting presentations, portfolios that document growth, and reflective self-evaluations. By including these types of assessments and emphasizing motivation and stimulation, teachers can better understand student progress and

make informed instructional decisions, while students who design modules will learn to design effective, comprehensive, and motivating assessments.

Ideally, the assessment in the Independent Curriculum is designed more holistically and focuses on developing student competencies authentically. Authentic assessments can examine various aspects of students, including cognitive, emotional, and psychomotor aspects. This is done to ensure that students have enough time to understand the concept and develop their skills optimally according to the learning content delivered by the teacher (GH et al., 2023).

Analysis of the abilities of prospective chemistry teachers in developing the Independent Curriculum teaching module based on Discovery Learning shows that although many prospective chemistry teachers have a theoretical understanding of Discovery.

Learning syntax, its application in the context of a dynamic curriculum such as the Independent Curriculum requires additional expertise. The knowledge and abilities of prospective teachers still need to be improved in order to meet the demands of the Independent Curriculum. In addition, LPTK needs to ensure that they offer the required capabilities effectively (Dirgantoro, 2023).

Prospective chemistry teacher students need to conduct further learning discussions in developing teaching module indicators, including planning activities that encourage student stimulation and motivation activities in accordance with the Discovery Learning syntax. In addition, prospective chemistry teacher students must also be trained to create assessment activities, especially diagnostic assessments and summative assessments, in compiling the Independent Curriculum teaching module based on Discovery Learning. This is important to ensure that prospective chemistry teacher students are able to produce teaching modules that not only comply with curriculum standards but are also effective in increasing student engagement and learning independence.

Teachers guide students to align learning indicators with chemistry competencies by emphasizing a deep understanding of competencies (knowledge, skills, attitudes) and ensuring that indicators describe measurable learning outcomes. The process includes analyzing the relationship between indicators and competencies through questions, mapping the relationship between the two with students, ensuring the relevance of learning activities, designing aligned assessments, and guiding students to reflect and evaluate alignment at the end of the module. This aims to improve student understanding, motivation, and engagement.

Student Learning Outcomes

Table 7. Student Learning Outcomes

Range of Values	Number of Students	Percentage
96-100	4	19.05%
91-95	7	33.33%
86-90	3	14.29%
81-85	7	33.33%

The learning outcomes of students after compiling the independent curriculum teaching module based on discovery learning showed a diverse distribution of scores. A total of 4 students obtained the highest scores in the range of 96-100, indicating a very good understanding of the material. The second largest group consisted of 7 students who obtained scores of 91-95, indicating a strong mastery of the material. Meanwhile, 3 students obtained scores of 86-90, and 7 other students obtained scores of 81-85. This distribution suggests that the discovery learning-based teaching module is effective in encouraging most students to achieve a good to very good level of understanding, although there is variation in individual achievement.

The diverse distribution of scores indicates that discovery learning-based learning modules may be effective for most students (those who get high scores), but there is also variation in individual achievement. This may be because well-designed modules, with clear instructions, interesting activities, and adequate resources, tend to produce better learning outcomes. To improve student learning outcomes, it is important to continuously evaluate and improve learning modules, consider student characteristics, and create a supportive learning environment.

CONCLUSION

Based on the assessment results in the tables presented, it can be concluded that the ability of prospective chemistry teacher students in compiling the Independent Curriculum teaching module based on Discovery Learning is generally good in each component of the teaching module. The results of the analysis show that although prospective chemistry teacher students have a theoretical understanding of Discovery Learning syntax, its application in the Independent Curriculum requires additional skills. Students need to plan activities that encourage stimulation and motivation and practice making more holistic assessments, including diagnostic and summative assessments, to ensure that the teaching module is compiled in accordance with the Independent Curriculum standards.

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