Mastery Level of Higher – Order Thinking Skills (HOTS) High School Students in Mathematical Learning: Systematic Literature Survey

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Abstract
This study is a systematic literature review of 18 study articles focusing on the level of mastery of high school students' HOTS in Mathematics subjects. The study was conducted to identify students' level of mastery in Mathematics subjects, identify the challenges and constraints faced by students in the process mastery of HOTS in Mathematics subjects and identifying factors that influence the level of mastery of HOTS among students. This study was conducted based on *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* PRISMA guidelines. Two main bases were used in this study, namely Scopus and Google Scholar and found 18 study articles selected for analysis based on established acceptance criteria by the researcher. Based on the analysis of the findings, the researchers devised four main themes highlighted in each selected study article. There are 3 study articles containing themes of HOTS' mastery levels and influencing factors, 9 study articles that use diverse learning approaches and its influence on the dominance of HOTS. Next the theme of the relationship of the level of mastery of HOTS with the level of student achievement contains 2 study articles and 4 of the 18 selected articles contain the theme of perception and students' readiness towards HOTS. Through the findings of this study, we can conclude that studies focusing on the full level of mastery of HOTS are still under-implemented. Hence, through the review of this systematic literature, it is hoped that further studies can be conducted based on the study of this literature.
Keywords: Higher, Order Thinking Skills, Mathematics, High School, Systematic Survey

Introduction
Higher - Order Thinking Skills (HOTS) is an ability to apply knowledge, skills and values in making reasoning and reflection to solve problems, make decisions, innovate and be able to create things. In this regard, the Ministry of Education Malaysia has put emphasis on HOTS in the school system in line with the intensifying global competition. This HOTS approach is applied in students' learning so that students, not only memorize what is learned but can understand and know what is being learned and use their thoughts at a high level through the mastery of the skills of evaluating, applying, analyzing and creating. The implementation of HOTS is one of the MOE's initiatives in producing a balanced and responsible person for the

prosperity of the country which can help students to perform thinking operations such as making analysis and inference which in turn can improve their understanding and performance of achievements.[1]

In the learning of Mathematics, HOTS is interpreted through non-routine problems and unclear problems or dilemmas. Questions that require HOTS are indispensable to enable students to apply, analyze, synthesize and evaluate information, not just a retelling of facts. In this regard, through the mastery of HOTS, students can increase their level of understanding of a mathematical concept and so on. In addition, students can also learn the concepts of Mathematics more effectively through the application of HOTS. This is because, HOTS is able to enhance the ability of students to investigate and explore the idea of Mathematics and thus apply scientific investigations. Students are also able to justify solutions and findings well.

According to (Normah et al., 2018), HOTS has become a necessity in determining the success of students by the 21st century. This is because the Ministry of Education (MOE) has already implemented the HOTS element in the school curriculum starting in 2014 through an increase in the percentage of questions that have elements of HOTS in public examinations such as UPSR and SPM by 20% compared to 10% in 2013. The adoption of HOTS was implemented following the very low results of the PISA (*Programme International Student Assessment*) Test and was at that level of average score set by the OECD. This clearly shows that the level of mastery of HOTS students in Malaysia is still at a low level. In this regard, this study was conducted to identify several matters related to HOTS, namely the level of student mastery, the challenges and constraints faced by the students and the factors that influence the level of mastery of HOTS students especially in Mathematics.

Objectives of The Study
1. Identify the level of mastery of Higher - Order Thinking Skills (HOTS) of secondary school students in Mathematics subjects
2. Identify the challenges and constraints faced by students in mastering Higher - Order Thinking Skills (HOTS) in Mathematics subjects
3. Identifying factors that influence the level of mastery of students' Higher - Order Thinking Skills in Mathematics subjects

Study Questions
1. How is the level of mastery of Higher - Order Thinking Skills (HOTS) of school students in Mathematics?
2. What are the challenges and constraints faced by students in mastering Higher - Order Thinking Skills (HOTS) in Mathematics?
3. What are the factors that affect the level of mastery of students' Higher - Order Thinking Skills in Mathematics subjects?

Literature Highlights
In the process of teaching and learning, HOTS plays a very important role in the student's development. These skills are closely linked to the six aspirations that all students in Malaysia need to compete globally as outlined in the Malaysian Education Development

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[1] Curriculum Development Division. (2014). High Level Thinking Skills: Applications in Schools. In the Ministry of Education Malaysia.

Plan (PPPM). The six things include leadership skills, bilingual skills, ethics and spirituality, social identity, knowledge and thinking skills as well as national identity. (Normah et al., 2018). In this regard, students need to be exposed and equipped with HOTS in order to cope with the progress of an increasingly modernized world with a very high level of competition.

However, the student's level of mastery and readiness towards HOTS is still weak. This is in line with the study (Sarah & Lilia, 2021) which states that students are still not ready or poorly versed in using thinking skills in the process of teaching and learning (PdP) which has had an impact in their mid-year exams where they often do not answer questions involving HOTS and leave only empty space on question paper without answers.

Every day mathematics is often considered as a difficult subject to understand. In addition, with the application of HOTS in Mathematics learning, students' performance is deteriorating especially when it comes to high-level questions. This clearly shows that students are still weak in Higher - Order Thinking Skills which leads to a decline in achievement in Mathematics (Marlina, 2013). However, according to (Sarah & Lilia, 2021), students are still weak and do not master the technique of answering questions in the form of inference, prediction and explanation. This shows that students are still weak and increase the difficulty of questions involving HOTS despite the increased percentage of their academic typing.

In addition, most students consider this Mathematics subject to be a subject that only requires students to follow the rules even if they do not understand the rules (Wahida, 2013). According to the students' opinion, they only need to follow and follow each method taught by the teacher in solving the given Mathematics problem. This will result in students not having the self-confidence to deal with more complex math problems. Therefore, teachers need to play an important role in increasing students' confidence in facing the math problems involved in HOTS as well as the help of technology able to assist pupils in mastering mathematical concepts. This can be proven through the statement (Kim & Ruzlan, 2016) where the application of HOTS elements and 21st century learning in Mathematics learning should be supported by resources based on technology such as *GeoGebra* dynamic geometry software which can assist students in visualization and imagination and be able to increase the mastery of students in the concept of Mathematics. According to (Suhaily, et al., 2020) the use of technological resources such as *GeoGebra* is also able to increase the level of Higher - Order Thinking Skills (HOTS) of the students because it can help them to think creatively and critically and can also assist students in making assumptions, predictions and hypothetical. In addition, students can also associate existing knowledge with something new through visualization techniques.

Questions that involve problem solving are among the forms of questions that are very synonymous with learning Mathematics. This is because problem solving is one of the branches in Mathematics education which consists of a series of tasks and thought processes that have a degree with the formation of a heuristic set. which requires students to develop new knowledge and skills through the application of various strategies in the problem-solving process (Halim et al., 2019). Thus, it is also able to improve the students' Higher - Order Thinking Skills in learning Mathematics especially in secondary school.

However, in reality, students in Malaysia are still weak in the application of HOTS in Mathematics learning. This is in line with the findings from the study (Halim et al., 2019). According to the researchers, students take a long time to understand the problem of the questions given. Students also do not fully understand the content of the question which leads to the student failing to answer the question. This has also been stated in a study (Norulbiah, 2017) in which teachers only assume that students who only manage to solve

math problems understand the lesson and vice versa. This causes the student's understanding of mathematical concepts to become non-permanent. This will also make it difficult for students to solve more complex problems because they are not trained to use critical thinking skills and creative in solving Mathematical problems. When students are weak in solving Mathematics problems, this will cause students to be weak in performing Mathematical reasoning where it can be proven through the findings of the study (Eizuan, et al., 2017) which showed that the level of scientific reasoning skills among secondary school students is at alarming level. This reasoning skill is important as it is able to educate students to think more creatively and critically and innovatively and be able to apply Knowledge of Mathematics in real life thus can increase the level of HOTS among students.

Study Methodology

This study used a systematic literature review method to identify the level of mastery of HOTS among secondary school students especially in Mathematics subjects. Several acceptance criteria are applied during the article selection process. The selected articles are in the form of full access, Malay and English language published in the most recent 7 years between 2015 and 2022. The selected articles must contain content that covers aspects of Higher - Order Thinking Skills (HOTS), Mathematics subjects, and also touches on aspects of the student's level of mastery. The researchers place great emphasis on all the selection criteria that have been stated to ensure that the review of the literature is able to meet the objectives and answer the questions of the studies that have been carried out. built.

Article search is done using two main databases, Scopus and Google Scholar using several relevant terms. Among the terms used during the article search process are "*HOTS", "High Schools"* and "*Mathematics"* to obtain articles in English. While the terms " Higher Level Thinking Skills ", "HOTS", "Secondary School Students" and "Mathematics" are used to obtain articles in Bahasa Melayu and analysis is made on the title, abstract and also the content of the article.

Title selection	→	Article search	→	Article Selection (Acceptance and Exception)	→	Data Extraction	→	Data Analization

Chart 1 Flowchart of Execution of Systematic Literature Review

Title Selection

Referring to the objectives of the study constructed, the researcher selects the title – the title of the article focusing on Higher - Order Thinking Skills (HOTS) and makes an exception to the articles that has no association with HOTS. Researchers also used a flowchart based on *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* PRISMA guidelines to report the findings of this systematic literature review study.

Article Search

Researchers searched for articles using two main databases, Scopus and Google Scholar. The search was made using several terms related to the study title such as "HOTS in Mathematics" and "Student HOTS Level" to obtain articles in the Malay language. While the term "Hots in Mathematic Educations" is used to obtain articles in English.

Article Selection

In order to obtain an article that fits the title of the study, the researcher makes a selection of articles based on the reading of the title and abstract of the article found. In this section, the researcher begins the selection and exclusion process so that the selected articles meet the standards and criteria for the selection of the specified titles and articles selected in accordance with the title and objectives of the study. A total of 279 articles were obtained from both databases used. 123 of the 279 articles were excluded because the article title did not meet the reviewer's acceptance criteria. The 156 articles received were subsequently screened in more depth. Screening was done more deeply through abstract reading and found that only 18 articles were successfully selected. The exception of these 40 articles was made because it had no association with the respondents of the selected study i.e. students, and the content required by researchers i.e. the level of mastery of HOTS.
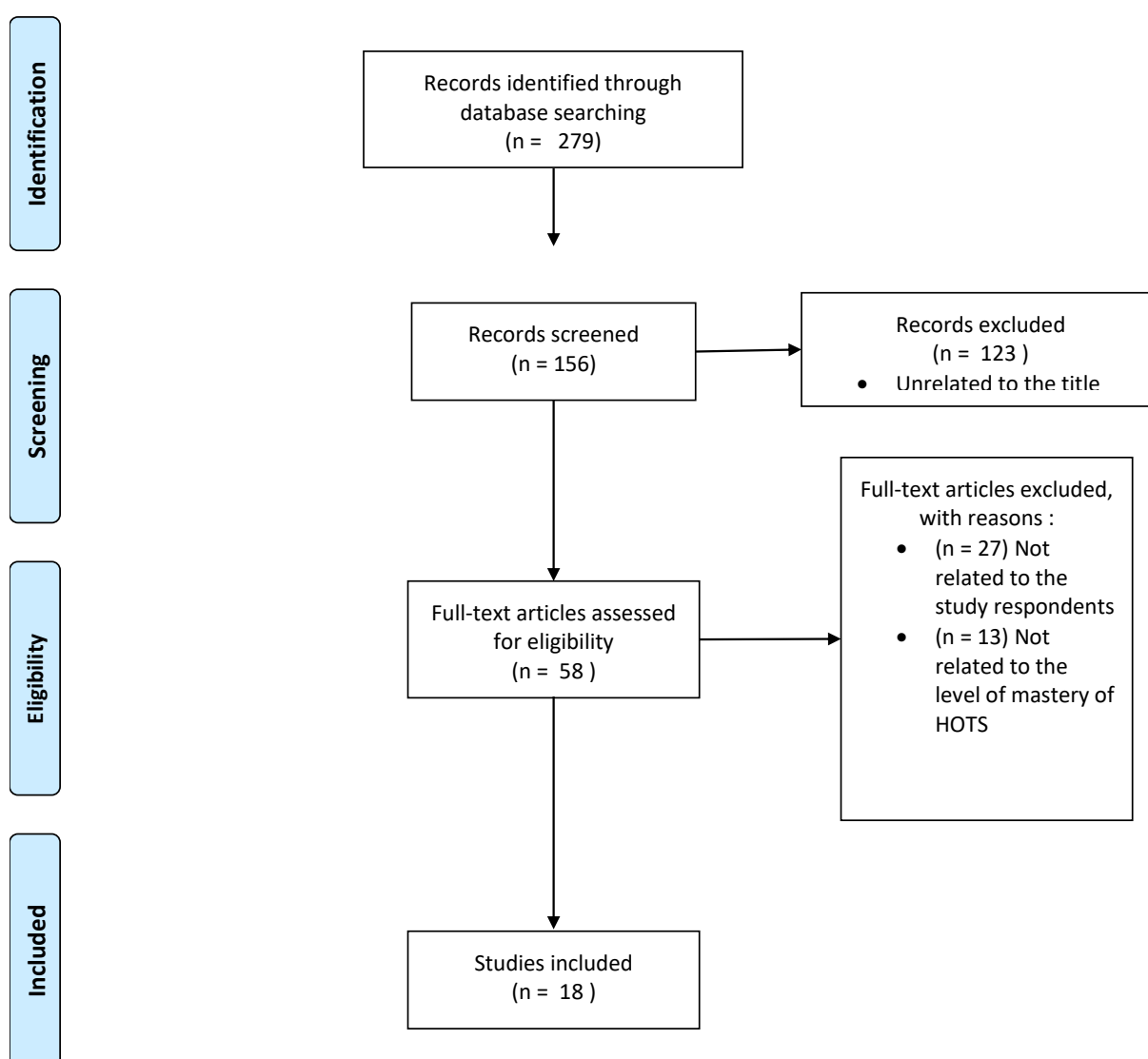
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Identification

        Records identified through
        database searching
        (n =  279)
                 │
                 ▼
Screening

        Records screened          Records excluded
        (n = 156)       ───────▶  (n =  123 )
                 │                 • Unrelated to the title
                 │
Eligibility                        Full-text articles excluded,
                 │                 with reasons :
                 ▼                 • (n = 27) Not
        Full-text articles assessed      related to the
        for eligibility  ───────▶        study respondents
        (n =  58 )                 • (n = 13) Not
                 │                       related to the
                 │                       level of mastery of
Included         │                       HOTS
                 ▼
        Studies included
        (n =  18 )
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Chart 2 Flowchart of Article Selection Through PRISMA Guidelines

Study Findings

The 18 articles selected are made extraction data to obtain input – detailed and scheduled input. Table 1 below shows the formulation of information about the selected articles, namely language, year of publication, keywords, and form of study.

Article	Language	Year of publication	Keywords	Forms of study
(Normah et al., 2018)	English	2018	*i-Think*, Higher - Order Thinking Skills	Quasi experiments
(Muzirah & Atiqah, 2021)	English	2021	Implementation, Higher - Order Thinking Skills (HOTS), Teaching and Mathematical Facilitation (PdPc)	Quantitative
(Eizuan, et al, 2017)	English	2017	Scientific reasoning skills, Teacher teaching style, Lawson Classroom Formal Reasoning Test	Quantitative
(Halim et al., 2019)	English	2019	Form-three assessment (PT3), high-order thinking skills (HOTS), mathematical problem-solving, Model of Polya	Qualitative
(Suhaily et al., 2020)	English	2020	HOTS, Inductive Reasoning Strategy, Geogebra	Quasi experiments
(Mui Kim, & Ruzlan, 2016)	English	2016	GeoGebra, Mathematical Education, Modular learning, Visualization ability, spatial, creative thinking.	Quasi experiments
(Duden et al., 2021)	English	2021	Innovative learning, HOTS, meta-analysis	Quantitative
(Sarah & Lilia, 2021)	English	2021	Higher - Order Thinking Skills, HOTS, Critical thinking, problem solving.	Action research
(Rohaya et al, 2021)	English	2021	STEM integration, effectiveness of learning modules, design thinking approach, Higher - Order Thinking Skills.	Quasi experiments
(Naquiah & Ramlah, 2021)	English	2021	Process Oriented Guided Inquiry Learning (POGIL), Higher - Order Thinking Skills (HOTS), POGIL Cycle Adaptation Model, Inquiry, Mathematics.	Quantitative
(Syamsuddin et al., 2020)	English	2020	Online learning medium, Mathematics, Higher Leve Thinking Skills (HOTS), Covid-19	Experiments

(Azizi & Roslinda, 2021)	English	2021	Higher - Order Thinking Skills, Attitudes, Readiness, Students, Mathematics	Quantitative
(Payadnya & Wibawa, 2021)	English	2021	Higher-order thinking skills, Two-tier Multiple Choice, Qualitative Analysis, COVID-19 Pandemic	Qualitative
(Izatul et al, 2021)	English	2021	Higher order thinking skills, COVID-19	Qualitative
(Tanujaya & Mumu, 2020)	English	2020	Not specified	Qualitative
(Bakry, & Md Nor, 2015)	English	2015	HOTS Question, Mathematics, Process of Thinking	Qualitative, case studies
(Benidiktus et al., 2017)	English	2017	Higher order thinking skills, academic performance. Correlation, regression analysis	Quantitative
(Zamri & Ridzuan, 2019)	English	2019	Algebraic components, flipped classroom, attitude toward problem solving	Quasi experiments

Number of Articles by language

The language selection for the article selected as the study sample is Bahasa Melayu and English. Figure 1 below shows the number of articles based on the language used in the writing of the article. There are 8 articles that use English namely (Halim et al., 2019; Suhaily et al., 2020; Duden et al., 2021; Payadnya & Wibawa, 2021; Izatul et al., 2021; Tanujaya & Mumu, 2020; Bakry & Nor, 2015; Benidiktus et al., 2017). While 10 articles in Malay consist of (Normah et al., 2018; Muzirah & Atiqah, 2021; Eizuan et al., 2017; Kim & Ruzlan, 2016; Sarah & Lilia, 2021; Rohaya et al., 2021; Naquiah & Ramlah, 2021; Syamsuddin et al., 2020; Azizi & Roslinda, 2021; Zamri et al, 2019).
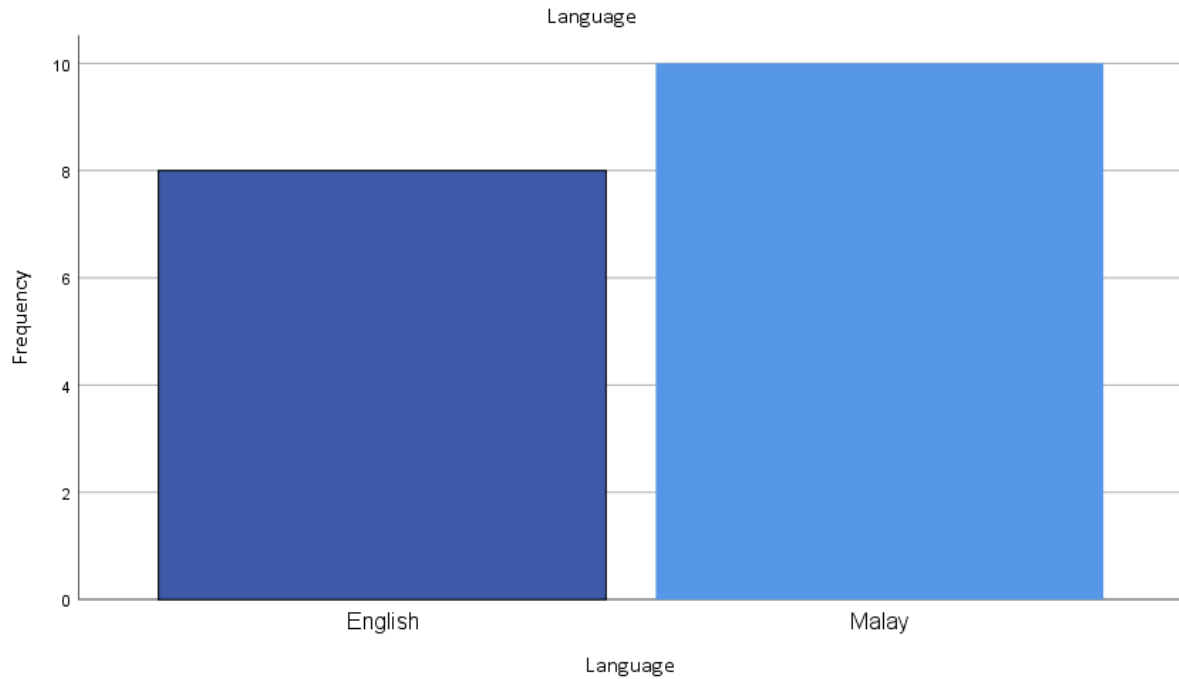
Figure 1 Number of Articles by Language

Number of Articles by Year of Publication

The selection of articles is taken based on the year of publication between 2015 and 2022. Referring to figure 2 below, a total of 8 articles were published in 2021 Muzirah & Atiqah (2021), Duden et al (2021); Sarah & Lilia, (2021); Rohaya et al (2021); Naquiah & Ramlah (2021); Azizi & Roslinda, (2021); Payadnya & Wibawa (2021); Izatul et al (2021), 3 articles published in 2020 Suhaily et al (2020); Syamsuddin et al (2020); Tanujaya & Mumu (2020), 2 articles in 2019 Halim et al (2019); Zamri et al (2019) and 2017 (Eizuan et al., 2017; Benidiktus et al., 2017). While there is only 1 article that has been published in 2018 (Normah et al., 2018), 2016 (Kim & Ruzlan, 2016) and 2015 (Bakry & Nor, 2015). Based on the above findings, the researchers did not obtain the appropriate article published in 2022.
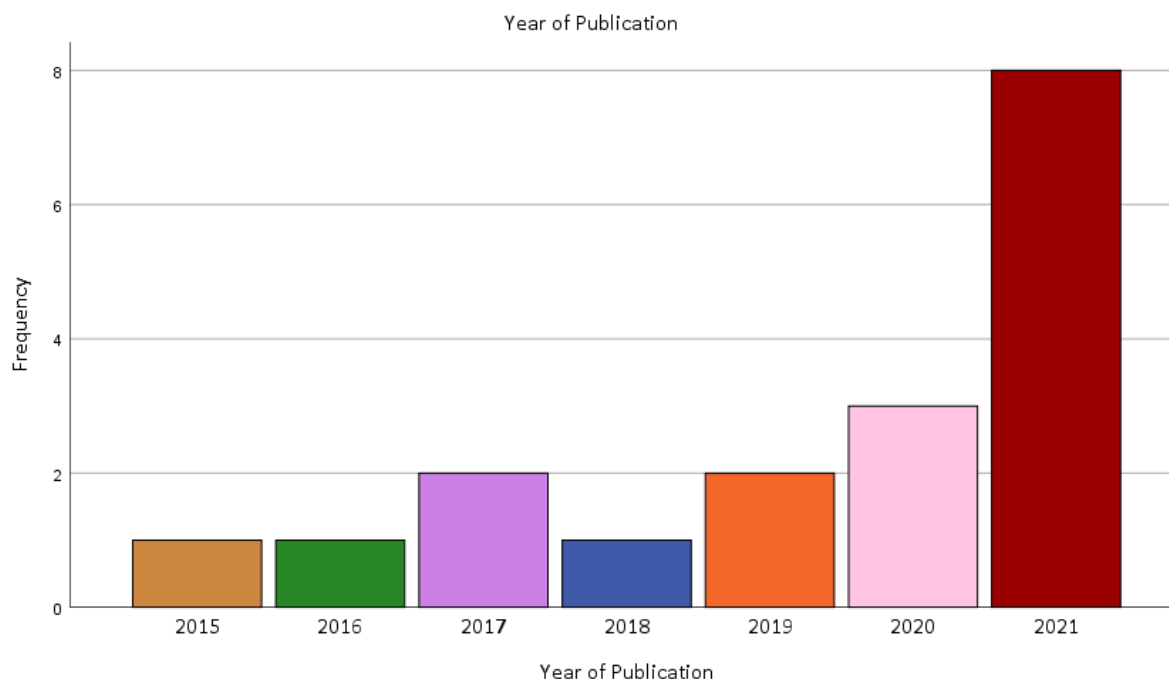
Figure 2 Number of Articles by Year of Publication

Number of Articles by Form of Study

There are several forms of study that have been used in the selected article. Figure 3 below shows the different types of forms of study and the number of articles according to the forms of the study. Based on figure 3 below, most of the articles selected have used the form of quantitative study, which is 6 articles (Muzirah & Atiqah, 2021; Eizuan et al., 2017; Duden et al., 2021; Naquiah & Ramlah, 2021; Azizi & Roslinda, 2021; Benidiktus et al., 2017). While 5 articles use quasi experimental study forms (Suhaily et al., 2020; Kim & Ruzlan, 2016; Rohaya et al., 2021; Normah et al., 2018; Zamri et al., 2019). Next 4 selected articles have used the form of qualitative studies, Halim et al (2019); Payadnya & Wibawa (2021); Tanujaya & Mumu, (2020); Izatul et al (2021) and only 1 article using the experimental form of study (Syamsuddin et al, 2020), study action (Sarah & Lilia, 2021) and a combination of qualitative studies and case studies (Bakry & Nor, 2015).
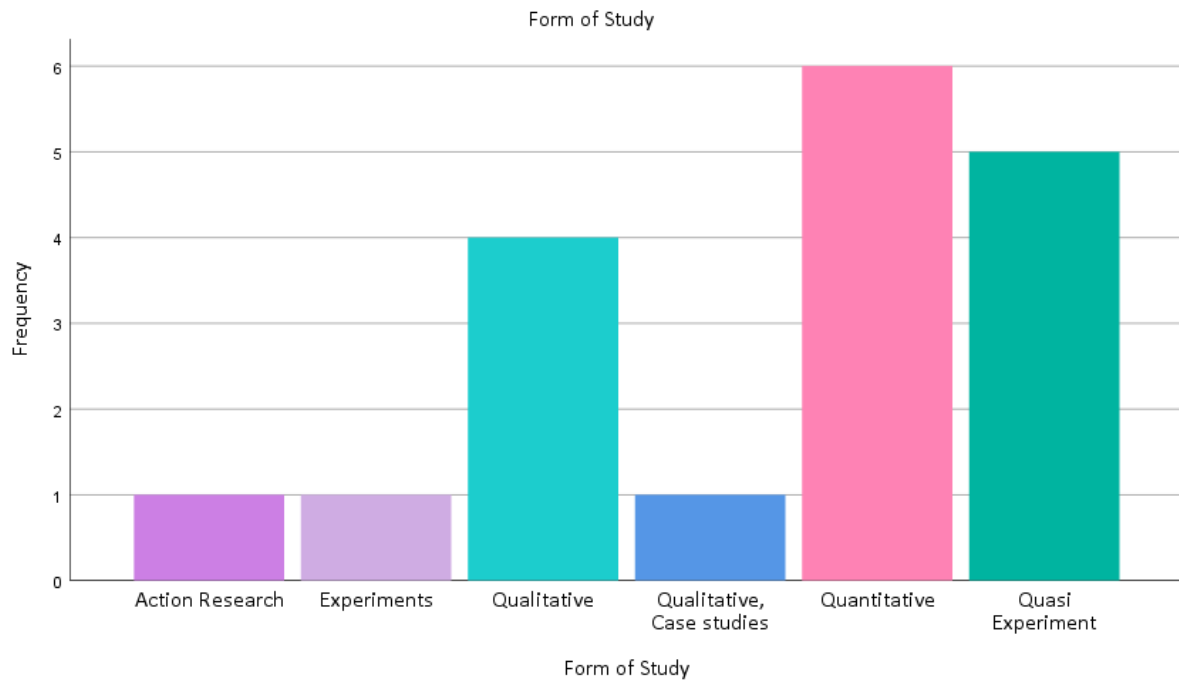
Figure 3 Number of Articles by Form of Study

Study Findings Analysis

A data analysis of the study was conducted on 18 selected articles. Based on the analysis, the researchers were able to conclude the content of the findings from 18 selected articles to 4 main themes, namely the level of mastery of HOTS: Influencing factors, learning approach: influence on students' mastery of HOTS, the relationship of HOTS mastery with the level of student achievement and the student's perception and readiness towards HOTS.
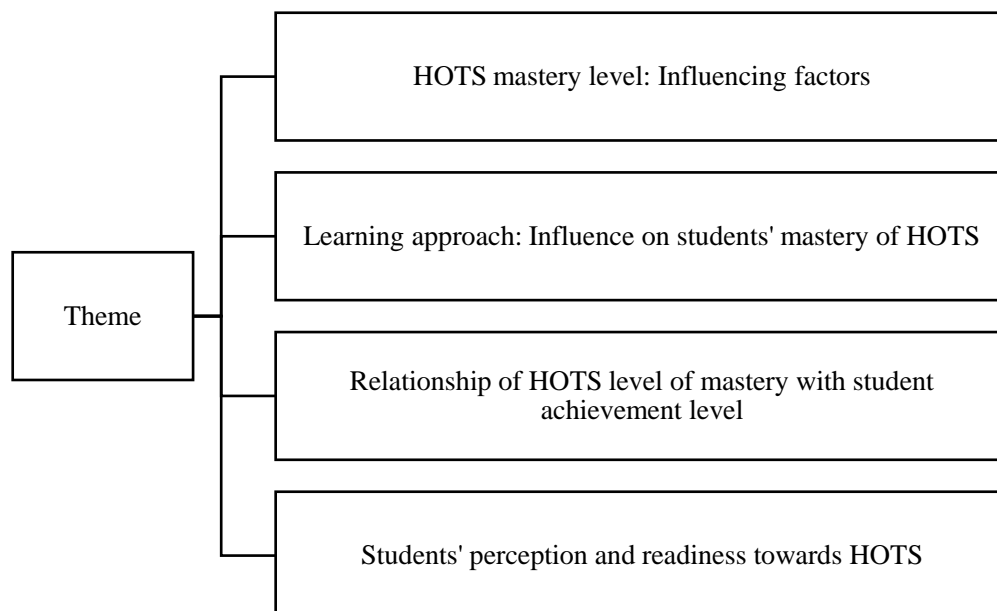

Figure 4 List of Themes found

HOTS Mastery Level: Influencing Factors

Based on the analysis of the findings, the researchers found that 3 out of 18 articles focused on the level of HOTS mastery among students (Izatul et al., 2021; Sarah & Lilia, 2021; Payadnya & Wibawa, 2021). These three articles focus on factors that influence students' poor grades of mastery. Referring to (Payadnya & Wibawa, 2021), the low level of HOTS mastery among students has caused students to be weak in understanding problems, expressing ideas main and analytical skills. In addition, the study also stated that the current situation of the study which is COVID-19 also affects the students' level of mastery of HOTS. The findings of the study found that the online learning process caused by the COVID-19 pandemic has caused students to face various challenges and constraints such as difficult to conducting group discussions thus reducing motivation in students. This can be seen through the observations made. Students were found to be less enthusiastic while in the online classroom, and less focused during the teaching and learning process. In addition, (Payadnya & Wibawa, 2021) also stated that the atmosphere is not conducive, the difficulty of getting good internet coverage, and the constraints of students from a financial point of view, it also leads to the poor effectiveness of online learning. This also makes it difficult for students to apply thinking skills in understanding learning and solving problems in learning Mathematics. This finding is in line with the statement made by (Izatul et al., 2021) which also states that the level of mastery of HOTS is influenced by learning environment factors. According to (Izatul et al., 2021), the constraints and challenges faced by students during online learning such as the absence of electronic devices and coverage of stable internet has influenced the students' level of mastery of HOTS. (Izatul et al., 2021) has measured the level of mastery of HOTS based on several aspects found in the HOTS Taxonomy Bloom theory. Among the aspects measured are the aspects of analyzing, evaluating, and creating. Based on the average percentage for each of the following aspects, (Izatul et al., 2021) found that the level of mastery of HOTS among students is located on a moderate level.

Apart from Izatul et al (2021); Payadnya & Wibawa (2021); Sarah & Lilia (2021) also stated among the causes of the level of mastery in solving HOTS problems among students are the language used in HOTS problems difficult to understand and fail to achieve the right level of understanding. Thus, (Sarah & Lilia, 2021) states that through the questioning techniques performed during the teaching and learning process, it is able to stimulate students to think critically in solving problems involving HOTS.

Learning Approach: Influence on Students' Level of Mastery

There are 9 out of 18 articles selected containing this theme (Suhaily et al., 2020; Syamsuddin et al., 2020; Normah et al., 2018; Halim et al., 2019; Kim, & Ruzlan, 2016; Duden et al., 2021; Rohaya et al., 2021; Naquiah & Ramlah, 2021; Zamri et al., 2019). Although all of these articles are under the same theme, the approaches mentioned in the studies are different. Among the learning approaches highlighted in each study are *Flipped Classroom* Zamri et al (2019), POGIL Naquiah & Ramlah (2021), Approach Module STEM Club Design Oemikiran (Rohaya et al., 2021), Innovative Learning (Duden et al., 2021), Modular Learning (Kim, & Ruzlan, 2016), Polya Model Learning (Halim et al., 2019), *i-Think* Thought Map (Syamsuddin et al., 2020), and Approach Inductive Reasoning Strategy (Suhaily et al., 2020)

Referring to (Halim et al., 2019), the level of HOTS mastery among students is measured based on the student's ability to solve the Mathematics problem applied with HOTS uses the Polya Model. (Halim et al., 2019) found that students' problem-solving skills in Malaysia are at a low level as they are only able to solve problems using basic and simple solution methods.

Therefore, guidance from teachers is consistently needed to improve the skills and capabilities of students in solving Mathematics problems that contain the application of HOTS. This is because, according to (Halim et al., 2019), the students who failed in solving the Mathematics problem were due to the student experiencing difficulties in the problem solving process which is also due to the fact that students have difficulty understanding the questions well. The same goes for (Kim, & Ruzlan, 2016) who stated that learning through problem solving and project learning can make room for students to create the association with real life which is also able to increase the level of mastery of HOTS in the students. Apart from learning to use problems involving HOTS, the use of learning aids such as *GeoGebra* electronic devices also helps students increase their level of HOTS mastery especially in the aspect of applying, analyzing and evaluating (Suhaily et al., 2020).

The use of electronic devices such as *GeoGebra* in the learning process using the inductive reasoning strategy approach can have a positive influence on the student's level of mastery of HOTS. This is because, according to (Suhaily et al., 2020), the use of *GeoGebra* can strengthen the relationship between HOTS's mastery level and students' inductive reasoning skills caused by students are able to make visualizations and observations clearly and are able to improve students' understanding in mathematical concepts. The findings of this study are in line with (Duden et al., 2021) which states that learning that involves problem solving can give students the opportunity to build knowledge, improving skills in analyzing, evaluating and creating even the learning approaches used for these two studies were different. In addition to improving students' mastery of HOTS, innovative learning can also reduce students' difficulties in solving problems involving HOTS.

In addition, the use of *the i-Think* mind map can also provide an improvement on students' achievement. This is because, through the use of *the i-Think* mind map, it can help students in organizing and organizing the content of their thoughts, making it easier for them to understand the content and help students present their ideas clearly and in an orderly manner (Normah et al., 2018). In this regard, it is also able to inculcate the positive attitude of students towards the mastery of the elements of HOTS. This statement is also supported by (Naquiah & Ramlah, 2021). According to (Naquiah & Ramlah, 2021), the POGIL approach is able to stimulate students' memory thus improving thinking skills and showing interest and fun during the process of teaching and learning. These activities involving POGIL can also have a positive impact on the students' HOTS achievement. Thus, it can influence the level of mastery of HOTS among the students.

Relationship of HOTS Mastery Level with Student Achievement Level

There are two studies that link between the application of HOTS and the level of student achievement which are (Benidiktus et al., 2017) and (Bakry & Nor, 2015). The study (Benidiktus et al., 2017) focused on how to measure the level of mastery of HOTS for Mathematics subjects and what are the indicators used in HOTS in Mathematics subjects. The findings of this study state that students with a high level of HOTS proficiency are expected to excel in learning Mathematics. This is in line with the results of the study which stated that most of the students with high levels of HOTS mastery were students who received excellent result in Mathematics and vice versa. This is in line with the statement (Bakry & Nor, 2015) which states that students with a high level of HOTS mastery are able to gather information, make assumptions and opinion and subsequently determine the mathematical concepts used and use the concepts presented in solving Mathematical problems. At the end of the learning, the student can give one conclusion.

Student's Perception and Readiness For HOTS

The latter theme focuses on the perception and also the level of students' readiness towards HOTS mastery. Based on the 18 articles selected, 4 articles discussing this theme are (Azizi & Roslinda, 2021; Eizuan et al., 2017; Tanujaya & Mumu, 2020; Muzirah & Atiqah, 2021). The construction of this theme is aimed at seeing how high the students' readiness and their perception of HOTS may affect the attitude and level of mastery HOTS the student himself,

According to (Tanujaya & Mumu, 2020), problems involving Higher - Order Thinking Skills (HOTS) are among the measurement instruments used to determine students' ability to solve questions, training or examples involving HOTS. Thus, this study found that there is a negative perception of students towards problems that use the HOTS approach. Among them is that students often consider HOTS questions to be difficult questions. This is because, based on the research done by (Tanujaya & Mumu, 2020), students who feel that the HOTS question is difficult due to the habits of the students who using a solution algorithm in solving Mathematical problems. This is due to students do not use mathematical thinking but simply memorize the formulas taught by the teacher. Hence, this will make it difficult for students to face questions or problems that are HOTS skills. Therefore, students need to be trained and guided to solve problems using standard memorized procedures but using thinking skills to plan strategies and build a solution. This is in line with the findings of the study (Eizuan et al., 2017) which states that the percentage of students in the high level of scientific reasoning is a little. Based on these findings, the researchers made an association with the teaching style of the Mathematics teacher in the classroom whether the teacher implements HOTS in the teaching process and learning or not. This greatly impacts the level of mastery of HOTS among students. Effective in-class conception of HOTS is able to give students a positive perception of learning involving HOTS (Muzirah & Atiqah, 2021). Azizi & Roslinda (2021) also stated that students' attitude and readiness towards problem solving and the ability to solve problems involving HOTS are at a moderate level and HOTS's adoption among teachers also plays an important role in changing students' attitudes towards HOTS.

Conclusion

Overall, this systematic literature review study was conducted to identify the level of mastery of HOTS among students. Based on the surveys conducted, studies focusing on the level of mastery of HOTS among students on Mathematics subjects are still underway. From the findings, a total of 3 study articles focused on the level of mastery as well as the influencing factors. Next there are 9 studies that highlight learning approaches involving HOTS and its influence on HOTS mastery. The theme of this study is seen as very popular among researchers because, in line with the changes in education that have been implemented by the government to improve the quality of Malaysian education, various methods and a new learning approach which focuses on the 21st century learning approach that requires the mastery of HOTS students. Next, the researchers found that only 2 studies conducted an approach to the relationship of HOTS mastery level with students ' level of achievement. According to the researchers, the theme of this study is less of a focus among other researchers because the issues highlighted in the world of education are the ability students in mastering thinking and problem-solving skills involving HOTS. Hence, the level of achievement of students is difficult to assess due to the diverse HOTS assessment indicators. Students' perception and readiness towards HOTS are among the themes of the study chosen by the researchers because following the change of the KBSM secondary school curriculum to KSSM that applies the element of HOTS, many researchers want to observe the acceptance

of HOTS among students so that teachers can build a teaching method that can implement HOTS more effectively and thus be able to enhance students' ability in solving problems involving HOTS.

Thus, through all 18 research articles selected in this systematic literature review study, the researchers were able to answer all three questions of the study that had been constructed. It is hoped that with the study of this literature, the researchers will be able to do a further study such as a survey study on the level of mastery of HOTS students in Mathematics subjects because it contains high HOTS application.

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