International Journal of Education, Vocational and Social Science
https://e-journal.citakonsulindo.or.id/index.php/IJEVSS
E-ISSN : 2963 4954
IJEVSS

Hot Question Instrument Development For Food Crop Agribusiness Courses At State Vocational High School In Bulukumba Regency

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Abstract

This study aims to develop a Hot Question instrument for Food Crop Agribusiness courses at State Vocational High Schools in Bulukumba Regency to measure students' higher-order thinking skills (HOTS). The research employed a research and development (R&D) method, involving stages of instrument design, expert validation, and empirical testing through item analysis, including validity, reliability, discriminating power, and difficulty level. The results indicate that the developed instrument has strong content validity, demonstrating good alignment with the conceptual measurement of HOTS. However, empirical findings reveal several limitations, including moderate reliability, low discriminating power, and an imbalance in item difficulty distribution dominated by easy questions, which reduce its effectiveness in distinguishing students' abilities. Despite these limitations, the instrument is still considered feasible as an initial evaluation tool in educational contexts. Further improvements are recommended, particularly in enhancing item quality, increasing the proportion of moderate and difficult questions, and strengthening discriminating power to produce a more reliable and comprehensive assessment instrument.

Keywords: Hot Question Instrument; Food Crop Agribusiness; Higher-Order Thinking Skills (HOTS); Vocational High School

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INTRODUCTION

Education in vocational schools plays a crucial role in preparing human resources who are not only technically skilled but also professionally competent in accordance with the demands of the labor market. Vocational High Schools (SMK) are expected to produce graduates who are ready to enter the workforce, equipped with strong vocational skills, discipline, responsibility, and adaptability to industrial dynamics. In the context of rapid technological advancement and the Industrial Revolution 4.0, the expectations for vocational education have expanded beyond technical proficiency. Students are now required to develop higher-order thinking skills, including critical thinking, creativity, problem-solving, and decision-making abilities, to remain competitive in a globalized and knowledge-based economy(Avery, 2020) .

One of the essential subjects in vocational education, particularly in the agricultural sector, is Agribusiness of Food Crops. This subject aims to equip students with knowledge, practical skills, and professional attitudes in managing agricultural resources effectively and sustainably. However, the learning process in this subject often emphasizes basic cognitive abilities such as memorization and understanding rather than encouraging deeper analytical and evaluative thinking. As a result, students tend to focus on recalling information instead of applying knowledge to solve real-world agricultural problems(Boltianska et al., 2020) .

The limitation is further reflected in the assessment instruments commonly used by teachers. Most evaluation tools are still designed to measure lower-order thinking skills (LOTS), such as remembering (C1), understanding (C2), and applying (C3), based on the revised Bloom's taxonomy. These instruments do not adequately stimulate students' ability to analyze, evaluate, and create, which are categorized as Higher Order Thinking Skills (HOTS). Consequently, students' potential to develop critical and innovative thinking remains underdeveloped, limiting their readiness to face complex challenges in the agricultural sector and the modern workforce (Long et al., 2022).

Higher Order Thinking Skills (HOTS) encompass advanced cognitive processes, including analysis, evaluation, and creation. These skills are essential for enabling students to interpret information deeply, assess various alternatives, and generate innovative solutions. In vocational education, especially in agribusiness, HOTS are highly relevant because students are frequently confronted with real-life problems, such as crop management, resource allocation, and production efficiency. Therefore, assessment instruments should not only measure knowledge acquisition but also foster students' ability to think critically and solve contextual problems(Amrina et al., 2025) .

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Previous studies have demonstrated that HOTS-based assessment can significantly improve students' critical and creative thinking abilities. Instruments designed with contextual stimuli and problem-solving tasks encourage students to engage in deeper reasoning processes. However, most existing studies focus on general or academic subjects such as mathematics and science, while research on HOTS-based instruments in vocational subjects, particularly Agribusiness of Food Crops, remains limited. This gap highlights the need for developing assessment tools that are specifically tailored to the characteristics of vocational education and aligned with real-world applications(Amrina et al., 2025) .

In addition to contextual gaps, there are also methodological challenges in developing valid and reliable assessment instruments. Variations in validation techniques and item analysis approaches indicate the need for a systematic and integrated development model. A well-structured instrument should meet essential criteria, including content validity, reliability, appropriate difficulty level, and discrimination power, to ensure accurate measurement of students' abilities (Rachmawati et al., 2023).

Based on these considerations, this study focuses on developing a HOTS-based test instrument for the Agribusiness of Food Crops subject in Vocational High Schools. The development process follows a systematic Research and Development (R&D) approach to produce an instrument that is valid, reliable, and feasible for classroom use. This instrument is expected to serve not only as an evaluation tool but also as a pedagogical medium that promotes higher-order thinking among students(Christie et al., 2025).

Ultimately, the development of HOTS-based assessment instruments is expected to contribute to improving the quality of vocational education. By providing teachers with effective tools to measure and stimulate higher-order thinking, and by encouraging students to think critically and creatively, vocational education can better prepare graduates who are adaptive, innovative, and ready to meet the challenges of the modern workforce.

Higher Order Thinking Skills (HOTS) in Vocational Education

Higher Order Thinking Skills (HOTS) represent a crucial component in modern education, particularly within the context of vocational learning. HOTS refers to advanced cognitive processes that go beyond memorization and comprehension, encompassing analysis, evaluation, and creation as outlined in the revised Bloom's Taxonomy. These skills are essential in preparing students to face complex and dynamic challenges in the 21st century. In vocational education, including Agribusiness of Food Crops, HOTS is not merely an academic requirement but a practical

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necessity. Students are expected to analyze agricultural problems, evaluate various farming strategies, and create innovative solutions to improve productivity and sustainability. The development of these skills ensures that learners are capable of adapting to technological advancements and evolving industry demands(Prasetya & Ramadani, 2025).

In the context of vocational high schools (SMK), HOTS plays a significant role in bridging the gap between theoretical knowledge and practical application. Agribusiness education requires students to engage in real-life problem-solving situations, such as determining optimal planting methods, managing resources efficiently, and responding to environmental challenges. However, traditional teaching practices often fail to stimulate higher-order thinking, as they primarily focus on lower cognitive levels(Rahman, 2021). This condition limits students' ability to think critically and creatively. Therefore, integrating HOTS into both instruction and assessment is essential for enhancing learning outcomes. Research findings indicate that students exposed to HOTS-based learning demonstrate improved critical thinking, problem-solving abilities, and decision-making skills. Consequently, HOTS is not only a cognitive framework but also a strategic approach to developing competent and competitive graduates in vocational education(Santoso, 2021).

Assessment of Learning Outcomes in Vocational Education

Assessment is a fundamental component of the educational process, serving as a tool to measure students' achievement and guide instructional decisions. In vocational education, assessment holds a more complex role because it must evaluate not only cognitive knowledge but also practical skills and work attitudes. The concept of assessment encompasses the systematic process of collecting, analyzing, and interpreting data to determine the extent to which learning objectives have been achieved. It includes formative assessment, which supports the learning process, and summative assessment, which evaluates learning outcomes at the end of an instructional period(Lakapu et al., 2025).

In SMK, assessment is expected to reflect real-world competencies aligned with industry standards. This means that evaluation instruments should be authentic, contextual, and comprehensive. Authentic assessment involves tasks that mirror real-life situations, allowing students to demonstrate their ability to apply knowledge in practical contexts. For example, in Agribusiness of Food Crops, students may be assessed on their ability to plan crop production, manage agricultural inputs, or analyze market opportunities. Such assessments provide a more accurate representation of students' readiness for the workforce(Amiruddin & Hasim, 2021).

However, in practice, many assessment instruments used in vocational schools are still

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limited to written tests that focus on lower-order thinking skills. These instruments fail to capture the full range of students' competencies, particularly their ability to analyze, evaluate, and create. As a result, there is a mismatch between the intended learning outcomes and the assessment methods employed. To address this issue, educators must design assessment tools that align with higher cognitive levels and reflect the demands of vocational learning. Effective assessment should not only measure learning outcomes but also support the development of critical thinking and problem-solving skills. By adopting comprehensive and context-based assessment approaches, vocational education can better fulfill its role in preparing students for real-world challenges(Torro et al., 2021).

Development of HOTS-Based Assessment Instruments

The development of assessment instruments is a systematic process aimed at producing tools that are valid, reliable, and suitable for measuring students' abilities. In the context of HOTS, instrument development becomes even more critical because it requires careful design to ensure that the items truly assess higher-order cognitive skills. A well-developed HOTS-based instrument should include contextual stimuli, non-routine problems, and tasks that require reasoning, analysis, and creativity. These characteristics distinguish HOTS items from traditional questions that only test recall and understanding(Misra et al., 2020).

The process of developing HOTS-based instruments typically involves several stages, including defining test specifications, writing items, conducting expert validation, administering try-outs, analyzing item quality, and revising the instrument. Each stage plays a vital role in ensuring the quality of the final product. Test specifications provide a blueprint that outlines the competencies to be measured, the cognitive levels targeted, and the format of the items. Item writing involves translating these specifications into clear and meaningful questions that reflect real-world contexts. Expert validation ensures that the content, structure, and language of the items are appropriate and aligned with learning objectives(Sardar et al., 2021).

After validation, the instrument is tested on a group of students to collect empirical data. This data is analyzed to evaluate item validity, reliability, difficulty level, and discrimination power. Validity refers to the extent to which the instrument measures what it is intended to measure, while reliability indicates the consistency of the results. Difficulty level and discrimination power help determine whether the items are appropriate for differentiating between students of varying abilities. Based on the analysis, items that do not meet quality criteria are revised or discarded(Akridge et al., 2025).

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In vocational education, the development of HOTS-based instruments must also consider the specific characteristics of the subject matter. For Agribusiness of Food Crops, this means incorporating real agricultural scenarios, such as crop management issues, environmental factors, and economic considerations. By doing so, the instrument becomes more relevant and meaningful for students. Moreover, HOTS-based assessment instruments serve not only as measurement tools but also as learning tools that encourage students to think deeply and engage actively with the material(Tewari et al., 2024).

Despite its importance, the development of HOTS-based instruments in vocational subjects remains limited. Most existing studies focus on general education subjects, leaving a gap in research related to vocational contexts. This highlights the need for further studies that address the unique demands of vocational education. By developing high-quality HOTS-based instruments, educators can enhance both the assessment process and the overall quality of learning. Ultimately, such efforts contribute to producing graduates who are not only knowledgeable but also capable of critical thinking, innovation, and problem-solving in real-world situations(Richardson, 2022).

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DISCUSSION

Content Validity of the Instrument

The results of the content validity analysis indicate that all test items achieved Aiken's V values ranging from 0.800 to 0.933, with an overall average of 0.864. This range demonstrates that the developed instrument meets the criteria for high content validity. In theoretical terms, this means that each item included in the instrument is well-aligned with the indicators it is intended to measure. Such a result confirms that the process of item construction was carried out systematically and in accordance with established principles of educational measurement.

High content validity further implies that the items accurately represent the intended construct, which in this study is higher-order thinking skills (HOTS). Each question has been carefully designed to reflect relevant indicators associated with the competencies targeted in Food Crop Agribusiness learning. This alignment ensures that the instrument is not merely assessing surface-level understanding but is instead capable of capturing complex cognitive processes such as analysis, evaluation, and problem-solving. Consequently, the instrument provides a strong conceptual foundation for measuring advanced student competencies within the specified subject area(Plastina et al., 2020).

In addition, the involvement of five validators in the validation process contributes

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significantly to the objectivity and credibility of the evaluation. The participation of multiple experts enhances the reliability of judgments, as it reduces individual bias and increases the stability of the results. A larger number of validators generally leads to more consistent and dependable assessments, as differing perspectives are integrated into the final evaluation. This collaborative validation process strengthens the claim that the instrument has undergone rigorous review prior to its implementation in field testing(Nugroho & Sudira, 2025).

From the material perspective, the items were considered appropriate and consistent with the current curriculum, encompassing essential concepts in food crop agribusiness. In terms of construction, the items were systematically arranged and adhered to the standard rules for writing multiple-choice questions, including clarity of options and logical structure. From a linguistic standpoint, the language used in the items was deemed clear, concise, and communicative, minimizing ambiguity and ensuring that students can understand the questions without unnecessary difficulty(Englin, 2025).

Therefore, the high level of content validity demonstrates that, conceptually, the instrument satisfies the requirements of a sound measurement tool. However, it is important to note that strong content validity does not automatically guarantee high empirical quality. This limitation is evident in subsequent analyses, which reveal variations in reliability and discriminating power among the items. These findings highlight the need to complement theoretical validation with empirical testing to ensure overall instrument effectiveness.

Reliability of the Instrument

The reliability analysis results show that, at the initial stage, the Cronbach's Alpha value was categorized as low. After problematic items were eliminated, the reliability coefficient increased to 0.525, placing it in the moderate category. This improvement indicates that item selection and refinement play a crucial role in enhancing the internal consistency of an instrument. By removing items with weak or negative correlations to the total score, the overall homogeneity of the instrument improves.

The increase in reliability following item elimination suggests that certain items were not functioning as intended and were negatively affecting the consistency of the measurement. These problematic items likely introduced noise into the data, reducing the coherence among test items. Once removed, the remaining items demonstrated a more consistent pattern in measuring the targeted construct. This finding underscores the importance of iterative testing and revision in instrument development(Sabong & Sumida, 2022).

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Despite the observed improvement, the reliability coefficient has not yet reached a high category. This indicates that the instrument is not fully consistent in measuring the same construct across all items. One of the primary factors influencing this condition is the imbalance in the distribution of item difficulty levels. When an instrument contains a disproportionate number of easy items, it tends to produce limited variation in student scores, which in turn reduces reliability.

An instrument dominated by easy questions typically results in many students achieving similar scores, thereby decreasing score variability. Since Cronbach's Alpha is highly sensitive to score variance, limited variability leads to lower reliability values. This highlights the importance of designing items with varying levels of difficulty to ensure a broader distribution of scores and a more accurate reflection of student ability(Njura et al., 2021).

Furthermore, the presence of items with low discriminating power also contributes to the moderate reliability level. Items that fail to differentiate effectively between high- and low-performing students weaken the internal consistency of the instrument. Such items do not contribute meaningfully to the measurement of the intended construct and may even distort the results.

In conclusion, the moderate level of reliability indicates that the instrument is sufficiently acceptable for use but still requires improvement. Enhancing the balance of item difficulty and improving the discriminating power of individual items are essential steps toward achieving higher reliability and overall measurement quality.

Discriminating Power of the Instrument

The analysis of discriminating power reveals that most items have low item-rest correlation values, and some items even exhibit negative values. This finding indicates that the ability of the items to distinguish between students with high and low abilities is still limited. Discriminating power is a critical indicator of item quality, as it reflects how effectively an item can differentiate among varying levels of student performance.

Ideally, a well-constructed item should be answered correctly by students with higher ability levels and incorrectly by those with lower ability levels. However, the results of this study show that many items do not meet this expectation. The limited discriminating ability suggests that the items are not yet optimal in capturing differences in student competence, particularly in the context of higher-order thinking skills(Long et al., 2022).

One major factor contributing to the low discriminating power is the predominance of easy items in the instrument. Items that are too easy tend to be answered correctly by most students,

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regardless of their ability level. As a result, these items fail to provide meaningful information about differences in student performance. This condition reduces the overall effectiveness of the instrument in distinguishing between varying levels of mastery.

Additionally, the presence of items with negative discriminating power indicates that these items are not functioning properly. Negative values suggest that lower-performing students are more likely to answer the item correctly than higher-performing students, which contradicts the expected pattern. This issue may arise from several factors, including unclear wording, the presence of misconceptions, or misalignment between the item and the intended indicator(Amrina et al., 2025).

These findings demonstrate that, although the instrument has strong content validity, it still exhibits empirical weaknesses in terms of item discrimination. This discrepancy highlights the importance of conducting empirical analyses to complement theoretical validation. Without adequate discriminating power, an instrument cannot effectively fulfill its role as a measurement tool.

Therefore, further refinement of the test items is necessary to improve their discriminating ability. This may involve revising item wording, adjusting difficulty levels, and ensuring closer alignment with the targeted indicators. By addressing these issues, the overall quality and effectiveness of the instrument can be significantly enhanced(Santoso, 2021).

Difficulty Level of the Instrument

The analysis of item difficulty indicates that most items fall into the easy category, with a total of 12 items classified as easy and only 3 items categorized as moderate. Notably, there are no items classified as difficult. This distribution suggests that the overall level of difficulty of the instrument is relatively low.

The dominance of easy items implies that the majority of students are able to answer the questions correctly. While this may indicate that the material is well understood, it also suggests that the instrument does not sufficiently challenge students' abilities. An effective assessment tool should include a range of difficulty levels to accurately measure different levels of competence(Rahman, 2021).

An unbalanced distribution of item difficulty has significant implications for the overall quality of the instrument. Ideally, a well-designed instrument should include a balanced proportion of easy, moderate, and difficult items. Such a distribution allows for a more comprehensive assessment of student ability, capturing both basic understanding and higher-

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order thinking skills.

The absence of difficult items is particularly concerning, given that the primary objective of the instrument is to measure higher-order thinking skills. Without challenging items, the instrument cannot effectively assess advanced cognitive processes such as critical thinking, analysis, and evaluation. This limitation reduces the instrument's ability to fulfill its intended purpose.Moreover, the predominance of easy items also affects the discriminating power and reliability of the instrument. When most students achieve high scores due to easy questions, score variation becomes limited. This, in turn, reduces the instrument's ability to distinguish between different levels of student ability and lowers the reliability coefficient(Lakapu et al., 2025).

In summary, the difficulty level of the instrument requires further improvement. A more balanced distribution of item difficulty is needed to enhance the instrument's ability to measure student competence comprehensively and accurately.

Feasibility of the Final Instrument

Overall, the instrument developed in this study demonstrates high content validity, indicating that it is conceptually aligned with the intended measurement objectives. This suggests that the instrument is theoretically sound and appropriately designed to assess higher-order thinking skills in the context of Food Crop Agribusiness learning.

However, from an empirical perspective, the instrument still exhibits several weaknesses, particularly in terms of reliability and discriminating power. The moderate reliability coefficient indicates that the internal consistency of the instrument is not yet optimal. Similarly, the low discriminating power observed in many items suggests that the instrument is not fully effective in differentiating among students with varying levels of ability(Prasetya & Ramadani, 2025).

These limitations are further supported by the results of the difficulty level analysis, which reveal a dominance of easy items. This imbalance contributes to reduced score variability, lower reliability, and limited discriminating power. Together, these factors highlight the need for further refinement and development of the instrument.

Despite these shortcomings, the instrument can still be considered sufficiently feasible for use as a measurement tool. It is particularly suitable for use in instructional settings as an initial evaluation tool to assess students' higher-order thinking skills. In this capacity, the instrument can provide valuable insights into student learning and serve as a foundation for further assessment development(Plastina et al., 2020).

Future efforts should focus on improving the quality of the test items, particularly by

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introducing a wider range of difficulty levels and enhancing discriminating power. This may involve revising existing items, adding more complex questions, and conducting additional rounds of empirical testing. In conclusion, the instrument developed in this study is reasonably suitable for use but requires further refinement to achieve optimal quality. With continued development and improvement, it has the potential to become a highly effective tool for measuring higher-order thinking skills in educational contexts.

CONCLUSION

The instrument developed in this study demonstrates strong content validity, indicating that it is conceptually well-aligned with the intended measurement of higher-order thinking skills (HOTS) in Food Crop Agribusiness learning. However, empirical analyses reveal that the instrument still has several limitations, particularly in terms of moderate reliability, low discriminating power, and an unbalanced distribution of item difficulty dominated by easy questions. These weaknesses affect the instrument's ability to consistently and effectively differentiate students' abilities. Despite these shortcomings, the instrument remains sufficiently feasible for use as an initial evaluation tool in educational settings. Nevertheless, further refinement is needed, especially in improving item quality, increasing the proportion of moderate and difficult questions, and enhancing discriminating power to achieve a more reliable and comprehensive measurement tool.

FUTURE DIRECTIONS

Future research should focus on refining the instrument to enhance its empirical quality by improving reliability, discriminating power, and the balance of item difficulty levels. This can be achieved through revising or replacing poorly performing items, incorporating a greater proportion of moderate and difficult questions, and ensuring closer alignment between items and higher-order thinking skill (HOTS) indicators. Additionally, expanding the sample size and diversity of participants in further trials would provide more robust data for validation. The use of advanced analytical approaches, such as item response theory (IRT), is also recommended to gain deeper insights into item characteristics. Continuous iterative testing and validation, supported by expert review, will be essential to develop a more accurate, reliable, and comprehensive assessment instrument for measuring students' higher-order thinking skills in Food Crop Agribusiness learning.

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