Exploring Demographic Disparities in the Mastery of Higher-Order Thinking Skills among Primary School Pupils

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***Abstract*— Today's pupils should cultivate higher-order thinking skills (HOTS) more than anything else. This study aims to assess the HOTS level among primary school pupils based on demographics and their differences. The population in this study included all Year 5 pupils at primary school in Malacca. Malaysia. A total of 73 pupils from a primary school in Malacca, Malaysia were selected as research samples. The SEA test (Synthesis, Evaluation and Analysis) was modified to collect research findings. Data were analyzed descriptively and inferentially using SPSS software and presented into mean, frequency, and percentage. The findings showed that most primary pupils have a very low level of HOTS based on gender and socioeconomics (SES). T-test analysis showed that there was no significant difference in the mean scores of HOTS level between male and female pupils. However, there was a significant difference in the mean scores of HOTS level based on SES. In conclusion, to support pupils' HOTS abilities, the HOTS instruction should cultivate reasoning and problem-solving techniques rather than procedural fluency.**

Keywords*— *higher order thinking skills, demographic, gender, socioeconomics, primary school pupils.

I. Introduction

In today's era of globalization and knowledge, pupils are confronted with the challenges of Industry 4.0, which differs significantly from the past. Educators play a crucial role in preparing pupils to thrive in this rapidly changing landscape. One of the essential skills necessary for navigating this new era is high-level thinking, often referred to as Higher-Order Thinking Skills (HOTS). These skills are vital for pupils to excel in the classroom, as well as in their personal and professional lives, as they tackle everyday challenges. The success of pupil achievement corresponds to the teacher's ability and role as a facilitator [1] in instilling high-level thinking to help them rise to a higher level [1].

The importance of applying higher-order thinking skills (HOTS) is increasingly challenging as pupils not only sit and listen to the lessons from teachers, but also require pupils to apply them to the real world. HOTS is something that is emphasized or a key initiative that needs to be undertaken by a number of key stakeholders in Ministry of Education (MOE) (Early report Malaysia Education Blueprint (MEB), 2013 - 2025) [2]. HOTS is the ability to apply knowledge, skills, and values to engage in critical thinking, problem-solving, decision-making, and creativity [3].

As a result, HOTS demands sophisticated cognitive abilities together with in-depth analysis to reach conclusions and resolve issues. The mental skills are also mentioned in HOTS. triggered when people run against unknown issues, doubts, queries, and conundrums. Pupils must utilize a combination of critical, logical, reflective, metacognitive, and creative thinking to design a creative strategy to handle such problems rather than relying solely on a memorized solution [4]. In order to derive new meaning and knowledge, pupils must also comprehend, integrate, correlate, categorize, and manipulate the information. This makes it possible for pupils to use what they know to create fresh answers for every issue or situation. With an emphasis on evaluating, analysing, exploring, and inventing elements, the HOTS fosters creativity and critical thinking abilities [5].

Learning was no longer limited to sitting still and listening to the teacher present the subject, which is why putting HOTS into practice became so important. Because learning requires real-world application, it becomes extremely crucial. Based on the application results, [6] states that pupils have a favourable opinion of the usage of HOTS in teaching and learning since it helps them in their everyday lives. Pupils could be trained to think critically and imaginatively because life presents many problems. Because they are able to actively participate in learning in real life, the pupils have a positive opinion of HOTS. On the other hand, Clark in [6] also said under the revised Bloom's Taxonomy, the three higher levels are analysing, evaluating and creating.

II. Problem Statement

The importance of building higher order thinking skills for pupils in this day is the absolute important. However, pupils'

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level of thinking is still low because they are still less skilled in choosing and using appropriate strategies to solve the given problem [7]. In addition, the findings of previous studies show that most pupils have problems in HOTS due to a lack of metacognitive, cognitive and affective learning strategies [8]. [9] identified pupils HOTS are not in satisfying level because their understanding in answering the questions is still low and this proves that the lack of pupils producing new ideas in the form of answers to the questions given. [10] stated that pupils still did not master the revised Bloom Taxonomy of HOTS comprising of application, analysis, evaluation and creation.

The Kestrel Education Consultant from England and the 21st Century School of the United States in 2011 stated that high-level thinking among teachers and pupils in Malaysia was still low [11]. Students' lack of creativity in problem-solving is directly attributed to their failure to effectively apply higher-order thinking skills in their learning [12]. The thinking process begins when the mind retrieves and processes stored data and information to gain understanding. However, this process is influenced by internal and external factors. A variety of demographic factors will have a direct impact on thinking. Meanwhile, findings of the difference gender analysis between various HOTS show that the mean score value of male pupils is higher than female pupils [13] and this finding is in line with a study by [14].

Studying the gender gap would provide a deeper knowledge of pupils' problem-solving abilities, as recommended by the Organisation for Economic Co-operation and Development [OECD] (2009). However, the results regarding the gender differences in problem-solving abilities are not entirely conclusive. For example, [15] discovered that there was a slight gender difference in the ability to solve complicated problems, with boys performing better. Conversely, [16] and [17] discovered that girls demonstrated stronger performance than boys in solving context-based word problems in the 2015 Programme for International Student Assessment (PISA).

Therefore, to develop a deeper and more comprehensive understanding of the role of gender in learning, it is important to relate the gender of pupils to their personal characteristics and learning context [18]. In the meantime, previous studies have found that parents' involvement in early childhood education depends on their country's economic status [19]-[20]. The findings of the study by [21], found very clear results related to achievement with different components of SES based on the highest occupational status of the parents. Thus, the objectives of this study are:

(1) To identify the HOTS level among Primary School Pupils based on demographics.

(2) To investigate the difference in HOTS level among Primary School Pupils based on gender.

(3) To investigate the difference in HOTS level among Primary School Pupils based on SES.

III. Methodology

This is survey research using quantitative approach identify primary school pupils' HOTS level. The population in this study were all the Year 5 pupils at primary school in Malacca. One national schools were selected in the district of Malacca. The total number of Year 5 pupils involved in this study was 73. In this study, the instruments were modified from [22] consist of SEA (Synthesis, Evaluation and Analysis) test to determine the level of mastery of HOTS (TABLE I). The mean score range and HOTS mastery level in this study were based on TABLE II and analysed using descriptive statistics to get the frequency and percentage via SPSS version 26.

TABLE I. Allocation and Distribution Number of Items for Modified Instrument

Part	HOTS	Item number
Part I	Analysis	11
Part II	Evaluation	34
Part III	Creation	18
Total		52

TABLE II. Mean Score Range and HOTS Mastery Level for the SEA Test

Mean score range	Level
73 – 100	Very high
63 – 72	High
53 – 62	Moderate
43 – 52	Low
0 - 42	Very low

IV. Results and Discussion

The research findings were based on three research objectives.

A. HOTS level among primary pupils based on demographics

Based on TABLE III, majority of primary pupils have very low level for 3 of HOTS regardless male or female pupils. [46] indentified pupils HOTS are not in satisfying level because their understanding in answering the questions is still low and this proves that the lack of pupils producing new ideas in the form of answers to the questions given. Only 1 female pupil have very high level on creating. This pupils were expected to create something different from the others. It was caused by the fact that idea was the core of creativity [23]. [24] noted that the results showed that the main cause of the pupils' inability to [16] affirms a slight gender difference favoring male pupils in the resolution of complex problems. Meanwhile, some of pupils have very high level on evaluation. Only 1 female pupil has high level.

[17] and [18] identified a similar pattern to the present study, affirming that female pupils demonstrated superior performance in solving problems presented in sentence form. Pupils with proficient evaluation HOTS can thoroughly assess and substantiate statements. Those at the higher proficiency level demonstrated the ability to identify errors and offer answers supported by evidence. In contrast, pupils at a moderate proficiency level could express the error but failed to provide supporting evidence, while those at a low proficiency level were unable to identify the error altogether.

Finding showed that both gender at very high level at the level of analysis. This pupils had been able to determine how to analyze the question and conclude correctly. It is required of the pupils to be able to identify the main idea of the question and respond to it in light of that idea. Pupils at the lower level

are not yet able to differentiate, but they are still trying to follow their way of thinking.

[25] revealed that generally no gender differences were found. Specifically, gender differences have shown that male pupils tend to see a higher level of teacher control than female pupils, while female pupils tend to see a higher level of teacher autonomy support than male pupils [26]. However, different from the findings of the study by and [23] and [15] reported that there was no significant difference for the factors of gender, academic achievement and SES on the studied HOTS.

TABLE III. HOTS LEVEL AMONG YEAR 5 PUPILS BASED ON GENDER FACTOR

HOTS	Level	Male		Female		Total	
		f	%	f	%	f	%
Analysing	VH	2	5.56	1	2.70	3	1.37
	H	1	2.78	3	8.11	4	1.83
	M	1	2.78	6	16.22	7	3.20
	L	5	13.89	5	13.51	10	4.57
	VL	27	75.00	22	59.46	49	22.37
Evaluating	VH	0	0.00	0	0.00	0	0.00
	H	0	0.00	1	2.70	1	0.46
	M	3	8.33	2	5.41	5	2.28
	L	2	5.56	6	16.22	8	3.65
	VL	31	86.11	28	75.68	59	26.94
Creating	VH	0	0.00	1	2.70	1	0.46
	H	1	2.78	0	0.00	1	0.46
	M	4	11.11	4	10.81	8	3.65
	L	5	13.89	12	32.43	17	7.76
	VL	26	72.22	20	54.05	46	21.00

Indicator:
VH – Very High
H – High
M - Moderate
L – Low
VL – Very low

Based on TABLE IV, majority of primary pupils have very low level for 3 of HOTS regardless SES. This indicates a greater frequency of lower-order thinking skills. The B40 category consistently exhibits higher percentages in very low levels, suggesting a potential need for targeted educational interventions to enhance HOTS among this group. However, it's acknowledged that children from low-income families may require additional educational resources and opportunities for equitable academic success [27]. In this case pupils in rural areas or villages belong to low-income families. Pupils from rural areas are often considered less proficient in mathematics compared to their urban counterparts due to the SES disadvantages prevalent in their schools [27]. This discrepancy is influenced by factors such as income disparities, as families with higher income levels can afford high quality materials. Nevertheless, the results of the study also show the same thing at the level of analyzing, evaluating and creating for the M40 category. Interestingly, another research explain that children from both lower and higher SES homes tend to advance academically at similar paces during the initial years of school [28]-[29].

The results of the study also show the highest percentage at the level of analysis for the T20 category. This explains that parents of pupils from higher SES backgrounds are often better educated and hold higher-level jobs, contributing to a positive correlation between parental education and family SES [30]. Additionally, the concept of a growth mindset has been linked to academic achievement, particularly for pupils from affluent homes [28]. [31] study on Filipino secondary school pupils revealed an exclusive association between a growth mindset and higher SES families, positively predicting achievement. Supporting a growth mindset is suggested to enhance educational achievements, particularly for high SES children with access to favorable opportunities. The T20 category also regularly shows higher percentages in very low at the evaluation and creation levels compared to the analysis level.

TABLE IV. HOTS LEVEL AMONG YEAR 5 PUPILS BASED ON SES FACTOR

HOTS	Level	B40		M40		T20		Total	
		f	%	f	%	f	%	f	%
Analysis	VH	0	0.00	0	0.00	**3**	**20.00**	3	1.37
	H	1	2.86	2	8.70	1	6.70	4	1.83
	M	3	8.57	1	4.35	3	20.00	7	3.20
	L	6	17.14	3	13.04	1	6.70	10	4.57
	VL	25	71.43	17	73.91	7	46.70	49	22.37
Evaluation	VH	0	0.00	0	0.00	0	0.00	0	0.00
	H	0	0.00	0	0.00	**1**	**6.70**	1	0.46
	M	2	5.71	0	0.00	3	20.00	5	2.28
	L	4	11.43	2	8.70	1	6.70	7	3.20
	VL	29	82.86	21	91.30	10	66.70	60	27.40
Creation	VH	**1**	**2.86**	0	0.00	0	0.00	1	0.46
	H	0	0.00	0	0.00	1	6.70	1	0.46
	M	2	5.71	2	8.70	4	26.70	8	3.65
	L	15	42.86	5	21.74	2	13.30	22	10.05
	VL	17	48.57	16	69.57	8	53.30	41	18.72

Indicator:
VH – Very High B40(< RM4360) - Lowest
H – High M40 (RM4361-RM9619) - Intermediate group
M – Moderate T20 (> RM9620) - Highest group
L – Low
VL – Very low

B. Difference in HOTS level among primary school pupils based on gender

TABLE V showed an independent t-test analysis of differences in HOTS level among Year 5 pupils based on gender. The independent-sample t-test results indicate no significant difference in HOTS levels between male and female pupils. The performance of Year 5 rural male and female elementary pupils [26, 32 & 33] and secondary pupils [18] in solving word problems related to measurement formulas and HOTS is almost the same.

TABLE V. INDEPENDENT T-TEST ANALYSIS FOR DIFFERENCES IN HOTS LEVEL AMONG YEAR 5 PUPILS BASED ON GENDER

Gender	N	Mean HOTS level	SD	*p*
Male	36	33.49	10.83	.860
Female	37	37.26	10.49	

Significant differences in $p < .05$

C. Difference in HOTS level among primary school pupils based on SES

TABLE VI showed an ANOVA test analysis of differences in HOTS level among Year 5 pupils based on SES. There is a significant difference in HOTS levels between B40, M40 and T20 pupils. This finding means that the SES factor can affect the HOTS. The result at this level is

consistent with a study [34] that discovered Malaysian students from low SES status schools, typically situated in rural areas, scored an average of 373 on the TIMSS 2011 exam. This was due to the majority of them being unable to apply their mathematical knowledge to solve problems, even in simple situations [35].

SES factors may have a role in the comparatively low mathematics performance of rural pupils [36]-[37] the pupil and school levels [38]-[18]. Due to their SES difficulties, individuals had less access to educational resources that may help them develop their capacity for HOTS [39].

In this regard, parents with high incomes have the advantage of providing the best access for their children in education in particular. This shows that children from high-income families start being exposed to communication in the form of HOTS earlier than low-income families [40]. For example, these parents are always positive in learning management in addition to being able to supply activity and training books as well as better learning tools. Nevertheless, low income parents stimulate cognitive activities less for their children at home [40]-[41].

TABLE VI. ANOVA TEST ANALYSIS IN HOTS LEVEL AMONG YEAR 5 PUPILS BASED ON SES

HOTS	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	865.101	2	432.550	4.054	.022
Within Groups	7468.615	70	106.694		
Total	8333.715	72			

Significant difference in $p < .05$

V. CONCLUSION

In conclusion, this study provides empirical evidence investigating demographic disparities in the level of higher-order thinking skills (HOTS) among primary school pupils based on gender and socioeconomic status (SES). The findings of this study highlight the cognitive levels based on the revised Bloom's Taxonomy of HOTS, which comprises analysis, evaluation, and creation. The findings of this study explain that the level of understanding related to HOTS and learning materials among pupils is limited to certain materials and can only be used at certain times.

Based on the highlighted urgency to shift the teaching focus towards mastery of thinking and problem-solving skills, some recommendations can support teachers in enhancing students' performance in HOTS including (1) regular training programs should be held to equip teachers with innovative strategies, (2) revising the curriculum to include activities and projects that promote critical thinking and problem-solving, (3) encouraging teachers to work in teams to design and implement lessons that stimulate students' higher-order thinking, and (4) modifying assessment methods to evaluate students' higher-order thinking skills effectively

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