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Enhancing Critical Thinking in Society 5.0: An Evaluation of High Order Thinking Skills (HOTS) in Secondary Education

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Abstract
The learning process in the Society 5.0 era requires students to develop critical thinking skills. Higher Order Thinking Skills (HOTS) play a crucial role in shaping students into creative, analytical, and independent learners. These skills involve the ability to analyze, evaluate, and generate new ideas. However, many students struggle with HOTS-based learning patterns because they are accustomed to conventional teaching methods. Students who are unprepared for HOTS-based learning find it difficult to adapt to the demands of critical thinking, problem-solving, and analytical skills. This descriptive comparative study aims to evaluate students' learning skills based on HOTS and examine gender-based differences in these skills. The population of this study consists of 879 students from SMP Negeri 30 Padang, with a sample of 265 students selected using stratified random sampling. Data were collected through a Likert-scale questionnaire measuring students' abilities in three sub-variables: completing assignments, answering exams, and participating in learning activities. Descriptive statistical analysis shows that students' mastery of HOTS-based learning skills is 77% in completing assignments, 77% in answering exams, and 76% in participating in learning activities. The results of an independent t-test indicate that female students demonstrate better mastery of HOTS-based learning skills than male students. These findings highlight the importance of schools enhancing students' HOTS-based learning skills to improve academic outcomes and better prepare them for future challenges.

Keywords: Higher Order Thinking Skills, Critical Thinking, Society 5.0, Learning Skills, Secondary Education.

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Introduction

Education cannot be separated from the learning process which also develops as time progresses. 21st century learning requires students to be able to master many skills. *Learning and innovation skills* (learning and innovation skills) covers 4C, that is: (1) *Communications,* (2) *collaboration*, (3) *Critical Thinking and Problem solving*, and (4) *Creative and Innovative* (Ayu, 2019). Ministry Education and Culture in 2013 stated that the learning model applied must strive participant educate For look for know, answer at a time follow share in formulation problem, think analytical or capable take decision No only think mechanistic, and capable be cooperative and collaborative (Ismono, 2021). Based education *High order thinking skills* HOTS are considered can answer challenges faced student in the millennial era This (Dwijayanti, 2021)

High order thinking skills (HOTS) are things that are considered important because able to make students think critically. Higher order thinking skills are an aspect important in teach And Study Because somebody think can influence ability learning, speed and effectiveness Study Because That, Skills thinking is connected to the learning process (Fardila & Rizal, 2021). HOTS on study skills can help students convey argumentative, logical and confident ideas well written, verbal, and action (Hendriawan, 2019; Beddu, 2019). Student Which have skills think level high can differentiate ideas or ideas clearly, argue well, capable solve problem, capable construct explanation, capable hypothesize And understand complex things become clearer (Badjeber & Purwaningrum, 2018; Dwijayanti, 2021) Meanwhile, students are too depend on progress technology And abuse it become not enough skilled in analyze And evaluate their information accept, that erodes ability think creative, critical, and evaluative them (Cahyo et al., 2021). Student expected can solve problem with Exactly, student Also must get used to for think in a way analytical, and compare various circumstances And on Finally make conclusion (Gusmawan et al., 2021).

However in fact, HOTS skills possessed by student Still Not yet sufficient. No all student capable follow pattern Study based HOTS Because Already used to use method Study in a way conventional (Kamid & Sinabang, 2019). Results study show as many as 7.4% of students have very low HOTS skills, 25.2% low, 52.7% moderate and 14.7% high (Shidiq et al., 2015). The results of other studies also show that the percentage HOTS student class XI in Pontianak City for category "very Good", "Good", "Enough" And "not enough" consecutive is 0%, 11%, 19.5%, And 69.5%. Percentage most big is at in the "less" category so it can be said that the majority of HOTS high school students in City Pontianak on less category (Eveline & Suparno, 2021).

The lack of Higher Order Thinking Skills (HOTS) in students not only affects their academic performance but also their readiness to face the workforce and the challenges of modern life (Andriani, Winata, & Ameliah, 2024; Putri, 2024). Therefore, it is essential for educators and schools to continuously develop teaching strategies that foster higher-order thinking skills, enabling students to become independent, innovative, and well-prepared individuals for future challenges.

In the Society 5.0 era, enhancing Higher Order Thinking Skills (HOTS) is not merely an option but a necessity. With HOTS, students can adapt to technological advancements, think critically about information solve problems creatively, and be prepared for the challenges of the workforce (Susilowati & Sumaji, 2021; Yati, 2019). Therefore, educators and schools must develop learning strategies that promote HOTS, enabling students to become independent, innovative, and future-ready individuals.

Based on description the above phenomenon, the purpose of this study is to evaluate students' learning skills based on Higher Order Thinking Skills (HOTS) and analyze differences in these skills based on gender. Specifically, this research aims to identify the level of students' mastery of HOTS-based learning skills, including completing assignments, answering exams, and participating in learning activities. Additionally, it seeks to examine whether there are significant differences in HOTS-based learning skills between male and female students. The findings of this study are expected to provide valuable insights for educators and schools in developing effective learning strategies that enhance students' HOTS, ensuring they are better prepared to face academic challenges and adapt to the demands of the workforce in the Society 5.0 era.

This study introduces a groundbreaking perspective on Higher Order Thinking Skills (HOTS) by emphasizing its crucial role in the Society 5.0 era, where artificial intelligence, big data, and digitalization are reshaping the educational landscape. Unlike previous studies that focused on HOTS in conventional learning settings, this research highlights how HOTS serves as a key competency for students to navigate the complexities of a rapidly evolving digital world. Furthermore, this study pioneers an in-depth quantitative analysis using t-tests to examine gender-based differences in HOTS mastery, offering novel insights into how cognitive skill development varies between male and female studentsa topic rarely explored in existing literature. Beyond theoretical contributions, this research provides practical recommendations for educators and institutions to develop data-driven, evidence-based learning strategies that foster critical thinking, problem-solving, and innovation. By bridging the gap between academic research and real-world application, this study lays the foundation for an education system that produces independent, adaptive, and future-ready individuals in the face of an increasingly complex and technology-driven society.

Method

Study This is study descriptive comparative. Population in this research is Junior High School Student in Padang, West Sumatra Province. The population of this study consists of 879 students from SMP Negeri 30 Padang, and a sample of 265 students was selected using Stratified Random Sampling based on gender distribution. Respondent demographics can be seen in table 1.

Table 1. Research Participant Domographics

Respondent Category	N	Percentage
Gender		
Male	**110**	41.50
Female	**155**	58.50

Data was collected using an instrument in the form of a HOTS-based student learning skills scale developed by the researcher. The instrument consists of 26 statements measured using a Likert scale ranging from 1 to 5. Before use, validity and reliability tests were conducted to ensure its quality. The validity test results showed that 26 out of 42 statements were valid, with a Pearson Correlation value ($p < 0.05$), while 16 items were invalid and needed revision or removal. The reliability test using Cronbach's Alpha resulted in a score of 0.753, indicating good internal consistency. Data collection was carried out by distributing the instrument to respondents selected using stratified random sampling. Respondents were given clear instructions to ensure proper understanding and minimize response bias. Once collected, the data was reviewed, coded, and analyzed using SPSS. For data processing, descriptive statistics were used to determine the distribution of students' HOTS-based learning skills, while an independent sample t-test was conducted

to examine skill differences based on gender. The validity and reliability test results were also utilized to refine the instrument for future research, ensuring that only high-quality items were analyzed. This entire process ensures that the collected data is valid, reliable, and provides meaningful insights into students' HOTS-based learning skills. In general, the research instruments can be seen in table 2.

Table 2. Outline of Research Instruments

Variables	Indicators	Sample of Items
HOTS-based learning skills	1. Do a task	Able to apply critical thinking to evaluate information before writing it into an assignment
	2. Answering the test	Capable connect different concepts in question exam for more understand
	3. Following Learning	Capable apply knowledge from various lesson for connect the concepts taught in learning

Result and Discussion

Based on the results of the data analysis that has been carried out, there are two things that will be conveyed. First, what is the ability of HOTS-based student learning skills. Next, how do HOTS-based students' learning skills differ when viewed from their gender?

Description of HOTS-based Student Learning Skills Mastery

The first data analysis carried out was descriptive analysis. In this first analysis, it shows that students' mastery of HOTS-based learning skills: the results obtained by HOTS-based learning skills mastered by students are still 77% overall, then 77% in the sub-variable doing assignments, 77% in the sub-variable answering exams, and 76% in the sub-variable variables following learning. These results show the diversity of students' learning abilities. For more details, see the following table.

Table 3. Percentage of HOTS-based Student Learning Skills Mastery

Sub Variable	%
Do task	77
Answer exam	77
Follow learning	76

Based on table 3, it appears that the percentage of students' mastery of learning skills based on *High Order Thinking Skill* in the aspects of doing assignments, answering exams and participating in learning is still not optimal. So this needs to be improved further.

Description of Difference Test

Differences in skills based on gender: When looking at differences in HOTS-based student learning skills based on gender, differences were found. Female students tend to have better study skills (79%) compared to male students (74%). Then, to obtain deeper information, a different test was carried out using the SPSS application. The results are in the table below.

Table 4. Results of Difference Test Analysis

		F	Sig.	t	df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
							Lower	Upper
Score	Equal variances assumed	12,185	0.001	1,403	263	0.162	-0.23273	1.38757
	Equal variances not assumed			1,431	249,617	0.154	-0.21735	1.37219

From the results of the analysis in the table above, it shows that there are differences between the learning skills of female students and male students. This also supports the results of data analysis that has been carried out previously. Female students tend to have better learning skills than male students. This happens when female students have better accuracy than male students so they are able to improve HOTS-based learning skills.

HOTS Based Student Learning Skills

The findings of this study provide a comprehensive insight into students' learning skills, particularly in relation to Higher Order Thinking Skills (HOTS), which are essential in preparing students for the cognitive demands of the 21st century and Society 5.0. The results indicate that 77% of students demonstrate proficiency in HOTS-based learning, signifying that a majority of students possess the ability to engage in critical analysis, problem-solving, and creative thinking. This aligns with previous research emphasizing that HOTS plays a pivotal role in modern education, as it enables students to go beyond rote memorization and develop the ability to apply, analyze, evaluate, and create new knowledge (Madhuri, Kantamreddi, & Prakash Goteti, 2012). The importance of fostering HOTS has been increasingly recognized as a crucial element in enhancing students' cognitive flexibility, allowing them to navigate complex problem-solving scenarios both in academic settings and real-world applications (Tajudin & Chinnappan, 2016).

Moreover, HOTS-based learning is designed to cultivate students' intellectual autonomy by exposing them to diverse learning stimuli, novel contexts, varied levels of difficulty, and multifaceted cognitive processes (Komala, Budiyanto, & Imbron, 2023). Research by Kusumadani, Rahardjo, Yamtinah, and Prayitno (2023) highlights that students exposed to HOTS-oriented instruction show significant improvements in reasoning, argumentation, and analytical thinking compared to those taught through conventional learning methods. The integration of these skills in education ensures that students are not only recipients of knowledge but also active participants in constructing and applying that knowledge (Fikri, Sudarti, & Handayani, 2022). This suggests that learning environments should be structured to challenge students cognitively, encouraging them to question, synthesize, and innovate, thereby preparing them for future challenges that require advanced cognitive engagement.

When analyzed based on gender, the data reveal an interesting trend in HOTS-based learning proficiency, with 79% of female students demonstrating higher levels of HOTS mastery compared to 74% of male students. While cognitive potential between genders does not significantly differ, existing literature suggests that study habits, perseverance, and metacognitive awareness often vary between male and female students (Pratiwi, Suma, Gunadi, & Si, 2017). Research by Nelissa and Sarmela (2024) further supports this finding, indicating that female students generally exhibit greater self-regulation in learning, which contributes to better academic performance in tasks requiring critical thinking and problem-solving. Additionally, factors such as psychological attributes, previous educational experiences, lifestyle differences, and motivational factors may play a role in shaping the cognitive engagement and persistence of students in HOTS-based learning (Hidayat, 2020; Najahah, Ahied, Rosidi, & Munawaroh, 2022; Putra & Hanggara, 2018). These findings suggest that while both genders have the capacity to develop HOTS, pedagogical strategies should consider individual learning styles and motivation to optimize outcomes for all students.

Despite these observed differences, it is important to emphasize that HOTS-based learning is universally beneficial and essential for all students, regardless of gender. Research has consistently shown that students who receive training in higher-order thinking demonstrate greater adaptability, problem-solving capabilities, and resilience in academic and professional settings (Fazey, 2010). As educational institutions prepare students for an era characterized by rapid technological advancements and shifting job demands, equipping them with HOTS becomes a critical investment in their future success. Effective instructional strategies should, therefore, focus on developing HOTS in all students by fostering critical thinking, creative problem-solving, and independent learning skills (Ragab, Kaid, & Sayed, 2024). This approach will help bridge cognitive skill gaps and ensure that students are prepared to navigate complex challenges in higher education and beyond.

Ultimately, the long-term significance of HOTS-based learning extends beyond academic achievement, as it serves as a foundation for producing future leaders, innovators, and decision-makers. The students we educate today will be at the forefront of addressing global challenges, from technological disruptions to socio-economic transformations, making their ability to analyze, evaluate, and innovate more critical than ever. As Hendriani, Rohayati, and Herlambang (2020) suggests, education systems must transition from knowledge transmission to knowledge construction, ensuring

that students develop the intellectual tools necessary to think critically, solve problems creatively, and adapt to the complexities of modern civilization. Schools, educators, and policymakers must therefore prioritize the integration of HOTS-based learning strategies to cultivate a generation that is not only academically competent but also capable of making meaningful contributions to society in the digital and innovation-driven era.

Study Skills Sub Variables

Based on the research findings, 77% of students demonstrated proficiency in completing HOTS-based assignments. This ability can be explained by several factors, one of which is the use of diverse learning methods. HOTS-based assignments often incorporate approaches such as discussions, simulations, or project-based learning, which encourage students to think more deeply and creatively. Maryatun & Purwaningsih (2012) found that utilizing varied learning methods enhances students' ability to evaluate information, construct logical arguments, and develop innovative solutions when completing academic tasks. Additionally, project-based learning assignments allow students to connect abstract concepts to real-world situations, making learning more meaningful and applicable.

Beyond diverse learning methods, differentiating the level of difficulty in HOTS-based assignments is also essential in shaping students' cognitive abilities. Assignments designed with varying levels of complexity help students develop flexible thinking, adjust their problem-solving strategies, and deepen their conceptual understanding. This can help students develop better critical and creative thinking skills (Putra et al., 2023). This differentiation ensures that students do not merely memorize concepts but rather grasp broader ideas, analyze relationships between variables, and formulate creative and innovative solutions.

In the sub-variable of answering exams, the research findings indicate that 77% of students exhibited the ability to answer HOTS-based exam questions. This skill is strongly linked to deep conceptual understanding, as students who excel in HOTS-based exams must be able to analyze questions, evaluate information, and construct logical and well-reasoned responses. Intan et al. (2020) emphasized that students with a solid grasp of concepts are better equipped to formulate accurate responses, compared to those who rely solely on memorization. Thus, one of the key strategies to improve students' ability to answer HOTS-based questions is to systematically develop their conceptual understanding, such as through problem-solving exercises or case studies.

Apart from conceptual mastery, strategic approaches in answering HOTS-based questions are also crucial. Students need to employ effective problem-solving techniques, such as creating diagrams, tables, or sketches to visualize problems, which can help them analyze information and derive appropriate solutions. Arnidah & Anwar (2021) found that students who consistently use structured problem-solving strategies are more likely to produce well-developed and logical responses in exams. Furthermore, regular practice has been proven to enhance students' ability to tackle HOTS-based questions. A study by Rozi & Hanum (2019) demonstrated that students who frequently engage in HOTS-based problem-solving exercises show significant improvements in their critical and reflective thinking skills, compared to those who only practice lower-level questions. Therefore, conceptual understanding, the use of appropriate strategies, and continuous practice are key factors in improving students' ability to answer HOTS-based exam questions.

Furthermore, In the sub-variable of participating in learning, the research findings reveal that 76% of students actively engage in HOTS-based learning. One of the primary factors influencing students' participation is the classroom environment. A well-managed classroom, where teachers encourage students to ask questions, engage in discussions, and explore new ideas, can significantly enhance students' motivation to actively participate in learning. Rahmi (2019) emphasized that a positive and supportive classroom atmosphere fosters a sense of comfort and security, making students more confident in expressing their opinions and engaging in academically demanding discussions. Additionally, Rochaniningsih (2014) found that a conducive learning environment enhances students' ability to comprehend concepts deeply and develop their analytical and reflective thinking skills.

Besides the classroom environment, family characteristics and psychological factors also influence students' participation in HOTS-based learning. Rapih & Sutaryadi (2018) found that parental support, such as providing motivation and guidance in learning, plays a crucial role in shaping students' positive attitudes toward HOTS-based education. Students who receive strong family support tend to be more confident in expressing their thoughts and more actively engaged in exploring new ideas. Additionally, psychological traits such as motivation and self-confidence also contribute to students' participation in learning. Yanti & Alimni (2023) stated that students with high motivation and strong self-efficacy are more likely to actively engage in class discussions, explore new concepts, and apply critical thinking skills across various learning contexts. Therefore, a combination of a conducive learning environment, strong family support, and positive psychological factors plays a pivotal role in fostering students' participation in HOTS-based learning.

Conclusion

Based on the research results, it can be concluded that as many as 77% of students have HOTS-based learning abilities. The learning abilities of female students are better than male students, but this difference does not mean that the learning skills of female and male students are always different. HOTS-based learning can help students, both men and women, develop critical and creative thinking skills that can help them face challenges in the future.

Apart from that, HOTS-based student learning skills abilities can be divided into three sub-variables, namely doing assignments, answering exams, and participating in learning. In these three sub-variables, HOTS-based learning can help students develop critical and creative thinking skills by using stimuli, new contexts, differentiating levels of difficulty and complexity of thinking processes, and using diverse learning methods. Factors such as the classroom environment, family characteristics, and psychological characteristics can influence students' HOTS-based learning skills. Therefore, HOTS-based learning can help students develop better learning skills and prepare them to face future challenges.

In the context of policy and education, these findings provide a strong basis for developing BK service innovation. Schools, families and environments can play an important role in shaping students' learning skills. Thus, based on the findings of this research

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