

## **The Need Analysis of Inculcating Higher Order Thinking Skills in Design and Technology**

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### **ABSTRACT**

Design and Technology (RBT) subjects in the Primary School Standard Curriculum (KSSR) is introduced by the Ministry of Education to stimulate and create a critical, creative and innovative human capital. Thinking skills are emphasized and prioritized in RBT's teaching and learning to develop the imagination and creativity of students in order to compete globally parallel with the evolution worldwide. As an implementer of the established curriculum, the success of this aspiration depends on the teachers' content knowledge and pedagogical skills. Therefore, the purpose of this study is to observe the level of content knowledge and pedagogical skills in RBT among teachers in primary schools. Furthermore, the results will be implemented in developing a Thinking Skills Training Module that emphasized on higher-order thinking skills (HOTS) in RBT. A total of 320 RBT teachers in the primary school of the Central Zone were involved in this study. The findings show that the teacher's content knowledge and pedagogical skills rated as moderate level. This situation shows that teachers' knowledge in RBT's content is still inadequate and they have not grasped the pedagogical skills to be integrated in higher order thinking skills (HOTS) of teaching and learning the RBT subjects in primary schools.

#### **Key words:**

Curriculum Design, Design and Technology (RBT), Teaching and Learning, Higher Order Thinking Skills (HOTS)

### **Introduction**

In the 21<sup>st</sup> century pedagogy, teachers are expected to inculcate higher order thinking skills (HOTS) elements to encourage deeper thinking activities among students. Thinking skills are the most basic skills that can be developed in the classroom and is the key high achievement for all students (Nessel & Graham, 2007) and these higher order thinking skills are teachable and learnable.

Ministry of Education Malaysia (KPM) has introduced the Primary School Standard Curriculum (KSSR) with the aim of creating creative, critical, innovative, and highly motivated thinking skills (Kementerian Pendidikan Malaysia, 2013a). Thinking skills are of the six key attributes needed by every student to be globally competitive (Kementerian Pendidikan Malaysia, 2013a). The ability of a student to think will influence the way of learning and the effectiveness of the next learning that they are able to transfer the skills to the situations required in solving problems in everyday life.

Design and Technology (RBT) subjects have been introduced to ensure the students' overall, balanced and integrated potential and manage productive lives and take the initiative and seize opportunities wisely and creatively (Kementerian Pendidikan Malaysia, 2015). In addition, the basic skills also provide opportunities for primary school children to become skilled human capital and makes them are willing to pursue higher education (Kementerian Pendidikan Malaysia, 2016).

Changes in the education system require Design and Technology (RBT) teachers to be prepared and mastered in the thinking skills especially in line with the students' learning process. Design and Technology (RBT) teachers need to have basic domains including content knowledge, skills to teaching thinking skills and attitudes leading to higher

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order thinking. Therefore, teachers should ensure that higher order thinking learning takes place during the teaching and learning process.

## **Problem Background**

The rapid development and advancement of technology at the global level is a key element in developing creative thinking and adopting innovative practices that will be used to solve various problems. The ability to think by using imagination is needed to change the new world and change the ordinary to something extraordinary. According to De Bono (1976), the need for thinking skills rather than solving problems leads to involving the quest for trouble and exploration of new opportunities, new possibilities and the generation of new ideas.

Thinking skills can be learned and developed with appropriate practice by students. Thinking skills also depend on the skills of an individual to handle the potential of his brain intelligence. According to Maimunah (2004), thinking skills are a discipline that can be learned and practiced to form habits or experiences. In fact, this thinking skill demonstrates the ability of individuals to use information for various active activities (Ainon & Abdullah, 1994).

Design and Technology (RBT) are the basic subjects of technical and vocational education introduced to use the project-based curriculum design and emphasize the process of design and the use of knowledge and process skills (Kementerian Pendidikan Malaysia, 2015). The compilation of higher order thinking skills in the teaching and learning process involves a wide scope, diversity of delivery methods and the use of stimuli materials. Moreover, this process is also challenging in improving the motivation and thinking of the students. In the context of Design and Technology (RBT), students are expected to produce creative and technology-based products. This situation shows Design and Technology (RBT) subjects require higher levels of thinking. Therefore, the understanding of teachers on the expression of high level thinking skills in the curriculum should be clear to enable all forms of teaching and learning activities to be planned and implemented effectively in the classroom.

The main problem faced by teachers to integrate higher order thinking skills is their inability to implement this agenda from the aspect of knowledge and skills (Rosnani & Suhailah, 2003). Rajendran (2001) also found that teachers are less prepared to teach higher order thinking skills than aspects of knowledge, pedagogical skills and attitudes. Similarly, Ball and Garton (2005) discussed that most teachers do not know how to teach higher order thinking skills to students and some are not ready to teach the skills.

Suhaimi and Razali (2014) stated that teachers are the critical factor in teaching higher order thinking skills since students' readiness relies heavily on teachers. Teachers need to incorporate thinking skills to integrating related strategies to improve students' thinking skills.

The specific objectives of this study are to:

1. identify teacher's content knowledge on the application of higher order thinking skills in Design and Technology (RBT),
2. identify teachers' pedagogical skills towards the application of higher order thinking skills in Design and Technology (RBT),
3. identify elements of higher order thinking skills in Design and Technology (RBT) teaching and learning process.

## **Research Methodology**

A set of questionnaire was developed by the researchers and modified from the instruments formed by the Bahagian Pendidikan Guru, KPM (2015) and used as the research instrument. The questionnaire was used as it was easy to

handle and easier to get the collaboration of the respondents; therefore, the efficacy of answering questions can increase the reliability of the study.

For this study, descriptive statistics and inferential statistics were used. Descriptive statistics are used to summarize the entire data of the study, giving an understanding of the various data obtained. On the other hand, the statistical test used includes the frequency, percentage, mean and standard deviation.

## Data Analysis and Result

The data analysis was a quantitative approach and the gathered data were analysed using IBM SPSS Statistics software. The selection method of data analysis in this study was based on the research objective. The findings are showed in the tables with calculation of mean score.

Both descriptive and inferential statistics are used in the research findings as analytical tools. Mean score and the categorization application of higher order thinking skills in Design and Technology (RBT) subject are shown in Table 1.

**Table 1.** Mean Score and Categorization of Higher Order Thinking Skills

Mean Score	Level
1.00 – 2.00	Low
2.01 – 3.00	Moderate
3.01 – 4.00	High

### The level of teachers' content knowledge on the application of higher order thinking skills in Design and Technology (RBT)

Referring to Table 2, the overall mean of the level of teachers' content knowledge towards the application of higher order thinking skills in Design and Technology (RBT) subjects are at the moderate level ( $M = 2.558$ ,  $SD = 0.379$ ).

**Table 2.** Mean and standard deviation in content knowledge

Variable	Mean	SD
Content Knowledge	2.558	0.379

### The level of teachers' pedagogical skill towards the application of higher order thinking skills in Design and Technology (RBT)

Based on Table 3, the findings show that the mean of the teachers' pedagogical skill level towards the application of higher order thinking skills in Design and Technology (RBT) as a whole is also at the moderate level ( $M = 2.625$ ,  $SD = 0.450$ ).

**Table 3.** Mean and standard deviation in pedagogical skills

<b>Variable</b>	<b>Mean</b>	<b>SD</b>
Pedagogical Skills	2.625	0.450

### **The level of element of higher order thinking skills in Design and Technology (RBT) teaching and learning process**

The element of higher order thinking skills in the process of teaching and learning in Design and Technology (RBT) subjects is measured based on four elements that are applying, analysing, evaluating and creating. The findings from the study showed that no teacher perceived that her thinking skills' element were at the high level in Design and Technology (RBT) teaching and learning process. The element of higher order thinking skills in Design and Technology (RBT) teaching and learning rated as the moderate level.

**Table 4.** Mean and standard deviation in higher order thinking skills elements

<b>Variable</b>	<b>Mean</b>	<b>SD</b>
Applying	2.840	0.423
Analysing	2.791	0.416
Evaluating	2.680	0.529
Creating	2.708	0.411

## **Discussion**

Based on the findings, the knowledge level of teacher content on the application of higher order thinking skills in RBT subjects is moderate. Teachers do not master the knowledge of Design and Technology (RBT) subject matter and cause difficulty in applying higher order thinking skills in the teaching and learning process. Teachers are fully responsible for the intellectual involvement in the classroom. This situation refers to the Model of Pedagogical Reasoning and Action developed by Shulman (1987), discussing that teaching begins by understanding and mastering the content that will be taught for one subject.

Based on this model, acquisition of new understanding will go through new understanding processes, transformation, teaching, evaluation, reflection and understanding where teachers and students will gain a clearer understanding of the subject matter. Shulman (1987) also states that teacher for each option needs to understand and master every subject she teaches. In this regard, adequate knowledge and skills on higher order thinking skills should also be emphasized well by teachers to apply higher order thinking skills to pupils.

The statement shows that each teacher needs to have an understanding of the subject matter for teaching purposes. In other words, teachers need to think about how to build bridges between teachers' understanding of the content and the understanding of students on the same content. The study also emphasised on the implementation of teaching of teachers that can develop students' higher order thinking skills to enhance their achievements (Boaler & Staples, 2008; Franco, et al., 2007).

In the context of integrating higher order thinking skills in each subject in Malaysian schools, trained teachers need to have basic things like knowledge about subject, skills to teach higher order thinking skills and appropriate attitudes and environment. For example, in the Teacher Education Institute (IPG), the focus on the higher order thinking skills based teaching and learning environment has been the main strategy throughout the course of study (Azmi & Nurzatulshima, 2016).

In addition, there are also studies showing that teachers have a positive perception of the value and importance of thinking teaching (Rosnani & Suhailah, 2002; Sukiman et al., 2012). Most teachers are prepared and realize the

importance of higher order thinking skills in creating a society with higher order thinking (Barathimalar, 2014). The importance of teachers' knowledge quality is the most important part of educational planning so this readiness is also closely linked with teaching materials, extensive knowledge in pedagogy, and also skills in applying higher order thinking skills.

The findings also found that the level of teacher pedagogical skills towards the application of higher order thinking skills in Design and Technology (RBT) subjects was at the moderate level. Teachers still do not ensure appropriate strategies and methods in applying higher order thinking skills in the teaching and learning process. The findings are also in line with the study of Norzilawati et al. (2014) which states that some teachers are not fully prepared or still inadequate to carry out the teaching and learning process through the integration of higher order thinking skills. Similarly, the study conducted by Sharifah, et al. (2012) found that teachers do not master the skills in the teaching strategy aspect and the curriculum reform goals.

From the study, it is also found that teachers are not specifically exposed to the appropriate strategies and methods of higher order thinking skills and this situation causes teachers to carry out lessons based on what is understood. This situation is in line with the findings of the study by Hassan et al. (2017) which states that the teaching and learning process relies only on the creativity of the teacher to think about the application of higher order thinking skills and sometimes does not have any effect on the improvement of the mastery of higher order thinking skills among students.

However, the findings also show that Design and Technology (RBT) subject teachers are expected to carry out Design and Technology (RBT) teaching through the integration of higher order thinking skills. Design and Technology (RBT) teachers expressed their willingness to improve understanding on the application of higher order thinking skills in the teaching and learning process. This is also in line with the findings of the study that shows the relationship between teacher's perception of teaching and practice (Sukiman, et al., 2012). In addition, teachers have a positive perception of thinking teaching as well as practicing teaching thinking skills in the classroom. This opinion is also supported by the study of Hasmaliza (2015) which explains the level of teacher's skill to apply high-performance thinking skills during the teaching process at a high level as a whole.

Furthermore, based on findings of Sukiman et al. (2012), teachers have enough skills to develop thinking skills among students. The choice of methods in the teaching of thinking skills depends on a number of factors namely learning objectives, infrastructure facilities, class sizes, and the level of students' ability. The most effective teaching approaches can be realized when the lessons learned are well received, understood and memorized and can be applied in the daily lives of students (Morrisson, et al., 2011). A study conducted on the elements of higher order thinking skills include cognitive skills to apply, analyse, evaluate and create. The findings of the study show that the level of elements of the higher order thinking skills of teachers in the teaching and learning process of Design and Technology (RBT) subjects is still in the weak level. The most frequent higher order thinking skills element used by Design and Technology (RBT) teachers is the applying element. Followed by the element of the analysis, creation and the least used is the element of evaluation.

This situation shows that the ability of Design and Technology (RBT) teachers is still leveraging on the level of elements of applied higher order thinking skills compared to the other elements of higher order thinking skills. Referring to the Examination Board, the application element describes the situation of using information in a new situation (Kementerian Pendidikan Malaysia, 2013b). Indirectly, this finding is in line with the report by the Kestrel Education Consultant of England and the 21<sup>st</sup> Century School of the United States in 2011 stating that higher order thinking among teachers and students is still low. Similarly, studies such as Yunos et al. (2010) found that the level of mastery of higher order thinking skills among school children was low.

From this study, it was found that not all teachers knew and understood the Bloom's taxonomic level as the basis of higher order thinking skills. Teachers are still blurred about the use of these levels in the teaching and learning process. As noted Bloom's Taxonomy (1956) and Revised Bloom Taxonomy (2001) are the main frameworks of the ministry to develop higher order thinking skills (HOTS) in the curriculum (Kementerian Pendidikan Malaysia, 2013b). In addition, Krathwohl (2002) also explains that Bloom (1956) emphasizes the function of cognitive taxonomy just as a measurement tool. In addition, their use can also be used as an effective tool to assist teachers in building their teaching designs and tasks (Radmehr & Alamolhodai, 2010).

Even Rajendran (2008) explains the emphasis of these higher order thinking skills that need to be resolved even by ordinary applications. The emphasis of these higher order thinking skills is triggered when an individual uses thinking skills to deal with complex, new and challenging situations (Rajendran, 2008; Halimah, 2009; Yee, et al., 2010). According to Miri et al. (2007), if teachers consistently practice higher order thinking skills strategies, encourage the application of everyday life problems, encourage open-ended class discussions and conduct inquiry-oriented experiments, then there is a wider opportunity for the development of critical thinking capabilities or higher order thinking. Hence, adequate knowledge, skills and readiness in respect of higher order thinking skills are the key aspects that teachers need to emphasize.

## Conclusion

The issue of inculcating this thinking skill should not be disputed anymore, even more concrete solutions should be made. This is because thinking skills are the foundation of the learning process and the cultivation of effective thinking skills during the teaching and learning process will influence the students' ability to generate ideas and solve various problems in everyday life. Design and Technology (RBT) teachers need to strengthen the knowledge of the content and improve the diversity of pedagogical skills in inculcating higher order thinking skills in the learning process to students. In this regard, the findings from this study can provide input to carry out a holistic study in preparing the best strategies and methods to enhance the knowledge and pedagogical skills as a trigger in developing the module on the application of higher order thinking skills among teachers of Design and Technology (RBT) in primary schools.

## References

- Ainon & Abdullah, (1994). *Pemikiran Reka Cipta*. Kuala Lumpur. Utusan Publication & Distributors Sdn. Bhd
- Anderson, L. W., & Krathwohl, D. R. (eds.). (2001). A taxonomy for learning, teaching and accessing: A revision of Bloom's Taxonomy of educational objectives. New York: Longman.
- Ball, A. L. & Garton, B. L. (2005). Modelling higher order thinking: The alignment between objective, classroom discourse and assessment. *Journal of Agricultural Education*, 46(2), 58-69
- Krishnan, B. (2014). The acceptance and problems faced by teachers in conducting higher order thinking skills. Tesis Sarjana yang tidak diterbitkan. University Teknologi Malaysia, Skudai, Johor Bahru
- Bloom, B. S. (ed). (1956). *Taxonomy of educational objectives handbook I: Cognitive domain*. New York: McKay.
- Boaler, J., & Staples, M. (2008). Creating mathematical futures through an equitable teaching approach: The case of rail side school. *Teachers collage record*, 110(3), 608-645.
- Kementerian Pendidikan Malaysia, (2013a) *Pelan Pembangunan Pendidikan Malaysia (PPPM) 2013 – 2025 (Pendidikan Prasekolah hingga Lepas Menengah)*. Putrajaya; Kementerian Pendidikan Malaysia
- Kementerian Pendidikan Malaysia, (2013b). *Pentaksiran kemahiran berfikir aras tinggi*. Putrajaya; Lembaga Peperiksaan Malaysia
- Kementerian Pendidikan Malaysia (2015), *Dokumen Standard Kurikulum dan Pentaksiran. Reka Bentuk dan Teknologi Tahun 4,5 dan 6*. Putrajaya; Bahagian Pembangunan Kurikulum
- Kementerian Pendidikan Malaysia, (2016). *Panduan Pelaksanaan Kurikulum Pendidikan Asas Vokasional*. Putrajaya; Bahagian Pembangunan Kurikulum
- Krathwohl, D. R (2002). A revision of Bloom's Taxonomy: An overview. *Theory into Practice*, 41, 212-218

- Osman, M. (2004). *Kemahiran Berfikir*. Kuala Lumpur. Institut Tadbiran Awam Negara (INTAN)
- Miri, B., David, B. C. & Uri, Z. (2007). Purposely teaching for the promotion of higher order thinking skills.: A case of critical thinking. *Research Science Education*, 37, 353-369.
- Nor, M. N. A. M. & Kamarudin, N. (2017) Penerapan kemahiran berfikir aras tinggi (HOTS): Kesiediaan guru dalam pengajaran dan pembelajaran Reka Bentuk dan Teknologi (RBT) di sekolah rendah. *International Research Journal of Education and Sciences*. Volume 1; Special Issue 1 (Malay). 1-5.
- Nor, M. N. A. M., Kamarudin, N., Manaf, U. K. A. & Puad, M. H. M. (2017) Penerapan kemahiran berfikir aras tinggi (HOTS) dalam kurikulum Reka Bentuk dan Teknologi (RBT) sekolah rendah. *International Journal of Educations and Training*, 3(2), 1-7.
- Nor, M. N. A. M., Kamarudin, N. (2016) Penyebatian kemahiran berfikir aras tinggi (HOTS) dalam proses pengajaran dan pembelajaran di Institut Pendidikan Guru (IPG), *Malaysian Journal of Higher Order Thinking Skills in Education*, 2, 199-214.
- Hassan, M. N., Mustapha, R., Yusuff, N. A. N., & Mansor, R. (2017). Pembangunan modul kemahiran berfikir aras tinggi di dalam mata pelajaran sains sekolah rendah: Analisis keperluan guru. *Sains Humanika* 9: 1-5, 119-125.
- Md Yunus J., Tee, T. K., & Yee, M. H. (2010). *The level of higher order thinking skills for technical subject in Malaysia*. Proc. of the 1st UPI International Conference on Technical and Vocational Education and Training (UPI2010). Bandung. Universiti Pendidikan Indonesia
- Miri, B., David, B. C., & Uri, Z. (2007). Purposely teaching for the promotion of higher order thinking skills.: A case of critical thinking. *Research Science Education*, 37, 353-369.
- Morrisom, G. R., Ross, S. M., Kalman, H. K. & Kemp, J. E. (2011). *Designing Effective Instruction*. (6th Eds.). New York, NY: John Wiley & Sons, Inc.
- Abdullah, N., Noh, N. M., Hamzah, M. & Yusuf, N. A. N. (2014). Kesiediaan guru sains dan matematik dalam pelaksanaan kurikulum standard sekolah rendah. *Jurnal Pendidikan Sains dan Matematik Malaysia*, 4(1), 81-96
- Philips. A. J. (1997). *Pengajaran Kemahiran Berfikir – Teori dan Amalan*. Selangor; Utusan Publication & Distributor Sdn. Bhd
- Radmehr, F. & Alamolhodaei, H. (2010). A study on the performance of students' mathematical problem solving based on cognitive process of revised Bloom Taxonomy. *Research in Mathematical Education*, 14(4), 381-402.
- Rajendran. N. S. (2008). *Teaching & acquiring higher order thinking skills: Theory & practice*. Malaysia. Penerbitan Universiti Pendidikan Sultan Idris
- Rajendran. N. S. (2001). *Pengajaran kemahiran berfikir aras tinggi: Kesiediaan guru mengendalikan proses pengajaran dan pembelajaran*. Kertas kerja di bentang pada Seminar Projek KBKK. Poster Warisan-Pendidikan –Wawasan 2001.
- Hashim, R. & Hussien, S. (2003). *The Teaching of thinking in Malaysia (1st ed.)*. Kuala Lumpur: Research Centre IIUM
- Shulman, L. S. (1987). Knowledge and teaching: Foundation of the new reform. *Harvard Educational Review*, 57(1): 1-22
- Muhamad, S. & Hassan, R. (2014) *Pelaksanaan kemahiran berfikir aras tinggi (HOTS) dalam pengajaran Pendidikan Islam berasaskan kaedah simulasi*. Prosiding Wacana Pendidikan Islam Peringkat Kebangsaan Siri ke-10, Universiti Kebangsaan Malaysia, 665-677
- Saad, S., Saad, N. S., & Dollah, M. U. (2012). Pengajaran kemahiran berfikir aras tinggi: Persepsi dan amalan guru matematik semasa pengajaran dan pembelajaran di bilik darjah. *Jurnal Pendidikan Sains & Matematik Malaysia*, 2(1), 18-36.