Research Article

The Relationship Between Attitude And Higher Order Thinking Skills (Hots) Among Secondary School Students

[1]Mohd Saifulkhair Omar & [2]Mohd Isha Awang
[1,2]Centre of Education and Modern Languages, Universiti Utara Malaysia, Malaysia
[1]E-mail address: epui7779@gmail.com

Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 16 April 2021

Abstract: The aim of this study would be to determine the attitude of students in secondary schools towards science and the degree of Higher Order Thinking Skills (HOTS). The objective of the research is also to examine the connection between the dimensions of the student's attitude and HOTS. This study is a quantitative method which is a correlation study. The questionnaire was used for the collection of respondent's information. The questionnaire was divided into two sections, which are: (A) Students' attitude towards science and (B) Higher Order Thinking Skills (HOTS). The attitude toward science using an instrument was adapted and modified by Harery (2007) from the Science Attitudes Inventory which was developed by Lilia et al. (2003). The HOTS survey was consequently designed by the researchers centered on the 2001 Bloom's Taxonomy and based on the questions adapted and updated from Pentaksiran Tingkatan 3 (PT3) 2016 and 2017. A total of 89 secondary school students were randomly selected from the two secondary schools in Kuala Nerus, Terengganu. The study found that student's attitude towards science was moderate (mean = 3.08), while HOTS level was low (mean = 1.28). However, there was a substantial connection between the dimensions of the science importance in society of the student attitude variables and the dimensions of evaluating and creating HOTS variables. Therefore, The Ministry of Education Malaysia (MOE) must plan the programs and activities to increase the awareness and understanding of the students about the importance of science in society.

Keywords – Student attitude towards science, Higher Order Thinking Skills (HOTS), Kuala Nerus, Pentaksiran Tingkatan 3 Assessment, the importance of science in society, evaluating, creating.

INTRODUCTION

The education system in Malaysia has changed according to recent trends, creating an internationally competitive and balanced community (Saipolbarin, Muhammad Taufiq, Nazri & Taj Rijal, 2019). To enable our students to be able to compete at the international level, then Higher Order Thinking Skills (HOTS) should be given priority (Nur Hawa Hanis & Ghazali, 2018; Sole & Anggraeni, 2020). This argument is supported by Dian et al. (2019), who found that life in the 21st century requires a person to possess more than one skill than ever before in order to determine one's success or failure. This prompted the government to reform national education policy and develop a long-term strategy, the Pelan Pembangunan Pendidikan Malaysia (PPPM) (2013-2025), with a focus on world-class quality education, with one change in the PPPM being to have fair access to education of international standard quality (Mazlini et al., 2016).

The international benchmarks TIMSS (Trends in International Mathematics and Science Study) and PISA (Programme International Student Assessment) have been adopted to evaluate the performance of Malaysian students (PPPM, 2013). Hence, Malaysia's low position in the test has proven that Malaysian students find it difficult to apply high-order thinking skills (PPPM, 2013). Malaysia's TIMSS and PISA achievement reports from 2007 to 2015 indicate a deterioration in the mastery of science and mathematics subjects among Malaysian students globally (Shahril, Azlin Norhaini, Subahan & Azliza, 2018). Therefore, the vision of PPPM 2013-2025 is to place Malaysia in the top one-third group in international benchmarks, TIMSS and PISA in science and mathematics subjects by 2025 (PPPM 2013-2025, 2012). However, the study by Vadsala and Kamisah (2015) is worrisome when they have found that the decline in Malaysia's achievement in such international assessments is due to the problem of students who are passive and like to keep quiet in implementing HOTS in the classroom. This finding is supported when the study of Arnita, Sajidan, Yudi, Afandi and Prasetyanti (2019) on high school students in Surakarta, Indonesia when they found that some students are passive while doing group work.

This negative attitude of students is contrary to the practice of 21st Century Learning (PAK21) because, in PAK21, students will do together the tasks given by the teacher in a group that is Cooperative Learning (Mashira, Rusyati, Nor Sazila & Khairul Anuar, 2020). This is because attitude is important. After all, it will affect what is learned and the efforts made while carrying out learning activities (Nur Bahiyah, Sharifah Nurulhuda Azman, Jailani & Zulkifli, 2017). Furthermore, according to Azimar, Sipahutar and Syarifuddin (2017), students who are positive towards science will cause him or her to do more tasks to improve their ability to think creatively. Edward Glatser's Theory of Critical Thinking Ability (1941) has found that critical thinking is influenced by (1) Intelligent attitude in considering problems, (2) Knowledge of logic-based investigations, (3) Skills in applying critical thinking methods (Zulmaulida, Wahyudin and Dahlan, 2018; Zaid et al., 2021). Next, a study by Miele and Wigfield (2014) has found that student motivation will influence students 'critical

thinking skills. They also discovered that two factors determine the motivation of students to participate in critical thinking abilities: (1) the presence of belief, accomplishment and learning objectives affect the relationship between motivation and critical thinking, and it also encourages students to do critical thinking with continuous efforts, (2) different desires, students are more likely to be critical thinking, compared to their fellow students, in their own way and differently (Azlisham et al., 2021). The objectives of this study are:

1. identify attitudes towards science among secondary school students in Kuala Nerus, Terengganu.
2. identify the level of higher-order thinking skills among secondary school students in Kuala Nerus, Terengganu.
3. study the relationship between the dimension of attitude towards science and the dimension of high order thinking skills among secondary school students in Kuala Nerus, Terengganu.

LITERATURE REVIEW

Studies have found that there is a relationship between attitudes and high-level thinking skills (Cornejo, Campos & Quinones, 2019; Dwi Isnaini Amin & Darsono Sigit, 2018; Julianto, Wasis & Rudiana, 2018; Fauziyana et al., 2020). Furthermore a study by Kaili, Harrison, Yinghui and Xuan (2021) and Zaid et al. (2020) on students in a smart classroom environment found that peer interaction and learning motivation have a strong influence on student HOTS. The willingness to apply knowledge, abilities, and values to reasoning and reflection to solve challenges, to take decisions, to invent, and to build something are defined as Higher Order Thinking Skills (HOTS) (BPK, 2014). This is because the ability to think critically is important to build students competencies in problem solving and discovery (Ani Sutiani, Manihar Situmorang, Albinus Silalahi, 2021). HOTS can be identified in Content Standards (CS) and Learning Standards (LS) through the statement of thought level verbs in Anderson's revised Bloom's Taxonomy, where HOTS is a reference to the skills of applying, analysing, evaluating and creating (BPK, 2016).

Past studies have found that the level of higher-order thinking skills of secondary school students is low and also there is no significant difference between the sexes (Gulistan, Saedah, Abu Bakar & Omed Saadallah, 2018; Siti Nur Hasanah, Sunarno & Prayitno, 2020. Rosnee et al., 2021). According to Sole and Anggraeni (2020), the preparation of higher-order thinking skills questions does not mean having a high level of difficulty because a high level of difficulty does not necessarily mean having higher-order thinking skills. For example, a question asking a meaning that has never been learned does not mean that the question is a question of higher-order thinking skills. Meanwhile, Aznur, Khazriyati, Idris, Ruhizan and Mimiko (2019) have found that the structure of SPM examination questions in Malaysia only requires students to solve problems by giving answers in the form of values without requiring students to change answers to new formulas or in other forms such as graphs. Meanwhile, Mohd Saifulkhair and Mohd Isha (2020) found that the importance of sufficient materials and apparatus for experiments will help students develop original ideas and further improve students' higher-order thinking skills. The importance of HOTS learning is important as it will cause students' academic achievement to increase (Tanujaya, Mumu & Margono, 2017, Norazmi et al., 2019). Next, Gulistan, Saedah, Abu Bakar & Omed Saadallah (2018) also stated that the level of synthetic thinking and evaluating should be given more attention in improving students' HOTS.

According to Cezar and Pinto's (2017) analysis of primary school teachers and students in Spain, students in rural schools had more optimistic attitudes compared to students in urban schools, and teachers reported that they did not perform experiments in science classes. Furthermore, the findings of a study by Sofiani, Maulida, Fadhillah and Sihite (2017) have also shown that students' attitudes towards science are moderate with the highest mean being self-concept in science (mean = 3.53), followed by the excitement in science (mean = 3.19), value in science (mean = 3.05). The lowest mean was motivation in science (mean = 2.84). Nevertheless, previous studies have found that students' attitudes towards science are positive and there are no significant differences between genders (Nasyimah & Zamri, 2016; Oon, Cheng & Wong, 2019; Sakariyau, Taiwo & Ajagbe, 2016; Norazmi et al., 2020; Sofiani, Maulida, Fadhillah & Sihite, 2017).

RESEARCH METHODOLOGY

Research Question

1. What is the attitude towards science among high school students?
2. What is the level of higher-order thinking skills among high school students?
3. Is there a relationship between attitudes and higher-order thinking skills among high school students?

Research Instruments

Attitudes towards science

The instrument used was an instrument adapted and modified by Harery (2007) from the Attitudes Towards Science Inventory that was developed by Lilia et al. (2003).

Table 1
Attitude Towards Science Instrument

Attitude Dimension	No. of Item	Item Number
The importance of science in society	8	1, 2, 8, 11, 20, 21, 28*, 33*.
Motivation in science	8	3, 6, 7, 9, 22, 25, 32*, 35*.
Excitement in science	8	5, 12, 14, 16*, 24, 27, 29*, 38.
Anxiety in science	8	10*, 13, 18*, 23*, 31*, 34*, 37, 39
Self-concept in science	8	4*, 15, 17*, 19*, 26, 30, 36, 40*.
	40	

Higher-order thinking skills

Furthermore, researchers built and created a series of standardised query instruments based on a research by Stanger-Hall (2012), discovered that using formal questions promotes higher-order thinking skills in pupils. The questions have been modified and upgraded from the questions in 2016 and 2017 Pentaksiran Tingkatan 3 and 2001 Bloom's Taxonomy. For construct evaluation, the researchers carried out a construct test with two experts and experienced teachers from AKRAM (Angkatan Kerja Rajin dan Mulia) Terengganu. Following that, an accuracy test was performed to assess the instrument's reliability value.

Table 2
Instruments of Higher Order Thinking Skills (HOTS)

HOTS Dimension	No. of Items	Item Number
Applying	2	1, 5
Analysing	2	2, 6
Assessing	2	3, 7
Creating	2	4, 8
	8	

Data Collection Procedure

The researcher requested approval from the Education Planning and Research Division (EPRD) in advance to undertake the studies before the data collection process was started. The researcher then requested the State Education Department (JPN) for a permission and then the Principal of the school. The researcher circulated the questionnaire to the chosen respondents after receiving approval from both the State Education Department and the school. In the district of Kuala Nerus, Terengganu, the researchers went to two participated secondary schools.

The researcher then met with the school administrator and explained briefly the purpose of this study and requested the goodwill of the administrator to manage this questionnaire to be answered by Form 2 students in the school. A total of 100 sets of questionnaires were prepared and distributed to the two schools involved. Finally, recollection of questionnaires for each school was made within a week after reminders via telephone calls were made as suggested by Creswell (2012, 2014), Sekaran (2006), and Sekaran and Bougie (2010, 2013).

The questionnaire was divided into two parts, namely (I) attitudes towards science and (III) higher-order thinking skills. Part I is the interval data using a 5-point Likert scale. Meanwhile, part II is the ratio data, where the researcher has placed a score of 1, 2, 3, 4 and 5. Next, moderation was done with two teachers examining PT3 science questions at Kuala Nerus, Terengganu. This is because, HOTS questions should be in the form of open-ended questions that have more than one answer (Suhaimi @ Othman et al., 2014). Finally, the total score will be summed for each dimension.

DATA ANALYSIS

Table 3
Types of Data Analysis

No.	Research Questions	Type of Analysis

1	What are the attitudes towards science among high school students?	Mean
2	What is the level of higher-order thinking (HOTS) skills among high school students?	Mean
5	Is there a relationship between attitudes and higher-order thinking skills among high school students?	Spearman's Correlation

To answer research questions 1 and 2, the researcher has constructed a level table to determine the attitude towards science and the level of higher order thinking skills among high school students. Researchers have divided into three levels namely high, medium and low.

Table 4
Level Table

Mean Score	Level
3.34 – 5.00	High
1.67 – 3.33	Medium
0 – 1.66	Low

RESULTS AND DISCUSSION OF THE STUDY

1. What is the attitude towards science among high school students?

Table 5
Mean Value of Attitude Dimension

Attitude Dimension	Mean	Standard deviation
The importance of science in society	4.00	.65
Motivation in science	3.36	.63
Excitement in science	3.15	.47
Anxiety in science	2.17	.74
Self-concept in science	2.66	.85

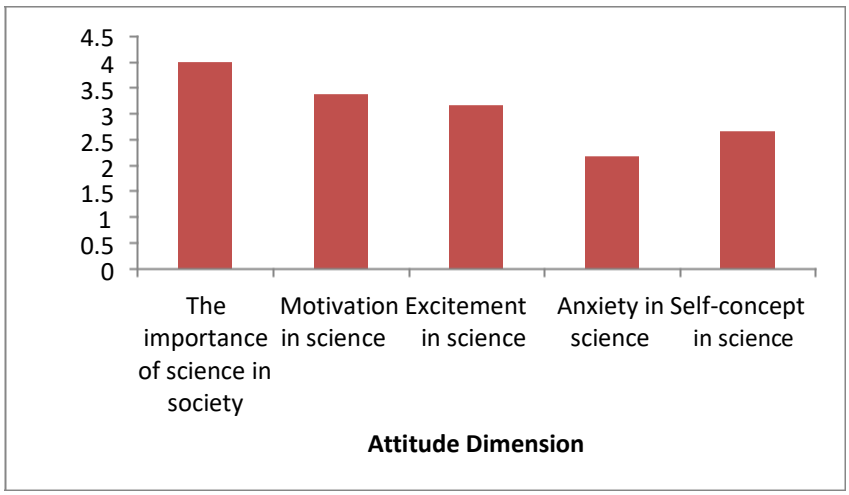

Figure 1: Comparison Graph of Mean Values of Attitude Dimensions.

Table 5 above shows the dimensions of the importance of science in society (mean = 4.00) and motivation in science (mean = 3.36) are at a high level. Meanwhile, the other three dimensions of excitement in science (mean = 3.15), self-concept in science (mean = 2.66), and anxiety in science (mean = 2.17) were at a moderate level. This finding is in line with the findings of a study by Zanaton, Lilia, and Kamisah (2006) who have found that the dimension of the importance of science in society has a high mean compared to other dimensions. The importance of science in society can be defined, according to Zanaton, Lilia and

Kamisah (2006) by the importance and need of science in everyday life. It can also be used to solve challenges every day.

Similarly, the findings by Aziz and Ling (2011) found that students' perceptions of the importance of science in society are positive. The findings of this study are reinforced by Siegal et al. (2003) who have found that students positively asserted that science is closely linked to their lives.

2. What is the level of higher-order thinking skills among secondary school students?

Table 6

Mean Value of HOTS Dimension

HOTS Dimension	Mean	Standard deviation
Applying	1.05	.67
Analysing	1.67	1.06
Assessing	1.05	.81
Creating	1.35	.97

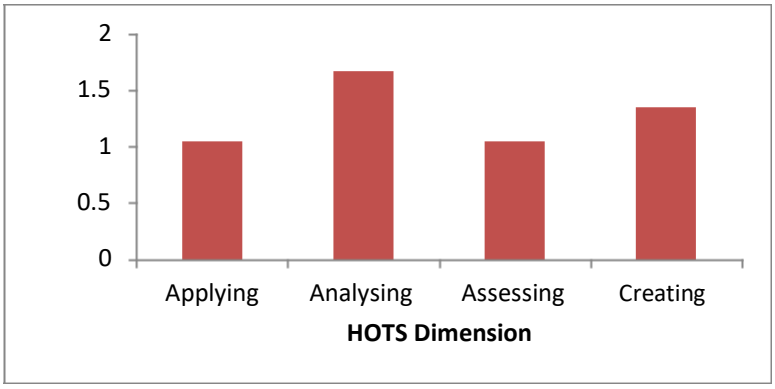

Figure 2: Comparison Graph of Mean Values of HOTS Dimensions

Table 6 above shows that the highest mean is the analysing dimension (mean = 1.67) and is at a moderate level. Meanwhile, the other three dimensions are at a low level, namely creating (mean = 1.35), applying (mean = 1.05), and evaluating (mean = 1.05). This finding is supported by Ichsan, Sigit, and Miarsyah (2019) who have found that the highest score is the analysing dimension (3.81), while the lowest score is the creating dimension (2.57).

3. Is there a relationship between attitudes and higher-order thinking skills among high school students?

Table 7

Spearman's Correlation Test for the Relationship between Attitude and HOTS

	HOTS							
	Applying		Analysing		Assessing		Creating	
	r_{xy}	Sig.	r_{xy}	Sig.	r_{xy}	Sig.	r_{xy}	Sig.
The importance of science in society	.068	.524	.176	.098	.280**	.008	.214*	.044
Motivation in science	.136	.205	.022	.835	.090	.403	.151	.158
Excitement in science	.080	.456	.162	.129	.107	.320	.097	.367
Anxiety in science	.021	.846	.077	.475	.027	.798	.112	.295
Self-concept in science	.170	.112	.170	.111	.125	.242	.141	.075

* Significant at the 0.05 level

** Significant at the 0.01 level

In HOTS, there is a significant association between the aspects of the significance of science in society and the dimensions of evaluating ($p = 0.008 < 0.01$) and creating ($p = 0.044 < 0.05$), as seen in Table 7. The usefulness and need to use scientific knowledge for everyday life and also for work to resolve everyday problems will demonstrate the relevance of science in societies (Zanaton, Lilia & Kamisah, 2006).

CONCLUSION

The findings of the research found that the level of higher-order thinking skills (HOTS) among Form Two students in the Kuala Nerus district was low (mean = 1.28), where the analysing dimension showed the highest mean (mean = 1.67) compared to other dimensions. In addition, the findings showed that the students' attitudes towards science were moderate (mean = 3.08), meanwhile, the importance of science in society had the highest mean (mean = 4.00) compared to other dimensions.

Furthermore, the correlation test also found that there is a relationship between the dimensions of the importance of science in society to the dimensions of evaluating and creating. The level of evaluative and creative thinking is a higher-order thinking skill and is the 5th and 6th levels in Bloom's Taxonomy (2001). The importance of science in society can be explained when science can be used to solve everyday problems in society.

In this regard, teachers and schools should plan activities that can provide awareness to students about the importance of science in life, as well as critical and creative thinking in solving everyday problems. For example, Project-Based Learning (PBL), where students will combine the science knowledge learned in the laboratory with high-level thinking skills that have been applied to create and solve problems in community life. The findings of a study by Rosa (2021) have supported that PBL will enhance the critical thinking of students in Taiwan.

REFERENCES

1. Abdul Halim Abdullah, Mahani Mokhtar, Noor Dayana Abd Halim, Dayana Farzeeha Ali, Lokman Mohd Tahir & Umar Haiyat Abdul Kohar (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*(1), 3-17.
2. American Psychological Association. (2013). Publication manual of the american psychological association. (Sixth Edition). Washington: APA.
3. Ani Sutiani, Manihar Situmorang, Albinus Silalahi (2021). Implementation of an Inquiry Learning Model with Science Literacy to Improve Student Critical Thinking Skills. *International Journal of Instruction, 14*(2), 117 - 138.
4. Arnita Cahya Saputri, Sajidan, Yudi Rinanto, Afandi & Nanik Murti Prasetyanti (2019). Improving students' critical thinking skills in cell-metabolism learning using stimulating higher order thinking skills model. *International Journal of Instruction*, *12*(1), 327-342.
5. Azimar Rusdi, Herbert Sipahutar & Syarifuddin Syarifuddin (2017). Hubungan Kemampuan Berpikir Kreatif dan Sikap Terhadap Sains Dengan Literasi Sains Pada Siswa Kelas XI IPA MAN. *Prosiding Seminar Nasional III Biologi dan Pembelajarannya Universitas Negeri Medan, 08 September 2017*, (pp. 314-325).
6. Azizi Yahaya, Shahrin Hashim, Jamaludin Ramli, Yusof Boon & Abdul Rahim Hamdan (2007). *Menguasai penyelidikan dalam pendidikan: Teori, analisis & interpretasi data*. Kuala Lumpur PTS.
7. Azlisham Abdul Aziz, Mohd Nor Mamat, Daud Mohamed Salleh, Syarifah Fadylawaty Syed Abdullah, Mohd Norazmi Nordin (2021). An Analysis Of Systematic Literature Review On The Development Of Islamic Oriented Instruments. Journal of Contemporary Issues in Business and Government Vol. 27, No. 1: 3222-3233.
8. Aznur Aisyah, Khazriyati Salehuddin, Idris Aman, Ruhizan Mohammad Yasin & Mimiko, N. (2019). Eliciting elements of higher order thinking skills in the higher secondary examination question structure in Japan and Malaysia. M. Y. Mohamad Noor et al. (eds.), *Proceedings of the Regional Conference on Science, Technology and Social Sciences (RCSTSS 2016)* (pp. 455-464). doi.org/10.1007/978-981-13-0203-9_42.
9. Cezar, R., F., & Pinto, N., S. (2017). Attitude towards school science in primary education in Spain. *Revista Electronica de Investigación Educativa*,*19*(4), 113-123.
10. Cornejo, L., L., C. , Campos, M., A., J. , Campos, C., P., R., & Quinones, E., H., B. (2019). Critical thinking and attitudes towards learning between students from national and private universities in the Peru. *Weber Educational Research & Instructional Studies. 13*(1), 1-6.
11. Creswell, J., W. (2012). *Educational research: Planning, conducting and evaluating quantitative and qualitative research, (4th ed.)*. Boston: Pearson.

12. Creswell, J., W. (2014). *Educational research: Planning, conducting and evaluating quantitative and qualitative research, (4th ed.)*. Pearson new international edition. Harlow, Essex: Pearson Education Limited.
13. Dian Safitri, Agus Setiawan, Andi Suhandi, Adam Malik, Siti Ashri Sahidah Lisdiani dan Sapriadil (2019). The Effects of Higher Order Thinking (HOT) Laboratory Design in Hooke Law on Student's Creative Thinking Skills. *7th Asian Physics Symposium*. IOP Conf. Series: Journal of Physics: Conf., 1204, (pp, 1-6). doi:10.1088/1742-6596/1204/1/012037.
14. Dwi Isnaini Amin & Darsono Sigit (2018). Instrumen asesmen pemahaman konseptual berorientasi higher order thinking skills keterampilan proses dan sikap terhadap sains pada bahan kajian hidrokarbon dan minyak bumi. *Jurnal Pendidikan*, *3*(9), 1142-1146.
15. Een Nurhasanah, Uah Maspuroh, Nia Pujiawati, Mohd Norazmi bin Nordin. (2021). Socio-Economic Study: Middle Class Society Portraits in Drama "Sayang Ada Orang Lain" By Utuy Tatang Sontani. Multicultural Education Volume 7, Issue 2, 2021 189-199.
16. Een Nurhasanah, Uah Maspuroh, Rina Marlina S. Psi, M.Pd, Mohd Norazmi bin Nordin. (2021). Arifin C. Noor's Drama "Matahari Di Sebuah Jalan Kecil" As A Media For Literature Learning In Senior High School: A Study Of The Structure And Psychological Value. Psychology and Education (2021) 58(2): 11315-11328.
17. Fauzi Hussin, Jamal Ali & Mohd Saifoul Zamzuri Noor (2014). *Kaedah penyelidikan & analisis data SPSS*. Sintok: Universiti Utara Malaysia.
18. Fauziyana, M., Zaid, M., Rasid, A. R., Rosnee, A., Norazmi, N. (2021). Meta Analysis for Special Education Leadership In Malaysia. PalArch's Journal of Archaeology of Egypt / Egyptology, 17(7), 13455-13468.
19. Firkhan Ali Bin Hamid Ali, Mohd Zalisham Jali, Mohd Norazmi bin Nordin. (2021). Preliminary Study On It Security Maintenance Management In Malaysia Organizations. PalArch's Journal of Archaeology of Egypt / Egyptology, 18(1), 4061-4073.
20. Gulistan Mohammed Saido, Saedah Siraj, Abu Bakar Bin Nordin & Omed Saadallah Al Amedy (2018). Development of an instructional model for higher order thinking in science among secondary school students: a fuzzy delphi approach. *International Journal of Science Education*, *40*(8), 847–866. doi.org/10.1080/09500693.2018.1452307.
21. Harery Abu Saad (2007). *Perkaitan penghayatan akhlak, sikap terhadap sains, pencapaian dan pemilihan kerjaya di kalangan pelajar dalam konteks pembangunan modal insan bersepadu dalam bidang sains dan teknologi di SMKA*. Tesis doktor falsafah yang tidak diterbitkan, Universiti Kebangsaan Malaysia.
22. Hole, Y., & Snehal, P. & Bhaskar, M. (2018). Service marketing and quality strategies. Periodicals of engineering and natural sciences,6 (1), 182-196.
23. Ichsan, I., Z., Sigit, D., V., & Miarsyah, M. (2019). Students higher order thinking skills: analyze, evaluate, create green consumerism solution in environmental learning. *International Journal for Educational and Vocational Studies*, *1*(4), 308-313. doi.org/10.29103/ijevs.v1i4.1434.
24. Ishak Khairon, Kamarul Azmi Jasmi, Mohamad Khairul Latif, Muhammad Yusof Hakimi Mohd Kanafiah, Mohd Norazmi bin Nordin. (2021). Thrust Of Faith And Manifestations To Faith According To The Qur'an And Hadith: A Study Of Content Analysis. PalArch's Journal of Archaeology of Egypt / Egyptology, 18(4), 295-314.
25. Julianto, Wasis & Rudiana Agustini (2018). Profil sikap terhadap sains, keterampilan proses sains dan kreativitas Mahasiswa jurusan PGSD FID UNESA di mata kuliah konsep dasar IPA. *Seminar Nasional Pendidikan Banjarmasin*, (pp. 197-202).
26. Kaili, L., Harrison, H., Y., Yinghui, S. & Xuan, W. (2021). Examining the key influencing factors on college students' higher-order thinking skills in the smart classroom environment. *International Journal of Educational Technology in Higher Education*, *18*(1).
27. Kementerian Pendidikan Malaysia (2012). *Pelan Pembangunan Pendidikan Malaysia 2013 – 2025*. Putrajaya: Kementerian Pendidikan Malaysia.
28. Kementerian Pendidikan Malaysia (2014). *Kemahiran Berfikir Aras Tinggi aplikasi di sekolah*. Putrajaya: Bahagian Pembangunan Kurikulum.
29. Kementerian Pendidikan Malaysia (2016). *Dokumen Standard Kurikulum Dan Pentaksiran Sains Tingkatan 2*. Putrajaya: Bahagian Pembangunan Kurikulum.
30. Kementerian Pendidikan Malaysia (2018). *Kertas Soalan Peperiksaan Sebenar PT3 2016 dan 2017*. Selangor: Pustaka Yakin Pelajar Sdn. Bhd.
31. Mashira Yahaya, Rusyati Hanafiah, Nor Sazila Zakaria & Khairul Anuar Bahrin. (2020). Amalan Pembelajaran Abad Ke-21 (PAK21) dalam pengajaran dan pemudahcaraan (pdpc) guru-guru sekolah rendah. *Jurnal IPDA, 1*(26), 13-24.
32. Mazlini Adnan, Aminah Ayob, Tek, O., E., Mohd Nasir Ibrahim, Noriah Ishak & Jameyah Sheriff (2016). Memperkasa pembangunan modal insan malaysia di peringkat kanak-kanak: Kajian kebolehlaksanaan dan

kebolehintegrasian pendidikan STEM dalam kurikulum PERMATA negara. *Malaysian Journal of Society and Space, 12*(1), 29-36.
33. Miele, D., B. & Wigfield, A. (2014). Quantitative and qualitative relations between motivation and critical-analytic thinking. *Educ Psychol Rev, 26*, 519–541. DOI 10.1007/s10648-014-9282-2
34. Mohd Norazmi bin Nordin, Faiza Iqbal, Ruqia Safdar Bajwa. (2021). Challenges Of Parents In The Implementation Of Teaching Process And Facilitation At Home During Movement Control Order For Students With Special Needs With Hearing Impairment In Malaysia. Psychology And Education (2021) 58(2): 9188-9193.
35. Mohd Saifulkhair Omar & Mohd Isha Awang (2020). The relationship between of the learning environment and the higher order thinking skills (HOTS) among secondary school students. *International Journal of Management and Humanities (IJMH), 4*(5), 46-51. DOI:10.35940/ijmh.E0503.014520
36. Nik Nurhalida Binti Nik Hariry, Fahirah Syaliza binti Mokhtar, Nor Aeini binti Haji Mokhtar, Mohd Norazmi bin Nordin (2021). Enforcement Of Maritime Archaeology In Malaysia: A Review. Journal of Contemporary Issues in Business and Government Vol. 27, No. 2,2021: 2201-2210.
37. Norazmi, N. (2020). Effect Size for Model of the Influence of Headmasters Leadership on Teacher Task Load and Teacher Job Satisfaction of Special Education Integration Program. International Journal of Phycpsocial Rehabilitation. Vol. 24, Issue 10, 2020: 2102-2112.
38. Norazmi, N. (2020). Factors for the Task Load of Special Education Integration Program (PPKI) Teachers in Johor. International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume 9, Issue 3: 2413-2416.
39. Norazmi, N., Zaid, M. & Abdul Rasid, A. R. (2019). The Practice of Headmasters' Leadership and Its Effect on Job Satisfaction of Special Education Integration Program (PPKI) Teachers in Johor, Malaysia. Universal Journal of Educational Research 7.9 (2019): 2008-2014. DOI: 10.13189/ujer.2019.070923.
40. Norazmi, N., Zaid, M. & Abdul Rasid, A. R. (2020). Relationship between Headmasters' Leadership, Task Load on Special Education Integration Programme Teachers' Job Satisfaction. Universal Journal of Educational Research 8(8):3398-3405
41. Nordin, Aziz and Lin, Hui Ling (2011). Hubungan sikap terhadap mata pelajaran sains dengan penguasaan konsep asas sains pelajar tingkatan dua. *Journal of Science & Mathematics Education, 4*, 89-101.
42. Nunnally, J. (1978). *Psychometric theory*. McGraw-Hill, New York, NY.
43. Nur Bahiyah Abdul Wahab, Sharifah Nurulhuda Tuan Mohd Yasin, Azman Hassan, Jailani Md. Yunos & Zulkifli Mohamed (2017). Science attitude indicators among indigenous pupils. *Pertanika J. Soc. Sci. & Hum., 25* (S), 239-250.
44. Nur Hawa Hanis Abdullah **&** Ghazali Darusalam (2018). Kesediaan guru melaksanakan kemahiran berfikir aras tinggi dalam pengajaran. *Jurnal Kurikulum & Pengajaran Asia Pasifik*, *6*(3), 22-31.
45. Oon, P., T., Cheng, M., M., W., & Wong, A., S., L. (2019). Gender differences in attitude towards science: methodology for prioritising contributing factors. *International Journal Of Science Education*. (pp. 1-24). doi.org/10.1080/09500693.2019.1701217
46. Rosa, H., C. (2021). Fostering Students' Workplace Communicative Competence and Collaborative Mindset through an Inquiry-Based Learning Design. *Educ. Sci. 11*(1). doi:/10.3390/educsci11010017.
47. Rosnee Ahad, Mohamad Zaid Mustafa, Suhaimi Mohamad, Nur Hanim Saadah Abdullah, Mohd Norazmi Nordin (2021). Work Attitude, Organizational Commitment and Emotional Intelligence of Malaysian Vocational College Teachers. Journal of Technical Education and Training Vol. 13 No. 1 (2021): 15-21.
48. Saipolbarin Ramli, Muhammad Taufiq Abdul Ghani, Nazri Atoh & Taj Rijal Muhammad Romli (2019). Integrasi elemen kemahiran berfikir aras tinggi (KBAT) berasaskan kit media dalam amalan pembelajaran dan pemudahcaraan guru pelatih bahasa arab. *International Journal of Language Education and Applied Linguistics (IJLEAL), 09*(1), 33-44.
49. Sakariyau, A. O, Michael O., T. & Olalere W., A., (2016). An investigation on secondary school students' attitude towards science in Ogun State, Nigeria. *Journal of Education and Practice, 7*(28), 125-128.
50. Sakariyau, A., O., Taiwo, M., O. & Ajagbe, O., W. (2016). An Investigation on Secondary School Students' Attitude towards Science in Ogun State, Nigeria. *Journal of Education and Practice, 7*(28), 125-128.
51. Sekaran, U. (2003). *Research methods for business. A skill building approach (4th ed.)*. New York: John Wiley & Sons, Inc.
52. Shahril Sabudin, Azlin Norhaini Mansor, Subahan Mohd. Meerah & Azliza Muhammad (2018). Teacher-level factors that influence students' science and technology culture: HLM analysis. *International Journal of Academic Research in Business and Social Sciences*, *8*(5), 978-985.
53. Siti Nur Hasanah, Widha Sunarno & Baskoro Adi Prayitno (2020). Profile of students' critical thinking skills in junior high schools in Surakarta. *Advances in Social Science, Education and Humanities Research, 397*. 3rd International Conference on Learning Innovation and Quality Education (ICLIQE 2019). (pp. 570-575).

54. Sofiani, D. ,Maulida, A.,S. , Fadhillah, N., & Sihite, D., Y. (2017). Gender differences in students' attitude towards science. *International Conference on Mathematics and Science Education (ICMScE)*. IOP Conf. Series: Journal of Physics: Conf. Series, 895. (pp. 1-7).
55. Sole, F., B. & Anggraeni, D., M. (2020). Analysis of high order thinking skill (HOTS) in joint midterm examination at YAPNUSDA elementary school. *The 5th International Seminar on Science Education*. Journal of Physics: Conference Series; The 5th International Seminar on Science Education, 1440. (pp. 1-7). doi:10.1088/1742-6596/1440/1/012102.
56. Stanger-Hall, K., F. (2012). Multiple-choice exams: an obstacle for higher-level thinking in introductory science classes. *CBE—Life Sciences Education, 11*(3), 294-306.
57. Suhaimi Zakaria @ Othman, Baharuddin Aris, Hasnah Mohammed, Norasykin Mohd Zaid & Zaleha Abdullah (2014). Penerapan Kemahiran Berfikir Aras Tinggi Melalui Model Stesen Rotasi Pelbagai Mod. *Konvensyen Antarabangsa Jiwa Pendidik 2014, 11-13 Ogos 2014*. Retrieved from http://eprints.utm.my/id/eprint/60934/1/BaharuddinBinAris2014_PenerapanKemahiranBerfikirArasTinggi.pdf
58. Tanujaya, B., Mumu, J. & Margono, G. (2017). The relationship between higher order thinking skills and academic performance of student in mathematics instruction. *International Education Studies, 10*(11), 78-85. doi:10.5539/ies.v10n11p78.
59. Vadsala, V. & Kamisah Osman (2015). Persepsi dan masalah yang dihadapi oleh guru sains dalam melaksanakan kemahiran berfikir aras tinggi. *Educational Community and Cultural Diversity*. Proceeding: 7th International Seminar on Regional Education, 2. (pp. 1077-1082).
60. Yogesh Hole et al 2019 J. Phys.: Conf. Ser. 1362 012121
61. Zaid, M., Norazmi, N. & Abdul Rasid, A. R. (2020). Headmaster Leadership Effect On Task Load Of Special Education Integration Program Teacher. Humanities & Social Sciences Reviews, Vol. 8 No. 2 (2020): 451-456.
62. Zaid, M., Norazmi, N. & Abdul Rasid, A. R. (2020). Regression between Headmaster Leadership, Task Load and Job Satisfaction of Special Education Integration Program Teacher. Universal Journal of Educational Research 8.4 (2020) 1356 - 1362. Doi: 10.13189/ujer.2020.080428.
63. Zaid, M., Norazmi, N. & Abdul Rasid, A. R. (2020). Structural Equation Modelling Using AMOS: Confirmatory Factor Analysis for Taskload of Special Education Integration Program Teachers. Universal Journal of Educational Research, Vol 8 (Jan, 2020) No 1: 127-133. DOI: 10.13189/ujer.2020.080115.
64. Zaid, M., Norazmi, N. & Abdul Rasid, A. R., Badaruddin, I. (2021). Vocational College Teachers In Malaysia: Confirmatory Factor Analysisfor Job Attitude. PalArch's Journal of Archaeology of Egypt / Egyptology, 17(9), 5091 - 5098.
65. Zaid, M., Norazmi, N. & Abdul Rasid, A. R., Badaruddin, I. (2021). Vocational College Teachers In Malaysia: Emotional Intelligence. PalArch's Journal of Archaeology of Egypt / Egyptology, 17(9), 5099 - 5106.
66. Zaid, M., Norazmi, N. & Abdul Rasid, A. R., Badaruddin, I. (2021). Organizational Commitment of Vocational College Teachers in Malaysia. PalArch's Journal of Archaeology of Egypt / Egyptology, 17(9), 5023-5029.
67. Zanaton Hj Iksan, Lilia Halim dan Kamisah Osman (2006). Sikap terhadap sains dalam kalangan pelajar sains di peringkat menengah dan matrikulasi. *Pertanika J. Soc.Sci.&Hum, 14*(2), 131-147.
68. Zulmaulida, R., Wahyudin & Dahlan, J., A. (2018). Watson-Glaser's critical thinking skills. *2nd International Conference on Statistics, Mathematics, Teaching, and Research*. IOP Conf. Series: Journal of Physics: Conf., 1028. (pp. 1-6). doi:10.1088/1742-6596/1028/1/012094.