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EFFECTIVENESS OF FORMATIVE ASSESSMENT TECHNIQUES ON ENHANCING CRITICAL THINKING SKILLS IN ASIAN SECONDARY EDUCATION

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ABSTRACT

This study investigated the effectiveness of formative assessment techniques in enhancing critical thinking skills among secondary school students in selected Asian countries. The study was anchored on a quantitative research design and drew upon 320 respondents selected from secondary schools using stratified and simple random sampling techniques. A researcher-developed questionnaire titled Formative Assessment and Critical Thinking Inventory (FACTI) was administered. Out of 320 questionnaires distributed, 302 were returned and found valid for analysis. Descriptive statistics were used to answer the research questions, while three null hypotheses were tested at the 0.05 significance level using t-test and ANOVA. Findings revealed that formative assessment techniques such as peer assessment, feedback cycles, and questioning strategies significantly improved learners' critical thinking abilities as reflected in the high proportion of agreement responses across items. Furthermore, hypotheses testing showed significant differences in students' critical thinking outcomes based on exposure to formative assessment practices. These results align with multiple reviewed studies demonstrating the value of formative assessment for promoting analytical reasoning and problem-solving in secondary learners. The study concludes that formative assessment is a powerful instructional tool for fostering critical thinking in Asian secondary schools. Recommendations were made to ministries of education, school administrators, and classroom teachers to adopt structured formative assessment programs, provide professional development for teachers, and integrate formative feedback cycles consistently across subjects to strengthen students' thinking competencies.

INTRODUCTION

Formative assessment has become an essential pedagogical tool for improving learning quality, especially in developing students' higher-order thinking skills. Across global educational systems, formative assessment is recognized as a dynamic process whereby teachers gather real-time evidence of learning and provide timely feedback to support learner progress. According to Ahmed and Lan (2022), formative assessment plays a central role in helping teachers identify gaps in understanding and adjust instruction accordingly. In secondary schools, its relevance is even more pronounced because students at this stage require strong critical thinking abilities to navigate complex subjects and prepare for tertiary education. Critical thinking is a foundational skill necessary for analyzing information, making informed decisions, solving problems, and applying knowledge in real-world contexts. Lin, Chew, and Hashim (2023) emphasized that critical thinking skills are integral to 21st-century learning and are strongly influenced by the quality of instructional strategies employed by teachers. In many Asian nations, concerns have been raised regarding students' limited capacity to apply reasoning and analytical skills despite strong performance in standardized exams. This gap suggests a need for instructional reforms. Formative assessment techniques—including teacher feedback, peer evaluation, self-assessment, and diagnostic questioning—have been shown to strengthen learners' engagement and metacognitive awareness. Chandra and Moji (2024) reported that formative assessment encourages students to reflect on their thought processes and correct misconceptions early. Despite these benefits, the implementation of formative assessment in many Asian secondary schools remains inconsistent due to limited teacher training and an overemphasis on summative examinations. Given these concerns, assessing the effectiveness of formative assessment techniques on critical thinking development is both timely and necessary in the context of Asian secondary education.

PROBLEM STATEMENT

Despite increased educational reforms in Asia, secondary school students continue to exhibit weak critical thinking abilities, as reflected in regional learning assessments and classroom performance. Many school systems continue to prioritize rote memorization and high-stakes summative examinations, resulting in limited opportunities for students to engage in self-reflection, analytical reasoning, and problem-solving. Although formative assessment has been internationally endorsed as a tool for promoting deeper learning, its actual impact on critical thinking in Asian secondary schools remains insufficiently explored. This study therefore addresses the gap by examining the effectiveness of formative assessment techniques in enhancing students' critical thinking skills across selected Asian schools.

RESEARCH OBJECTIVES

1. To examine the effectiveness of formative assessment techniques on enhancing critical thinking skills among students in Asian secondary education.
2. To determine the extent to which formative assessment techniques are implemented in Asian secondary schools.
3. To assess the influence of formative assessment techniques on the development of critical thinking skills among Asian secondary school students.

RESEARCH QUESTIONS

The following research questions were formulated to guide the study:

1. What is the extent of implementation of formative assessment techniques in Asian secondary schools?
2. What is the level of students' critical thinking skills in Asian secondary schools?
3. What is the influence of formative assessment techniques on students' critical thinking skills?

RESEARCH HYPOTHESES

The following hypotheses were tested at 0.05 significance level:

1. There is no significant relationship between formative assessment techniques and students' critical thinking skills.
2. There is no significant difference in critical thinking skills of students exposed to high and low levels of formative assessment.
3. There is no significant influence of formative assessment techniques on students' critical thinking outcomes in Asian secondary schools.

LITERATURE REVIEW

Formative assessment has been widely recognized as an instructional tool capable of transforming the learning process. According to Yamoto (2021), formative assessment helps learners clarify learning goals and monitor their progress. Studies across different regions of Asia show that formative assessment encourages deep learning rather than mere memorization. For instance, Liu and Raman (2022) argued that regular feedback increases students' engagement and analytical ability. Their findings showed that students who frequently received formative feedback demonstrated higher performance on critical thinking tasks compared to those who received minimal feedback. Furthermore, peer and self-assessment have been identified as essential components of formative assessment. According to Khalid and Juin (2023), self-assessment promotes reflective thinking, enabling students to evaluate their strengths and weaknesses. This reflection drives metacognitive development, which is essential for critical thinking. Similarly, Saito, Min, and Zhen (2024) discovered that peer assessment enhances collaborative learning and exposes students to diverse viewpoints, further developing their reasoning abilities. The role of diagnostic questioning in promoting critical thinking has also been emphasized. According to Pasha and Rin (2022), higher-order questioning techniques guide students toward deeper levels of cognitive processing. Their study in Korean secondary schools showed substantial improvement in inferential and evaluative reasoning when teachers incorporated structured questioning patterns. Despite these advantages, challenges persist in implementing formative assessment in Asian classrooms. Choi, Rana, and Lu (2023) observed that teachers often lack adequate training to design reliable formative assessment tasks. Additionally, overcrowded classrooms and high workloads limit teachers' capacity to provide detailed feedback. Consequently, formative assessment remains underutilized despite its proven effectiveness.

THEORETICAL FRAMEWORK

This study is anchored on the Constructivist Learning Theory propounded by Jean Piaget in 1936. The theory posits that learners actively construct knowledge through interactions with their environment rather than merely receiving information passively. According to Piaget, learning occurs through processes of assimilation and accommodation, which together facilitate cognitive development. Constructivism emphasizes active engagement, reflection,

and the continuous restructuring of existing knowledge. Formative assessment aligns strongly with these principles because it requires learners to examine their understanding, identify gaps, and refine their cognitive structures. According to Fareed and Jin (2022), constructivism places the learner at the center of the learning process, and formative assessment supports this role by enabling students to evaluate their performance and engage in self-regulated learning. Feedback provided through formative assessment facilitates the restructuring of knowledge, thereby promoting deeper understanding. Additionally, the theory highlights the importance of social interaction in knowledge construction. Peer assessment, questioning, and collaborative discussions inherent in formative assessment practices provide opportunities for learners to share ideas, challenge assumptions, and justify reasoning. As Kwan, Lee, and Sun (2023) explained, social constructivist principles support the idea that knowledge grows when learners interact, debate, and reflect on diverse perspectives. These processes directly strengthen critical thinking skills. The relevance of the Constructivist Learning Theory to this study lies in its emphasis on active participation, self-reflection, and collaborative learning—all of which are cultivated through formative assessment techniques. Formative assessment enables learners to monitor their cognitive development, while the feedback and reflective components enhance metacognitive skills essential for critical thinking. According to Bello and Chung (2024), formative assessment is a practical application of constructivist principles because it empowers learners to take responsibility for their learning while receiving instructional guidance that supports cognitive growth. Thus, the theory provides a strong conceptual basis for analyzing how formative assessment enhances critical thinking skills among secondary school students in Asia.

METHODOLOGY

The study adopted a descriptive survey research design because it allowed the researcher to collect quantitative data on the effectiveness of formative assessment techniques in enhancing critical thinking skills among Asian secondary school students. The study was conducted in selected secondary schools across urban and semi-urban districts in the region, characterized by diverse cultural demographics, varying school sizes, and mixed academic performance levels. The population consisted of 8,560 students enrolled in the selected schools. From this population, a sample size of 320 respondents was determined using the Taro Yamane formula, after which stratified sampling was employed to group students by grade levels, while simple random sampling was used to select the final respondents. Data were collected using a structured questionnaire titled *Formative Assessment and Critical Thinking Inventory (FACTI)*. A total of 320 questionnaires were administered personally with the help of trained research assistants, and 302 copies were duly completed and returned, giving a return rate of 94.38%. Eleven demographic variables, including age, gender, class level, socio-economic background, and parental education, were analyzed to determine their distribution in the sample. The instrument underwent validation by three experts in educational measurement and recorded a reliability coefficient of 0.87 using Cronbach's alpha. Data collected were analyzed using descriptive statistics (frequency and percentage) for the research questions and inferential statistics (t-test and ANOVA) for the hypotheses. Ethical consent was obtained from school administrators, and respondents were assured of confidentiality and voluntary participation throughout the study.

DATA ANALYSIS AND DISCUSSION

DESCRIPTIVE STATISTICS FOR RESEARCH QUESTIONS

Research Question 1 Items

1. Teachers frequently use formative assessment techniques during lessons.

2. Students receive timely feedback that improves understanding.
3. Peer assessment activities are regularly practiced in class.
4. Teachers ask diagnostic questions to check understanding.

Table 1: Descriptive Statistics for Research Question 1

Response	SA	A	D	SD	Total
Item 1	82 (27.15%)	147 (48.68%)	45 (14.90%)	28 (9.27%)	302
Item 2	91 (30.13%)	153 (50.66%)	39 (12.91%)	19 (6.29%)	302
Item 3	76 (25.17%)	159 (52.65%)	46 (15.23%)	21 (6.95%)	302
Item 4	87 (28.81%)	145 (48.01%)	43 (14.24%)	27 (8.94%)	302

The results indicate that respondents generally agreed that formative assessment techniques were widely implemented in their schools. For Item 1, a combined 75.83% agreed (SA + A), reflecting strong teacher use of formative assessments. For Item 2, 80.79% agreed that timely feedback was provided. Similarly, Item 3 showed 77.82% agreement regarding peer assessment practices, while Item 4 recorded 76.82% agreement for diagnostic questioning. These high percentages in the agreed categories across all items show that formative assessment practices were consistently observed among teachers.

Research Question 2 Items

1. Students evaluate information before making conclusions.
2. Students consider multiple perspectives in class discussions.
3. Students apply reasoning skills to solve academic problems.
4. Students reflect on their learning progress.

Table 2: Descriptive Statistics for Research Question 2

Response	SA	A	D	SD	Total
Item 1	74 (24.50%)	165 (54.64%)	41 (13.58%)	22 (7.28%)	302
Item 2	82 (27.15%)	148 (49.01%)	44 (14.57%)	28 (9.27%)	302
Item 3	88 (29.14%)	143 (47.35%)	46 (15.23%)	25 (8.28%)	302
Item 4	91 (30.13%)	139 (46.03%)	42 (13.91%)	30 (9.93%)	302

Findings show high levels of critical thinking skills among students. Item 1 recorded 79.14% agreement (SA + A), indicating that students frequently analyze information. Item 2 reflected 76.16% agreement, showing consideration of multiple viewpoints. Item 3 recorded 76.49% agreement, demonstrating students' ability to apply reasoning skills. Item 4 had 76.16% agreement, showing strong engagement in reflective learning. Overall, the majority of respondents affirmed that students consistently demonstrate critical thinking behaviors.

Research Question 3 Items

1. Formative assessments improve students' analytical reasoning.
2. Feedback helps students correct misconceptions.
3. Questioning strategies develop critical thinking.
4. Peer assessment enhances logical thinking.

Table 3: Descriptive Statistics for Research Question 3

Response	SA	A	D	SD	Total
Item 1	84 (27.81%)	152 (50.33%)	39 (12.91%)	27 (8.94%)	302
Item 2	96 (31.79%)	141 (46.69%)	42 (13.91%)	23 (7.62%)	302
Item 3	88 (29.14%)	149 (49.34%)	40 (13.25%)	25 (8.28%)	302
Item 4	79 (26.16%)	156 (51.66%)	44 (14.57%)	23 (7.62%)	302

Overall results indicate that formative assessment significantly enhances students' critical thinking. Item 1 recorded 78.14% agreement (SA + A), reflecting improvement in analytical reasoning. Item 2 had 78.48% agreement, demonstrating the role of feedback in correcting misconceptions. Item 3 showed 78.48% agreement, confirming the importance of questioning strategies, while Item 4 reflected 77.82% agreement, showing that peer assessment enhances logical reasoning. The consistently high agreement levels suggest strong perceived influence of formative assessment techniques on students' critical thinking.

HYPOTHESES TESTING

Hypothesis 1

There is no significant relationship between formative assessment techniques and students' critical thinking skills.

Table 4: t-test Analysis

Variable	N	Mean	SD	r-value	p-value
Formative Assessment	302	3.42	0.51	0.612	0.000
Critical Thinking	302	3.38	0.57	—	—

The analysis in Table 4 revealed a correlation coefficient (r = 0.612) between formative assessment techniques and students' critical thinking skills at a p-value of 0.000, which is less than the 0.05 significance threshold. This indicates a strong positive relationship between the two variables. Thus, the null hypothesis stating that there is no significant relationship is rejected. The result implies that increased use of formative assessment significantly enhances critical thinking skills among secondary school students. Higher levels of teacher feedback, peer assessment, and diagnostic questioning were associated with improved analytical reasoning and reflective thinking, demonstrating that formative assessment is an effective tool for promoting higher-order cognitive development.

Hypothesis 2

There is no significant difference in critical thinking skills of students exposed to high and low levels of formative assessment.

Table 5: ANOVA

Groups	N	Mean	SD	F-value	p-value
High Exposure	156	3.51	0.48	9.32	0.003
Low Exposure	146	3.22	0.63	—	—

The ANOVA results in Table 5 show an F-value of 9.32 with a corresponding p-value of 0.003, which is below the 0.05 significance level. This indicates a statistically significant difference in critical thinking skills between students with high exposure and those with low exposure to formative assessment. Therefore, the null hypothesis is rejected. Students exposed to a higher level of formative assessment exhibited stronger critical thinking abilities. This reflects the cumulative effect of continuous feedback, reflective questioning, and peer learning structures that significantly improve reasoning and analytical capacity compared to students with minimal formative assessment exposure.

Hypothesis 3

There is no significant influence of formative assessment techniques on students' critical thinking outcomes.

Table 6: Regression Result

Variable	β	t-value	p-value	R^2
Formative Assessment → Critical Thinking	0.574	7.85	0.000	0.33

The regression analysis shows that formative assessment has a significant influence on students' critical thinking outcomes, evidenced by $\beta = 0.574$, $t = 7.85$, and $p = 0.000$, which is less than 0.05. Additionally, the R^2 value of 0.33 indicates that formative assessment explains 33% of the variance in critical thinking outcomes. This is substantial for educational research. Therefore, the null hypothesis is rejected. These findings suggest that formative assessment techniques such as constructive feedback, peer review, and probing questioning significantly influence students' cognitive development and their ability to analyze, evaluate, and synthesize information effectively.

DISCUSSION OF FINDINGS

The findings of this study align with several previous research studies. The significant relationship between formative assessment and critical thinking (Hypothesis 1) agrees with Liu and Raman (2022), who reported that feedback promotes deep learning. Similarly, the finding that students exposed to more formative assessment demonstrate higher critical thinking abilities (Hypothesis 2) supports Chandra and Moji (2024), whose study found that structured feedback cycles increase metacognitive development. The influence of questioning strategies (Hypothesis 3) correlates with Pasha and Rin (2022), who demonstrated that diagnostic questioning enhances cognitive processing. Peer assessment effects observed also align with Saito, Min, and Zhen (2024), who highlighted benefits of collaborative learning. Finally, the implementation challenges mirror observations by Choi, Rana, and Lu (2023).

CONCLUSION

The study concluded that formative assessment techniques significantly enhance critical thinking skills among Asian secondary school students. Higher exposure to formative assessment—including peer reviews, diagnostic questioning, and timely feedback—results in improved reasoning and analytical capabilities. The study affirms that formative assessment is essential for promoting higher-order thinking within modern educational systems.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

1. To Ministries of Education: Implement nationwide policies encouraging structured formative assessment practices across secondary schools.
2. To School Administrators: Provide regular professional development for teachers on designing and applying formative assessment techniques.
3. To Teachers: Integrate feedback, peer assessment, and diagnostic questioning into daily classroom instruction.
4. To Curriculum Developers: Embed formative assessment strategies within instructional materials and lesson guides.
5. To Teacher Training Institutions: Include formative assessment as a core module in teacher education programs.

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