Journal of Curriculum Studies Research

https://curriculumstudies.org

E-ISSN: 2690-2788

Volume: 8 Issue: 1 2026

pp. 157-177

The Status of Higher-Order Thinking Skills in Secondary School Mathematics Teaching and Learning

Zinab Aba-Oli Aba-Diga*[a], Kidane Koyas[a] & Abera Husen[b]

* Corresponding author
Email: zinab.abaoli@gmail.com
a. Department of Mathematics, College of Natural Science, Jimma University, Ethiopia
b. Department of Teacher Education and Curriculum Studies, College of Education and Behavioural Science, Jimma University, Ethiopia

Article Info
Received: February 18, 2025
Accepted: December 26, 2025
Published: January 22, 2026

10.46303/jcsr.2026.9

How to cite
Aba-Diga, Z. A., Koyas, K., & Husen, A. (2026). The Status of Higher-Order Thinking Skills in Secondary School Mathematics Teaching and Learning. *Journal of Curriculum Studies Research*, 8(1), 157-177. https://doi.org/10.46303/jcsr.2026.9

ABSTRACT
The study investigates the implementation of higher-order thinking skills (HOTS) in secondary school mathematics in Jimma City, Ethiopia. Multilevel sampling technique was utilized to select 496 secondary school students and 38 mathematics teachers, and convenience sampling for interview participants. The study employed convergent mixed methods design for data collection, analysis and integration. SPSS 27.0 software was used for descriptive and inferential data analysis whereas the qualitative data was analyzed narratively. The study found that moderate level of HOTS, the actual implementation falling short due to structural, pedagogical, and cultural limitations. Teachers rarely use HOTS-based strategies, influenced by contextual factors. The study also found that the implementation of HOTS-based practices significantly predicted students' HOTS level, implying the need for HOTS-based intervention to enhance students' HOTS in mathematics. The study provides new insights into the current status of HOTS in mathematics and the factors contributing to its low implementation, emphasizing the need for urgent intervention.

KEYWORDS
Higher-order thinking skills; HOTS-strategies; mathematics; secondary school.

INTRODUCTION

Globalization and the escalating complexity and challenges of the twenty-first century have led to a need for educational systems worldwide to concentrate on preparing students for the intricacies of life in the twenty-first century. Countries need to adapt their educational systems to incorporate higher-order thinking skills (HOTS), which allow students to solve complex problems and apply their knowledge in new contexts (UNESCO, 2015; Wagner, 2011). Consequently, it is becoming mandatory for mathematics education to update classroom instructional practices to help students develop transferable knowledge and skills (National Research Council, 2012). This includes moving away from lecture-based methods and toward interactive, learner-focused strategies that encourage higher-order thinking and diverse application of mathematical concepts (Ayanwale, 2023; Marais, 2023; Mustafa, 2023).

As a result, countries around the world attempted to introduce HOTS-based instructional approaches to mathematics. Despite this fact, several schools still rely on the conventional models (Saavedra & Opfer, 2012), and many students lack the foundational skills and knowledge necessary to advance their education or compete in the workforce (UNESCO, 2013).

Higher-Order Thinking Skills (HOTS)

Higher-order thinking skills (HOTS) and lower-order thinking skills (LOTS) represent two distinct levels of cognitive processing. The revised Bloom's taxonomy of educational objectives provides the theoretical foundation for this distinction. The revised version by Anderson and Krathwohl (2001) positions remembering, understanding, and applying at the lower levels, while analyzing, evaluating, and creating represent higher levels of cognition. LOTS are foundational for learning, but mainly focus on rote memorization and mechanical application of known procedures. On the other hand, HOTS go beyond simple memorization and recall, requiring learners to engage in reasoning, reflection, and problem solving, thus enabling the transfer of knowledge to unfamiliar contexts (Brookhart, 2010; King et al., 2011; Matabane & Machaba, 2023). In mathematics education, this distinction highlights the need to move beyond procedural fluency (LOTS) toward deeper reasoning, problem solving, and conceptual understanding (Zohar & Dori, 2003). Critical thinking (CT), problem-solving (PS), and creative thinking (CRT) are key elements of HOTS that must be prioritized in education (Begimbetova et al., 2025; Maharani et al., 2022; Sariyatun et al., 2025; Schoenfeld, 2016; Trilling & Fadel, 2009).

The development of students' problem-solving skills is one aspect of HOTS's role in mathematics. Solving non-routine mathematical problems requires breaking down complex situations, identifying patterns, and selecting appropriate strategies. These processes reflect analysis and evaluations, which are central HOTS dimensions (Schoenfeld, 2016). Beyond memorization and the use of traditional tools, problem-solving (PS) requires comprehension of the issue, critical analysis and evaluation, creating innovative solutions, and effective communication (Brookhart, 2010). It integrates both critical and creative thinking processes, allowing learners to analyze non-routine problems, adapt strategies, and construct new knowledge (Jonassen, 2011; Schoenfeld, 2016). These skills foster the capacity to make sense of mathematics beyond rote computation (Bhagwonparsadh & Pule, 2023). In this way, HOTS help students move from procedural fluency to adaptive expertise, enabling them to apply knowledge flexibly in new contexts.

CT is a purposeful, self-regulatory judgment that involves interpretation, analysis, evaluation, and inference (Facione, 2015). Within the HOTS framework, CT is essential for learners to evaluate mathematical arguments, justify solutions, and engage in logical reasoning (Ennis, 2013; Facione, 2015). It promotes the ability to weigh multiple solution strategies and judge their effectiveness (King et al., 2011; Motsoeneng & Moreeng, 2023), and fosters mathematical argumentation, proof, and problem-solving skills essential to advanced learning (Schoenfeld, 2016).

Whereas CRT refers to student's capacity to create and refine various ideas when solving problems to produce unique solutions and advance mathematical knowledge (OECD, 2019). It involves generating original and valuable ideas and products, observing new relationships, making associations, discovering unknowns, and transforming mathematical structures and concepts (Hadar & Tirosh, 2019; Puccio, 2014). CRT enables learners to generate multiple solution paths, formulate conjectures, and apply mathematics in novel contexts (Mann, 2006).

The constructivist learning paradigm, based on Piaget's developmental and Vygotsky's sociocultural theories, emphasizes the active process of building mathematical knowledge through experiences, interactions, and social mediation. It suggests that teaching mathematics through problem-based, inquiry-driven, and contextualized approaches is more effective in fostering HOTS than traditional methods. In the constructivist approach, students apply newly acquired mathematical knowledge to novel situations, extending beyond school and focusing on transfer opportunities (Brookhart, 2010; Collins, 2014). Problem-based learning environments demand analysis, evaluation, and synthesis, which are central to HOTS (Hmelo-Silver, 2004). Moreover, ill-structured problems in real-life mathematical applications stimulate critical and creative capacities (Jonassen, 2011). Research has shown that project-based learning and collaborative inquiry can enhance students' mathematical reasoning, communication, and problem-solving abilities (Boaler, 2016; Marais, 2023; Motsoeneng & Moreeng, 2023; Savery, 2006).

Recent studies further highlight the alignment of mathematics, HOTS, and constructivism in contemporary classrooms. For instance, Galbraith and Holton (2018) noted that mathematical modeling is a powerful platform for HOTS, as it requires students to move between real-world contexts and abstract mathematical representations. Saido et al. (2015) found that teaching strategies grounded in constructivist principles significantly improve students' critical and creative thinking in mathematics. King et al. (2018), stress that instructional practices that allow learners to hypothesize, test, and revise mathematical ideas directly cultivate HOTS. While applying the approach, teachers play a crucial role in facilitating students' learning through questioning, probing, clues, and scaffolding (Hmelo-Silver, 2004; Yew & Karen, 2016).

Study Context

The Ethiopian education system has been struggling since 1994 to cultivate HOTS, such as creative, critical, reflective, and logical reasoning. The lack of foundational knowledge and experience in secondary school students is an issue that requires immediate attention (Mengistie et al., 2020; MoE, 2020). Emphasis is now on student-centered approaches, innovative learning methods, and real-life applications of mathematics. HOTS like CT, PS, and CRT are given attention in the curriculum. However, previous studies have mainly focused on implementing 1994 policy directives, and there is no published study investigating HOTS in secondary school mathematics teaching, hindering reform in the area.

Research Questions and Hypotheses

In keeping with the demand that mathematics instruction go beyond procedural learning and promote HOTS (Brookhart, 2010; King et al., 2011), this study aims to assess how well secondary school mathematics teachers are implementing HOTS-based instructional practices. Accordingly, the study addresses the following research questions:

1. To what extent are secondary school mathematics teachers implementing HOTS-based instructional practices in their classrooms?
2. To what degree do the current instructional practices in secondary school mathematics contribute to the development of students' HOTS?
3. How do teachers' knowledge of HOTS strategies and demographic variables (gender, years of teaching experience, and qualification level) predict their level of HOTS-based instructional practices?

- Hypothesis (H1): Teachers' knowledge of HOTS strategies, gender, years of teaching experience, and qualification level significantly predict ($p < .05$) the level of HOTS-based instructional practices.

1. How do students' perceptions of teaching practices, gender, and age predict their level of HOTS?

- Hypothesis (H2): Students' perceptions of HOTS-based instructional practices, gender, and age significantly predict ($p < .05$) their HOTS level.

2. How do secondary school mathematics teachers interpret and implement HOTS-based instructional strategies in their classroom practice?

METHODS

This mixed methods survey was conducted as part of the doctoral dissertation project. Mixed methods descriptive survey was used to conduct the research. The purpose of the survey was to generate reliable evidence on the state of HOTS in the teaching-learning of secondary school mathematics at Jimma City. The researcher used a convergent mixed methods survey design to study HOTS implementation in school mathematics. This methodological plurality allowed for a detailed examination of HOTS implementation levels and contextual factors (Ngulube & Ngulube, 2015). The quantitative data obtained through student and teacher questionnaires separately analyzed using descriptive and inferential statistics and responds to research questions 1 – 4. The qualitative data collected through interviews analyzed using narrative description in response to research question 5. The two strands were then triangulated and merged during the discussion phase using narrative description (Fetters et al., 2013). This approach provided a comprehensive perspective on the research problem without losing significant points and helped to generalize findings beyond individual methods implementation.

Population and Sampling

The study involved seven secondary schools at Jimma City (southwestern Ethiopia) in the academic year 2023/24, The study employed three-level random sampling involving simple random sampling, cluster and systematic random sampling to obtain a sample of 496 students (Males=231, Females=265). For quantitative survey, sample size of 400 suffices from a population of 10,000 at 95% confidence and a .05 margin of error (Taherdoost, 2017). All mathematics teachers n=38 (Male=30, Females=8) were involved in the survey. Six teachers were selected for an interview using convenience sampling, requiring at least a first-degree in mathematics, five years of secondary school teaching experience, volunteer participation, and currently teaching secondary school mathematics.

Data Collection Instruments

Student Self-Report Questionnaire

The student self-response questionnaire for assessing higher-order thinking skills (HOTS-SSRQ) is a 26-item questionnaire designed to assess higher-order thinking skills (HOTS) in secondary mathematics instruction. It measures students' engagement in cognitively demanding tasks aligned with higher-order learning objectives (Abadiga et al., 2025). The tool has undergone rigorous validation processes, confirming its reliability and validity, with a total reliability of.92, construct reliability >.7, average variance extracted >.5.

Teacher Self-Report Questionnaire

The teacher self-response questionnaire for assessing higher-order thinking skills (HOTS-TSRQ) is a 30-item, five-point Likert scale questionnaire developed by researchers to assess teachers' knowledge and practice of HOTS-based instruction in mathematics. It is validated through expert and exploratory factor analysis. The questionnaire have total reliability of.92, with good potential validity indicated by item loadings >.5, AVE greater than shared variance, and no cross loadings (Cheung et al., 2024).

Interview Protocol

Researchers used a semi-structured interview protocol to align with the research objectives. Open-ended questions were designed to elicit detailed responses about teachers' instructional strategies, classroom practices, and perceived challenges, with follow-up probes used to encourage elaboration (Kvale & Brinkmann, 2015). The protocol was piloted with two volunteer teachers and refined for clarity (Merriam & Tisdell, 2016). Interviews lasted between 45 and 60 minutes and followed a flexible yet systematic process. Each session began with informed consent and rapport-building, followed by core interview questions, and concluded with a summary and opportunity for additional comments. All interviews were audio-recorded with permission and supplemented by field notes (Creswell, 2013).

Regarding the validity and reliability of the interview data, content and construct validity were addressed through expert review (Ph.D. supervisors, qualitative research expert, and measurement and evaluation expert) and alignment with established theoretical frameworks, and reliability of the data was addressed through consistent use of the protocol across participants (Merriam & Tisdell, 2016). Trustworthiness was further strengthened through triangulation with data obtained from HOTS-TSRQ and HOTS-SSRQ, and maintaining an audit trail of the protocol's development and implementation (Creswell, 2013; Kvale & Brinkmann, 2015).

Data Analysis

SPSS 27.0 software was employed to analyze the quantitative data, using descriptive statistics and regression analysis. The data was checked for the assumptions of regression analysis. Normality was checked using Shapiro-Wilk's test of normality as well as analysis of the normal Q-Q plot. Multicollinearity was checked through value inflation factor (VIF) and heteroscedasticity through analysis of standardized residual scatterplots.

Qualitative data was transcribed and coded following both deductive and inductive approaches to generate themes and narratively analyzed. Line by line coding was used to condense data into themes and subthemes. The narrative synthesis of the qualitative and quantitative results provides a more comprehensive picture.

RESULTS/FINDINGS

This section presents the major findings/results based on the five basic research questions, qualitative findings preceded by quantitative results.

Results of secondary school mathematics teachers' implementation of HOTS-based instruction (RQ1)

A total of 38 teachers rated the HOTS-TSRQ items of which 42.1% is between 2.62 and 3.42 and 57.9% above 3.42. Further descriptive statistics results showed that individual respondents mean on HOTS ranging from 2.44 to 4.33 with overall HOTS mean equals 3.53. For TIP individual respondents mean is between 2.66 and 4.46 with overall TIP mean equals 3.52. The individual respondents mean for the HOTS-TSRQ ranged from 2.72 to 4.28 with overall mean equals 3.53.

Result of Students' Rating on How Much Secondary School Mathematics Teachers Instructional Practices Helped them with HOTS (RQ2)

A total of 496 students rated the HOTS-SSRQ items, the average rating on HOTS items ranging from 1.42 to 4.68 out of which 20.3% were below 2.62, 52.1% between 2.62 and 3.42 and 27.6% above 3.42. Further descriptive statistics results showed that individual respondents mean on HOTS ranging from 1.42 to 4.68 with overall HOTS mean equals 3.10. For perceived level of TIP, individual respondents mean was between 1.00 and 5.00 with overall TIP mean equals 3.10. The individual respondents mean on HOTS-SSRQ indicated ranging from 1.58 to 4.73 with overall mean equals 3.10.

Further comparison of teachers and students ratings on similar TIP items showed inconsistence, providing further insights in to the data. For the pairs of students average rating of "*I apply the mathematical knowledge I learned in class to solve challenges that encounter in real-life contexts* (SItem30)" (*M*=3.27) and. "*My teaching methods and activities recognize students' actual real-life experiences* (TItem19)" (*M*=3.50); "*My mathematics teacher encourages me to take ownership of my learning* (SItem25)" (*M*=3.14) and." *I offer opportunities for my students to work independently on mathematical tasks* (TItem23)" (*M*=3.63); "*Our mathematics teacher encouraged us to work in groups on mathematical problems* (SItem28)" (*M*=3.12) and "*I provide sufficient time for students to discuss in groups and communicate ideas* (TItem26)" (*M*=3.59); and "*My mathematics teacher gives me constructive and descriptive feedback on my work* (SItem27)" (*M*=3.06) and "*I use a variety of assessment methods to provide appropriate guidance and feedback to my students as well as ensure student's mastery of contents* (TItem29)" (*M*=3.53). While student rating falls within the Likert-scale interval, 2.62-3.42, those of teachers fall in 3.43-4.23.

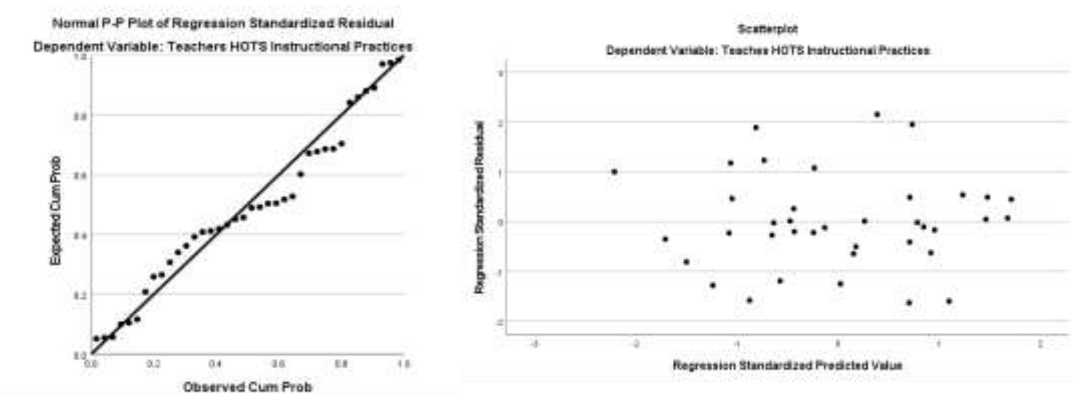
Impact of Teachers knowledge of HOTS-based methods, Gender, Teaching Experience and Qualification on their classroom teaching practices (RQ3)

Hypothesis testing was conducted to determine if independent variables: teachers knowledge of HOTS strategies, gender, years of teaching experience and their level of qualification, increase the likelihood to implement HOTS based instructional practices in the teaching-learning of mathematics. To test the hypothesis, the researcher employed multiple linear regression analysis at 95% confidence interval. The dependent variable TIP was checked for the assumptions of regression analysis.

Figure 1.

Normal P-P plot of regression standardized residual and scatter plot for TIP

A B



The result of the Shapiro-Wilk's test of normality (*df*=38, *p*=.753) as well as analysis of the normal Q-Q plot indicated that it is normally distributed. The result of the value inflation factor (VIF) showed no evidence of multicollinearity in the dataset. Furthermore, the analysis of the standardized residual scatterplots shows no evidence of heteroscedasticity (Figure 1).

Results of the regression analysis show that 39.3% of the variance in TIP can be accounted for by the four predictors collectively, *F(4, 33)=6.998, p<.001.* The unique individual contribution of the predictors shows that HOTS significantly predict TIP whereas the contributions of other predictors were found statistically not significant (Table 1).

Table 1.

Summary of the multiple linear regression analysis results of teachers' data

Variables	R^2	Adj. R^2	F	*ß*	*T*	Collinearity	
						TLR	VIF
CIVs	.459	.393	6.998**				
HOTS				.679	5.206**	.963	1.039
Gender				.061	.455	.918	1.090
YTE				.085	.628	.900	1.112
EQL				-.002	-.017	.900	1.112

Note. TIP= teachers instructional practices; YTE= years of teaching experience; EQL= education qualification level; CIVs= combination of all the four: previewed level of HOTS, gender, teaching experience and education level; *p < .05, **p < .001.

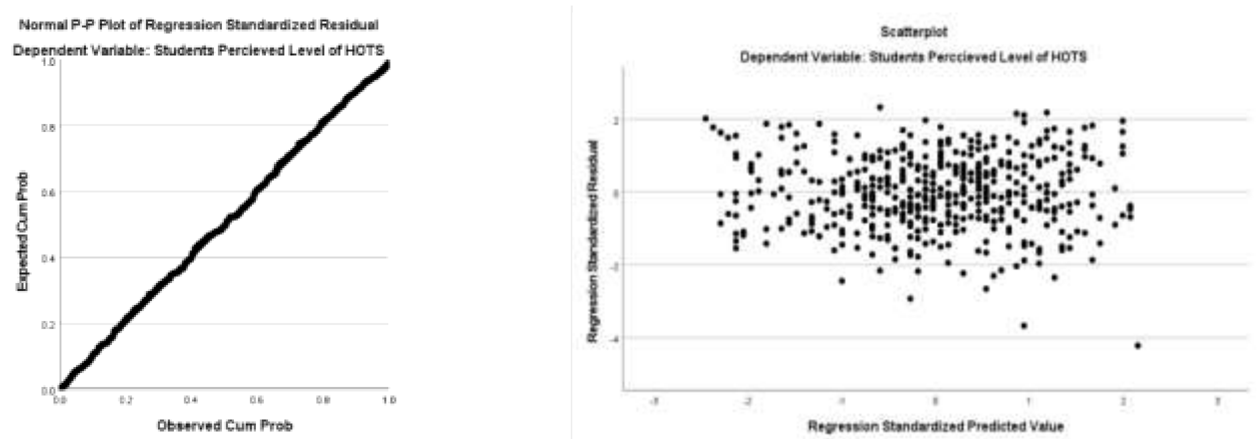
Impact of Students Perceived Teaching Methods, Gender and Age on the Level of Their HOTS (RQ4)

Hypothesis testing was conducted to determine if TIP, student gender and age, significantly contribute to students HOTS. To test this hypothesis, the researcher employed multiple regression analysis at 95% confidence interval. The dependent variable HOTS were checked for the assumptions of regression analysis.

Figure 2.

Normal P-P plot of regression standardized residual and scatter plot for HOTS

A B



The result of the Shapiro-Wilk's test of normality for the HOTS in the students' survey (*df*=496, *p*=.519) as well as analysis of the corresponding normal Q-Q plots indicated that it is normally distributed. The result of the value inflation factor (VIF) for the HOTS showed no evidence of multicollinearity in the dataset. Furthermore, the analysis of the standardized residual scatterplots for the DV showed no evidence of heteroscedasticity (Figure 2).

Results of the regression analysis show that 21.6% of the variance in HOTS can be accounted for by the three predictors collectively, F (3,492) = 46.486, *p*<.001. The unique individual contribution of the predictors show that TIP significantly predicted students use of HOTS whereas the contribution of other predictors were found statistically not significant as presented in Table 2.

Table 2.

Summary of the regression analysis results of students' survey data

Variables	**R^2**	**Adj. R^2**	**F**	***ß***	***T***	**Collinearity**	
						TLR	**VIF**
CIVs	.221	.216	46.486**				
TIP				.469	11.772**	.999	1.001
Gender				-.019	-.458	.948	1.055
Age				.023	.569	.949	1.054

Note. TIP= teachers instructional practices; CIVs= combination of all the three IVs: perceived level of TIP, gender, age; **p* < .05. ***p* < .001

How HOTS-Based Instructional Strategies Interpreted and Implemented By Mathematics Teachers (RQ5)

Line by line coding was used to condense data into themes and subthemes. The analysis yielded 21 codes and 10 subthemes, forming three main themes: "HOTs and Knowledge of its instructional strategies", "implementation of HOTS based instruction," and "contextual factors influencing the implementation of HOTS-based instruction." The findings were organized and presented under these themes.

HOTS and Knowledge of its Instructional Strategies

This theme encompassed three questions related to how teachers interpret HOTS in their teaching, the importance of HOTS and knowledge of HOTS strategies. Majority of the participant teachers described the concept of HOTS in mathematics, using terms, phrases or sentences closely tied to one or more of the concepts CT, CRT and PS). Participants in the CT category focused on the interpretive, analytic and evaluative characteristics pertaining to HOTS. They described that "Higher order thinking means critically analyzing what they learn and applying mathematics in their daily life" (P2). It was also understood as "the ability to analyze a problem and search for better way of solving it." (P6) and "the way we reason and think, develop logical thinking and make reasonable judgments" (P5). Those participants related HOTS to PS focused on the ability to apply mathematical knowledge and skill learned in school to real life context stating that:

HOTS reflect high level mental ability – ability to change what is learned in class into practice […] A student after building foundational knowledge is expected to apply the knowledge in [his/her] day to day life. If [he/she] did not find solution for problems [he/she] face in everyday life using what is learned in school, the end of the education has no meaning. (P6)

Finally, the description of HOTS as "the student ability to modify mathematical procedures or formulas to make it simple for use" (P3) and the assertion "[…]. They explained HOTS as adding creativity – something [new]" (P1) demonstrated the connection between HOTS and creativity.

The participant teachers explained the benefits of HOTS for their students from two complementary perspectives. Majority believed that HOTS develop students' ability to solve real life challenges stating that "higher thinking is beyond finding the x, y and z values. It is necessary to connect mathematics with student life and reveal its practical aspect so that students can understand its application in different areas." (P5). The "students can practically apply mathematics in their daily life so that the subject becomes meaningful to them rather than abstract" (P 4). They emphasized that "if the students apply HOTS in mathematics, they can also apply it in their daily life. The teachers also stressed that the practice of HOTS enables the students to play their role in solving life challenges we face in today's world" (P1). They can use their mental ability to solve challenging problems and earn good grade on exams and join higher education.

Regarding the strategies and problems/activities they may include in their plan to appropriately support students' HOTS, the participant teachers mentioned active learning strategies like group work and problem-solving as suitable for promoting HOTS. Many of them believed that "working in group allows students to ask question that they may fear to ask the teacher, share information, support each other and come up to the stage, particularly if you combine fast, medium and slow learners in one group" (P4). Teachers stated that they "can improve HOTS by connecting mathematics to students' practical life to help them in the line they need it" (P5) so that "they play their role in solving life challenges" (P1). This can make the lesson creative and tangible (P4).

Furthermore, the participant teachers provided inconsistent and mixed response on the type of problems/activities they think are appropriate to support their students HOTS. Participants claimed that "When students learn, I give them different tasks, assignments, different questions, examples and involve them in researching daily life problem. This way, I apply higher order thinking in teaching mathematics." (P1), "I sometimes include problem-solving activities from the student textbook to support this" (P6). "After completing a chapter, I usually arrange tutorial classes to solve related problems from textbook exercises and previous exams." (P3). Teachers suggested active learning strategies like group work and problem-solving to promote HOTS. They believed connecting mathematics to practical life helps students solve life challenges. However, scaffolding and problem-solving activities are inconsistent.

Participants provide mixed responses on appropriate activities, showing a lack of precision in distinguishing between HOTS and LOTS activities.

Implementation of HOTS-Based Instruction

When asked to share their experience on how they are practicing HOTS strategies they feel that they "are not practicing this other than talking. Our move [current approach] cannot help students reach at this stage [HOTS]; we tell them but changing what they learned into practice is lacking in our instruction" (P4), emphasizing the issue of students lack of background knowledge and skills to engage in HOTS activities. The methods of instruction remained lecture and demonstration in which teachers dominated classroom instructional activities and busy in chalk and board activities. "I divide the larger blackboard in to three and did not complete one question after filling the three parts with calculations" (P5), inclining "towards solving the problem myself and using lecture, as I need more instructional time to cover wider content and not to lag behind others." (P6) and I do not encourage using HOTS strategies "for the time being because there is no much awareness among students on group work. They were bored if given group activities" (P5). Though providing "limited time for group work and individual problem-solving" (P4, P6). The conventional lecture were evidenced in the following extracts,

> *What we do is we sometimes give activities and ask each student to think individually for one minute about the activity, then join temporary group with neighbors and share idea for four to five minutes and then ask question on what they did for about five minute. (P5).*
>
> *I give activities, the book is also prepared in this line; before starting the main content, discussion points are provided in the book at the beginning of each chapter, students discuss on the concepts; then they move to the topic of the day; the teacher workout examples provide in the book; provide group activities and then comment on their work" (P1).*

The frequency of HOTS-based practices was reported by participant teachers: "Once or twice per week for some proportion of a period." (P4), "ones per week" (P6); the time proportion allocated for those activities "to include 15'-20' [out of 80'] group discussion, reflection and individual exercise solving from their homework in class" (P6), "from five to six minutes for group work. […], out of 40'" (P1), were insufficient for students to engage in thinking activities such as analyzing, generating ideas, discussing on issues, evaluating alternatives, finding solutions, presenting solutions and reflection in light of developing HOTS. This is evident when the participants claimed that even "40' is not enough to incorporate group discussion and presentation." (P6), "in such context, let alone assessing the higher order thinking level of each student, thinking about checking attainment of the daily lesson objectives will be difficult." (P1), this "move cannot help students reach at this stage [HOTS]" (P4).

The participant teachers also discussed the consequences of the prevailing instructional practices in terms of failure to maintain relevance and equip students with necessary HOTS to facilitate knowledge transfer to contexts other than the classroom. Students usually ask "what is the advantage of learning x, y and z?" (P5), they say, 'the principles and rules you are teaching us in class is not working outside the classroom, so why you make us worry?" (P1). Despite the fact that "mathematics plays a vital role in changing the world and great mathematicians are behind almost all the technological innovations we are using today" (P3), "there are limitations in disclosing the advantages of learning mathematics for the life of human being and its application in other subjects and making students aware of these issues" (P5). That is why "when you call the name mathematics, students say 'wuyi' [a sense of irritation] and run away. This requires "changing perception, the kids [the students] need to sense the practical utility of mathematics and love the subject" (P1).

Contextual Factors Influencing the Implementation of HOTS-Based Instruction

The participants mentioned student related factors such as lack of background Knowledge and interest, dependency, absence from class as problematic for practicing HOTS activities in their teaching. Vast "majority of the class lacks background knowledge to engage in group work." (P1), "about 80% stated students, lack background knowledge to engage at higher level" (P2), may be due to "the ways students come across the class levels from the bottom make it difficult to equally engage all students in HOTS" (P4). Students "lack interest to engage in independent learning." (P2) and "do not show interest to attend the tutorial class to solve the problems by themselves." (P3) as well, "they are bored if given group activities." (P5). On top of this, "majority are dependent on the few smart students." (P1), and expecting "readymade contents from the teacher than grappling to learn by themselves" (P2). "For example, if you create conditions in which students discuss and work in group, majority of students are dependent on few active students and seek something from them rather than doing by themselves." (P4). Furthermore, "students do not attend class on daily bases, all come together only when there is a schedule for test" (P6).

> *There is high absence from the class. You may apply HOT for those regularly attending students to bring change. If there is a turn by turn absence in a regular basis, it is difficult to apply HOTS. Being self-help learners, coming far from rural and living in rent house are among the reasons for the absence. (P4).*

Teacher related factors include their belief about student learning and practicality of HOTS. Majority of the participant teachers believe that "unless their knowledge gap is first closed, it is unthinkable to learn high level thinking. "They cannot even apply procedures following the examples I worked for them" (P2), and "students are not competent enough to engage in high level thinking" (P1, P3, P5). Contrary to this, some teachers believe;

> *The students, if you connect what they learn to their real life, the acceptability is high, when you teach them how to solve life and make life easier, they are motivated and there is a possibility to accept it. If the teacher practice and put learning in students life, there is high probability from the students side to apply what they learned in their daily life. (P4)*

School related factors include leadership intention and lack of support in implementing learning of HOTS. The participants stated that “content coverage is emphasized and the condition is not conducive for applying group discussion and presentation” (P6), and “requires extended time for them [the students] to complete group work and problem-solving activities in class and the condition is not supportive for the implementation” (P6). As a result “I give a chance for group work once or twice per week only for few proportion of a period. This is mainly because; the requirement of course content coverage comes soon“(P4). The other challenge is that “the textbook is bulky – about 300 pages” (P4), “unless we use additional make up classes, we cannot cover the book by teaching six periods per week” (P5). So, “as I run to cover the bulky content, I need more instructional time for lecture and demonstration” (P6). Furthermore, there is a problem of “large class size teaching up to 60 students in one class” (P1, P4). Regarding support and training, teachers are “facing challenge in teaching some topics like economics added in the new book without having enough knowledge and training” (P2). “Even though the existing condition do not allow, I did not give up teaching kids about higher order thinking skills. […] [It] however, requires the support and commitment of all concerned bodies”, said P1.

Teachers' reflections reveal a gap between fostering higher-order thinking skills (HOTS) in students and actual classroom practices, with constraints like lecture-based teaching, insufficient instructional time, and limited student engagement highlighting the need for pedagogical change.

DISCUSSION

The survey study offers a rich and detailed examination of how HOTS are incorporated into mathematics education across secondary schools. Through the use of validated questionnaires and interviews, the study revealed important patterns in how teachers perceive and implement HOTS and how students experience and respond to these instructional practices. Quantitative results showed a moderate level of HOTS implementation, with teachers reporting a higher average score (mean = 3.53) than students (mean = 3.10) on a 5-point Likert scale. On this scale, the mean value of 3.53 is interpreted as frequent use of HOTS-based practices by teachers whereas the value 3.10 is interpreted as moderate HOTS implementation level (Alkharusi, 2022; Pimentel, 2019). Teachers often believed they regularly provided opportunities for reflection, group discussions, and real-life problem-solving. However, students’ responses consistently placed these experiences at a lower frequency level. This result reveals that teachers often rate their instructional behaviors more positively than students, mirroring previous findings that teachers often rate their instructional behaviors more positively than students perceive them (Shukla & Dungsungnoen, 2016; Van Sickle, 2016). It is possibly due to differences in how they define "opportunity" or "depth" in classroom activities. Teachers may report the intended frequency of pedagogical moves, while students report the experienced depth or usefulness of those moves (see discussion of parallel items above). This result suggests that the high teacher mean may be partly due to aspirational or policy-aligned reporting (Van Sickle, 2016)

A key aspect of the study lies in the hypothesis testing, which quantitatively assessed the influence of various factors on HOTS implementation. The first hypothesis tested whether teacher-related variables—such as knowledge of HOTS strategies, gender, years of teaching experience, and level of education—could significantly predict the extent to which they employed HOTS-based instruction. Using multiple linear regression, the analysis revealed that these variables collectively explained 39.3% of the variance in TIP. Notably, the only statistically significant predictor was teachers' knowledge of HOTS strategies (β=.679), suggesting that content knowledge alone is not sufficient; rather, teachers' pedagogical understanding of how to apply HOTS in instruction is crucial. The result is consistent with the results of the quantitative survey conducted by Chandran et al. (2023) that found teachers' knowledge of HOTS and pedagogical skills significantly predicted teachers teaching of HOTS in their mathematics instruction. It is also supported by the result of the study by Noor et al. (2022), that found a strong positive relationship between teachers' perceptions and their preparedness to use critical thinking techniques when teaching mathematics. Whereas the contribution of teachers, gender, years of teaching experience and their level of qualification were found not statistically significant. This result parallels the result of the study by Abdullah et al. (2017) that found no significant effect of academic qualification and teaching experience on mathematics teachers' knowledge and practice of HOTS-based instruction. Teachers' knowledge of HOTS strategies significantly influences their use of HOTS-oriented instructional practices, aligning with literature linking teacher knowledge and pedagogical content knowledge to enacting complex, active-learning strategies (Bhagwonparsadh & Pule, 2023; King et al., 2018; Zohar, 1999). Research shows that declarative and procedural knowledge about scaffolding reasoning, asking probing questions, and task design is more connected to classroom practice than background variables (Motsoeneng & Moreeng, 2023; Zohar, 1999). This finding emphasizes that improving HOTS implementation in classrooms requires targeted professional development focused on strategy use, rather than relying solely on experience or academic qualifications.

The second hypothesis examined whether students' perceived TIP, along with demographic factors such as gender and age, predicted their level of HOTS. Multiple regression analysis showed that these variables together accounted for 21.6% of the variance in students' HOTS scores. Among the predictors, only the perceived TIP had a statistically significant effect (β = .469). This suggests a strong link between how students perceive their classroom experience—specifically, whether teachers use engaging and challenging instructional strategies—and their own development of higher-order thinking. The result is in line with the study by Khavere et al. (2023), that revealed a statistically significant positive relationship between students' perception of teachers' classroom effectiveness and their academic achievement. Furthermore, the finding is consistent with meta-analytic and program-evaluation evidence showing that the quality and cognitive demand of classroom tasks, questioning patterns, and feedback strongly influence students' higher-order outcomes (Liu et al., 2022; Ong et al., 2016). In particular, research synthesizing HOTS literature identifies teacher questioning, problem posing, and scaffolding as high-leverage practices that mediate students' abilities to analyze, evaluate, and create (Liu et al., 2022).

Qualitative findings from teacher interviews provided deeper insight into the nature of this gap. Teachers generally understood HOTS in terms of CT (analyzing, evaluating, reasoning), CRT (modifying or creating new methods), and PS (applying learned concepts to real-world scenarios). They emphasized the importance of HOTS in helping students connect mathematics with practical life challenges and preparing them for future academic and personal success. Despite this theoretical understanding, most teachers admitted to relying predominantly on lecture-based methods, chalk-and-talk demonstrations, and conventional content delivery. Active learning methods such as group work, problem-solving, discussions, and independent inquiry were mentioned but used sparingly—often limited to a few minutes per week. For instance, some teachers allocated only 5–10 minutes per session (out of 40–80 minutes) for group tasks or student-led exploration. Even when such strategies were employed, their structure lacked depth and did not allow sufficient time for students to engage in the full cognitive processes necessary for HOTS development, such as sustained analysis, reflection, idea generation, and solution presentation. Experimental and observational literature indicates that the structure of active-learning tasks is crucial (Liu et al., 2022). Poorly scaffold group tasks or token group time do not reliably produce HOTS, while well-scaffold tasks with explicit roles, accountability, and teacher facilitation yield stronger reasoning and transfer. This explanation helps explain why students report only moderate exposure to HOTS-oriented learning

The contextual constraints described by teachers in the interviews — heavy curriculum coverage pressure, large class sizes, limited time for group work, and bulky textbooks — are widely documented barriers to positioning cognitively demanding instruction (Yan et al., 2021). These contextual factors are inhibitors of instructional change because they reduce opportunities for sustained student talk, teacher feedback, and iterative task refinement — all essential to HOTS promotion. Research shows that content-focused professional development (PD) with classroom coaching and collaborative lesson design improves teacher practice and student outcomes (Coe et al., 2014; Garet et al., 2016). Effective programs focus on concrete instructional routines, provide extended practice and coaching cycles, and are supported by school leaders. To address the observed implementation gap, PD that models HOTS tasks in real classrooms and provides follow-up coaching is an evidence-aligned next step.

The quantitative and qualitative data together form a coherent narrative. Data collected through the validated instruments show moderate implementation of HOTS, but the discrepancy between teacher and student perceptions highlights a significant issue in practice efficacy. While teachers may believe they are fostering HOTS, the qualitative data suggest that their strategies are inconsistently applied and often undermined by contextual realities. The high mean scores among teachers may reflect aspirational rather than actual practices.

Furthermore, regression results and interview data converge on the finding that the teacher's mastery of HOTS concepts is the strongest determinant of successful instructional practices, which in turn significantly influence student outcomes. However, without structural changes—such as reducing class sizes, reforming curricula, and offering sustained professional development—teachers remain limited in their ability to shift from conventional direct instruction model to HOTS-oriented instruction models.

This study's combined methodological approach offered a robust diagnosis of the HOTS landscape in Jimma City's secondary school mathematics classrooms. It suggested that while the foundational awareness and theoretical understanding of HOTS exist, practical implementation lags due to systemic and contextual constraints. Addressing these would be essential for aligning instructional practices with the cognitive demands of 21st-century education.

From a practical standpoint, the findings of this study highlight the urgent need for professional development programs that move beyond theoretical knowledge and focus on practical, classroom-based applications of HOTS strategies. Teachers need support in designing rich contextual problems, facilitating inquiry-based learning, and providing meaningful feedback. Moreover, structural adjustments—such as reducing class sizes, offering more instructional time, and aligning curriculum materials with HOTS objectives—are essential. School leaders must prioritize pedagogical support over content coverage and encourage collaborative planning and reflection among teachers. Students, too, should be actively involved through motivational strategies, peer learning structures, and scaffold tasks that gradually build independence and higher-level thinking.

Theoretically, the study supports constructivist learning models that emphasize learner-centered environments and the integration of real-life contexts into instruction. However, it also calls for a more refined understanding of the implementation gap in educational theory—particularly how teacher beliefs, school culture, and systemic barriers interact to influence instructional decisions. Models of pedagogical change must account for both cognitive and contextual dimensions, incorporating mechanisms for continuous reflection, feedback, and professional growth. Furthermore, the statistically significant role of instructional practice in predicting student HOTS offers empirical support for models that emphasize teacher behavior as a key driver of student cognitive development.

CONCLUSION

The study investigates the implementation of high-order thinking skills (HOTS) in secondary mathematics teaching and learning at Jimma City's government secondary schools in Oromia, Ethiopia. The study paints a complex picture: while there is a strong theoretical awareness of HOTS and recognition of its importance among teachers, the actual implementation falls short due to structural, pedagogical, and cultural limitations. The moderate ratings, along with the evidence from hypothesis testing and interviews, highlight that HOTS is present in mathematics classrooms, but not fully realized in practice. Overall, the study contributes valuable insights into both the promise and the challenges of fostering HOTS in real-world educational settings, calling for targeted interventions and systemic reforms to bridge the gap between theory and classroom reality.

RECOMMENDATIONS

- During challenging teaching times, teachers often adopt conventional instruction due to lack of knowledge, time constraints, limited resources, and students' lack of background knowledge. However, proper support like professional development and access to materials can enhance higher-order thinking skills.
- The evidence and gaps identified in the study can be used by researchers to introduce interventions to help students develop HOTS and use of mathematics in real context.
- Institutional reforms, including increased planning time for teachers, reduced student-teacher ratios, and policy focus on pedagogical innovation, are crucial for sustaining instructional change.
- The study's limited scope, focusing on government schools and interviews with six teachers, necessitates a more comprehensive mixed methods approach for broader application.

REFERENCES

Abadiga, Z., Tola, K., & Tulu, A. (2025). Development and Validation of Self-Report Questionnaire to Assess Higher-Order Thinking Skills in Secondary School Mathematics. *School Science and Mathematics*. https://doi.org/10.1111/ssm.18400

Abdullah, A., Mokhtar, M., Halim, N., Farzeeha, D., Mohd Tahir, L., & Abdul Kohar, U. H. (2017). Mathematics teachers' level of knowledge and practice on the implementation of higher-order thinking skills (HOTS). *Eurasia Journal of Mathematics, Science and Technology Education*, *13*, 3-17. https://doi.org/10.12973/eurasia.2017.00601a

Alkharusi, H. (2022). A descriptive analysis and interpretation of data from Likert scales in educational and psychological research. *Indian Journal of Psychology and Education*, *12*(2), 13-16.

Anderson, L. W., & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.

Ayanwale, K. (2023). Can Experience Determine the Adoption of Industrial Revolution 4.0 Skills in 21st Century Mathematics Education? *Research in Social Sciences and Technology*, *8*, 74-91. https://doi.org/10.46303/ressat.2023.6

Begimbetova, G., Retnawati, H., Kassymova, G., Triyono, M., Azman, M., & Sodikin, R. (2025). Developing Students' HOTS Digital Literacy Profile by Using IRT. *Journal of Curriculum Studies Research, 7*(2), 155-176. https://doi.org/10.46303/jcsr.2025.16

Bhagwonparsadh, Y., & Pule, K. (2023). Learning Support Strategies to Overcome the Effects of Promoting Condoned Senior Phase Mathematics Learners to the FET Phase. *Research in Social Sciences and Technology*, *8*, 16-30. https://doi.org/10.46303/ressat.2023.2

Boaler, J. (2016). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching*. Jossey-Bass/Wiley.

Brookhart, S. M. (2010). *How to assess higher-order thinking skills in your classroom*. ASCD.

Chandran, T., Kamarudin, N., Mustakim, S., Silvarajan, L., & Zaremohzzabieh, Z. (2023). Factors influencing teaching higher-order thinking skills among mathematics teachers in Malaysian primary schools. *Pertanika Journal of Social Sciences and Humanities*, *31*(4), 1509-1524. https://doi.org/10.47836/pjssh.31.4.09

Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2024). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pacific Journal of Management*, *41*(2), 745-783. https://doi.org/10.1007/s10490-023-09871-y

Coe, R., Aloisi, C., Higgins, S., & Major, L. E. (2014). What makes great teaching? Review of the underpinning research.

Collins, R. (2014). Skills for the 21st century: teaching higher-order thinking. *Curriculum & Leadership Journal*, *12*(10).

Creswell, J. (2013). Qualitative Inquiry & Research Design: Choosing Among Five Approaches (4th ed). *SAGE Publications*.

Ennis, R. (2013). Critical thinking across the curriculum: The Wisdom CTAC Program. *Inquiry: Critical thinking across the disciplines*, *28*(2), 25-45. https://doi.org/10.5840/inquiryct20132828

Facione, P. (2015). Critical thinking: what it is and why it counts. *Insight Assessment*. https://doi.org/ISBN13:978-1-891557-07-1

Fetters, M., Curry, L., & Creswell, J. (2013). Achieving Integration in Mixed Methods Designs-Principles and Practices. *Health services research*, *48*, 2134-2156. https://doi.org/10.1111/1475-6773.12117

Galbraith, P., & Holton, D. (2018). Mathematical modelling: A guidebook for teachers and teams.

Garet, M. S., Heppen, J. B., Walters, K., Parkinson, J., Smith, T. M., Song, M., . . . Borman, G. D. (2016). Focusing on Mathematical Knowledge: The Impact of Content-Intensive Teacher Professional Development. NCEE 2016-4010. *National Center for Education Evaluation and Regional Assistance*.

Hadar, L. L., & Tirosh, M. (2019). Creative thinking in mathematics curriculum: An analytic framework. *Thinking Skills and Creativity*, *33*, 100585. https://doi.org/10.1016/j.tsc.2019.100585

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, *16*(3), 235-266. https://doi.org/10.1023/B:EDPR.0000034022.16470.f3

Jonassen, D. (2011). Supporting problem solving in PBL. *Interdisciplinary Journal of Problem-Based Learning*, *5*(2), 95-119. https://doi.org/10.7771/1541-5015.1256

Khavere, S., Ogutu, J., & Bota, K. (2023). Students' perception of teacher classroom effectiveness and academic achievement: A case of secondary school students in Hamisi Sub-County, Kenya. *African Journal of Empirical Research*, *4*, 54-61. https://doi.org/10.51867/ajernet.4.2.8

King, F., Goodson, L. A., & Rohani, F. (2011). *Higher order thinking skills: Definition, teaching strategies, assessment*. Center for Advancement of Learning and Assessment.

King, F., Goodson, L. A., & Rohani, F. (2018). *Higher order thinking skills • Definition • Teaching Strategies • Assessment*. Florida: : A Publication of the Center for Advancement of Learning and Assessment, Florida.

Kvale, S., & Brinkmann, S. (2015). *Interviews: Learning the craft of qualitative research interviewing. (3. ed.)* SAGE Publications.

Liu, J., Ma, Y., Sun, X., Zhu, Z., & Xu, Y. (2022). A Systematic Review of Higher-Order Thinking by Visualizing its Structure Through HistCite and CiteSpace Software. *The Asia-Pacific Education Researcher*, *31*(6), 635-645. https://doi.org/10.1007/s40299-021-00614-5

Maharani S.D., Susanti R., Indarti L.H., Syamsi A. (2022). Integrating HOTS-Based Student Electronic Worksheet: Teaching Styles in Elementary School During the COVID-19 Pandemic. *Journal of Social Studies Education Research, 13* (3), 98 - 119. https://jsser.org/index.php/jsser/article/view/4016/578

Mann, E. L. (2006). Creativity: The Essence of Mathematics. *Journal for the Education of the Gifted*, *30*(2), 236-260. https://doi.org/10.4219/jeg-2006-264

Marais, E. (2023). The Development of Digital Competencies in Pre-Service Teachers. *Research in Social Sciences and Technology*, *8*, 134-154. https://doi.org/10.46303/ressat.2023.28

Matabane, E., & Machaba, F. (2023). First Year University Students` Use of Words, Symbols and Images to Convey Mathematical Ideas: A Case of Definitions. *Research in Social Sciences and Technology*, *8*, 92-105. https://doi.org/10.46303/ressat.2023.16

Mengistie, S. M., Tamiru, A. B., & Abebe, A. A. (2020). Measuring quality as students' problem solving skill development in mathematics: The case of grades 9 and 10 students in Addis Kidame Secondary School, Amhara Region, Ethiopia. https://doi.org/10.31248/IJET2020.071

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative Research: A Guide to Design and Implementation (4th ed.)*. San Francisco, CA: Jossey Bass.

MoE. (2020). *General education curriculum framework*. Addis Ababa, Ethiopia: Ministry of education

Motsoeneng, T., & Moreeng, B. (2023). Exploring Accounting Teachers' Effective Implementation of Assessment for Learning in the Classroom. *Research in Social Sciences and Technology*, *8*, 257-282. https://doi.org/10.46303/ressat.2023.42

Mustafa, A. N. (2023). Transformative approaches and challenges in 21st century mathematics education: A comprehensive review. *World Journal of Advanced Research and Reviews*, *20*(3), 444-457. https://doi.org/10.30574/wjarr.2023.20.3.2508

National Research Council. (2012). *A framework for k-12 science education: Practices, crosscutting concepts, and core ideas*. The National Academies Press. https://doi.org/10.17226/13165

Ngulube, P., & Ngulube, B. (2015). Mixed methods research in the South African Journal of Economic and Management Sciences: An investigation of trends in the literature. *South African Journal of Economic and Management Sciences*, *18*, 1-13. https://doi.org/10.4102/sajems.v18i1.633

Noor, S., Muhammad, S., Omar, M. N., & Suppiah Shanmugam, S. K. (2022). The practice of critical thinking skills in teaching mathematics: Teachers' perception and readiness. *Malaysian Journal of Learning and Instruction*, *19*, 1-30. https://doi.org/10.32890/mjli2022.19.1

OECD. (2019). *Framework for the assessment of creative thinking in PISA 2021 (Third Draft)*.

Ong, K. K. A., Hart, C. E., & Chen, P. K. (2016). Promoting higher-order thinking through teacher questioning: a case study of a Singapore science classroom. *New Waves-Educational Research and Development Journal*, *19*(1), 1-19.

Pimentel, J. (2019). Some biases in likert scaling usage and its correction. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, *45*, 183-191.

Puccio, G. J. (2014). *The Creative Thinker's Toolkit*. Teaching Company.

Saavedra, A. R., & Opfer, V. D. (2012). Teaching and learning 21st century skills: Lessons from the learning sciences. *A Global Cities Education Network Report. New York, Asia Society*, *10*.

Saido, G. A. M., Siraj, G., Nordin, S., & Abu Saadallah, O. (2015). Teaching strategies for promoting higher order thinking skills: a case of secondary science teachers. *Malaysian Online Journal Of Educational Management (Mojem)*, *Volume 3*, 16-30.

Sariyatun, S., Sutimin, L., & Abidin, N. (2025). Enhancing Historical Thinking and HOTS through Digital Learning Materials: An Inquiry-Based Approach Using Primary Sources for High School Students. *Journal of Curriculum Studies Research, 7*(2), 228-248. https://doi.org/10.46303/jcsr.2025.19

Savery, J. R. (2006). Overview of Problem-based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning*, *1*(1). https://doi.org/10.7771/1541-5015.1002

Schoenfeld, A. H. (2016). Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics (Reprint). *Journal of education*, *196*(2), 1-38. https://doi.org/10.1177/002205741619600202

Shukla, D., & Dungsungnoen, A. P. (2016). Student's perceived level and teachers' teaching strategies of higher order thinking skills; a study on higher educational institutions in Thailand. *Journal of Education and Practice*, *7*, 211-219.

Taherdoost, H. (2017). Determining sample size; how to calculate survey sample size. *International Journal of Economics and Management System*, *2*, 237-239. https://hal.science/hal-02557333

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. John Wiley & Sons.

UNESCO. (2013). *Making education a priority in the post-2015 development agenda: Report of the global thematic consultation on education in the post-2015 development agenda*.

UNESCO. (2015). *Rethinking education: towards a global common good*. https://www.researchgate.net/publication/321289639_Rethinking_Education_Towards_a_Global_Common_Good

Van Sickle, J. (2016). Discrepancies between Student Perception and Achievement of Learning Outcomes in a Flipped Classroom. *Journal of the Scholarship of Teaching and Learning*, *16*, 29. https://doi.org/10.14434/josotl.v16i2.19216

Wagner, T. (2011). *The global achievement gap: why even our best schools don't teach the new survival skills our children need--and what we can do about it. basic books*. https://books.google.com.et/books?id=V8NmJXDQMBMC

Yan, Z., Li, Z., Panadero, E., Yang, M., Yang, L., & Lao, H. (2021). A systematic review on factors influencing teachers' intentions and implementations regarding formative assessment. *Assessment in Education Principles Policy and Practice*, *28*. https://doi.org/10.1080/0969594X.2021.1884042

Yew, E., & Karen, G. (2016). Problem-based learning: An overview of its process and impact on learning. *Health professions education*, *2*(2), 75-79. https://doi.org/10.1016/j.hpe.2016.01.004

Zohar, A. (1999). Teachers' metacognitive knowledge and the instruction of higher order thinking. *Teaching and Teacher Education*, *15*(4), 413-429. https://doi.org/10.1016/S0742-051X(98)00063-8

Zohar, A., & Dori, Y. J. (2003). Higher order thinking skills and low-achieving students: are they mutually exclusive? *Journal of the Learning Sciences*, *12*(2), 145-181. https://doi.org/10.1207/S15327809JLS1202_1