



## **Tertiary Students' Learning Practices using Information and Communication Technology to Promote Higher-Order Thinking**

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### **ABSTRACT**

The National Education Blueprint (2013-2025) is grounded based on high-performing systems which promote a transformation of the Malaysian education system in line with the vision of Malaysia's National Philosophy in achieving educational outcomes which are of world-class status. Information and Communication Technology (ICT) impacts on the efficiency of promoting higher-order thinking skills (HOTs) as it provides a platform for educationists with clear educational objectives to share ideas and collaborate on ways to enrich the learning experiences of students. Now, the important question, how is this integration working out for Malaysian university students and educators? This exploratory study aims at gaining deeper insights into the current learning practices used by both university teachers and students, the types of ICT used in their classes, their views on the integration of these skills into the curriculum and also the application methods of teaching and learning using ICT to promote HOTs. Data were collected using purposive sampling where 199 participants were selected to take part in the study. These respondents were a group of English major undergraduate students from several faculties in a public university in Malaysia. This study shows that the students' experience in their degree programmes have revealed several successes, as well as poignant challenges, related to the use of ICT

in inculcating higher order thinking skills among learners. The implications of this study suggest several important insights on the potential opportunities of technologies in facilitating higher order thinking but success lies on the tasks that are appropriately designed for higher order thinking in the content.

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## INTRODUCTION

While educators may recognise the importance of critical thinking in the educational curricula, many may become disillusioned because of the difficulties in implementing and motivating non-native English-speaking students to become involved in critical thinking strategies and activities in the classroom. The major shift, as a result of explicitly including the development of critical thinking skills in a course curriculum, is not an addition of new materials or activities, but an alteration of the current practice (Stroupe, 2006). The gap between the intentions of lecturing staff and the reliance on assessment strategies that focus on the reproduction of knowledge rather than its manipulation or transformation, raises the question of whether higher order learning is in fact being assessed (Moir, 2013). The reason for this might be that in the classroom, an immersion approach is used. In order to make students more conscious critical thinkers, it is suggested that lecturers should make students more aware of the skills and dispositions that are required in different tasks and activities by directly making references to them (Orszag, 2015).

The twin forces of globalisation and internationalisation have put a critical demand on the higher education system in Malaysia to transform dynamically in measuring up to the global needs of the

21<sup>st</sup> century and achieving the advanced nation status vision by 2020 (Ganapathy & Kaur, 2014). According to the Malaysian Education Blueprint 2015-2025 (Higher Education), the Ministry of Education hopes to construct a system that is less focused on traditional academic pathways and intends to transform the mass product delivery model of teaching to technology-enabled innovations that delivers and tailors education for all students.

The Malaysian education system needs to undergo comprehensive transformation if it is to rise to meet the nation's ambitious visions and aspirations (Ganapathy, 2016). The learning culture in the university should be aligned with the national education aim to create students who are critical and active in the process of gaining knowledge. Therefore, this study aims to investigate the perceptions of university students on the success, challenges and importance of ICT utilisation in promoting higher-order thinking skills in the English as a second language (ESL) classroom. This study will be able to provide deeper insights into the current teaching and learning approaches used by both university teachers and students, the types of ICT used in their classes, their views on the integration of these skills into the curriculum and also the application methods of teaching and learning using ICT to promote Higher Order Thinking Skills (HOTs).

## LITERATURE REVIEW

It has been a major challenge for educators in the higher education sector to develop and

improve students' HOTS as it is something more abstract than developing students' knowledge or language proficiency. However, in a Singapore based study, Chan (2002) reported that schools could do more than just promoting recall (misleadingly called knowledge), comprehension and application to improve students' HOTS. As indicated by the Head of UNESCO-UNEVOC International Centre, there must be some foundational changes in the traditional pedagogical approach, role of education participants, as well as curricula (Majumdar, 2015) before any effects can really take place. The results of this shift from the traditional pedagogical approach should take into consideration the current industry needs, where learning trends in the 21<sup>st</sup> century should nurture students to be able to think, reason, analyse, evaluate evidence and communicate effectively. Ali (2012), in his Malaysian context study, has also supported that these critical thinking tools are vital survival skills that every student must have to be effective in the 21<sup>st</sup> century classroom.

The application of ICT in teaching and learning to promote HOTS is a good start to change traditional pedagogical approaches and design a more effective and functioning learning environment. The Ministry of Education is committed in its efforts to promote thinking skills in Malaysian educational institutions (Ali, 2002) by implementing the *i-Think* programme in collaboration with Agensi Inovasi Malaysia (AIM) to develop students' thinking skills

and cultivate lifelong learning in primary and secondary schools in 2013 (Tenth Malaysia Plan, 2011).

### **ICT Utilisation in a Constructivist Learning Approach**

Constructivism is built on the proposition that learning is a result of mental construction where new and old information is pieced together as we reflect on our experiences rather than being passively receptive towards all that was taught to us. Constructivism is a theory about learning, not a description of teaching (Fosnot & Perry, 1996). Learning, in this context, is an active process of constructing rather than acquiring knowledge, whereas instruction is a process of supporting that construction rather than communicating knowledge (Cunningham & Duffy, 1996).

The learning environment should provide the learner with opportunities to test and try out new conceptual understanding in various applied circumstances like problem solving (Chan, 2002). Under these circumstances, it is the educators' responsibility to model these constructivist approaches to engage with students in experiential learning, reflection, and self-examination (Abdul-Haqq, 1998). ICT may seem to be the solution towards transforming the traditional pedagogical approach. According to Derry & LaJoie (as cited in Chan, 2002, p. 34), these cognitive tools are unintelligent as it is merely relying on the user to key in the intelligence. The learner, instead of the computer, is

responsible for self-regulating her own learning and thinking, a situation totally opposite in reality.

When computers are used as partners in learning, learners are liberated from the unproductive task of memorising while the software should facilitate the students in extending and expanding their thoughts on what they are studying (Chan, 2002). When this happens, it would be an accurate projection of what the educators want in the integration of ICT and constructivist learning – generating authentic learning where students explore answers as autonomous learners. By harnessing the power of ICT, we can facilitate the development of students' mental capacity of learning and thinking actively.

It is understandable that educational institutions in developing countries are passing through the phase of mixing old and new technologies in their classrooms (Kundi & Nawaz, 2010). But relating constructivism as a theory of learning to the practice of instruction would be crucial to identify the current central principles in learning and understanding (Savery & Duffy, 2001). Summing up by quoting Petko (2012, p. 43), "We need a better understanding of whether constructivist beliefs are associated with more intensive actual use of digital media, or alternatively, if digital media would be equally likely to find use today in traditional instructional settings".

### **Bloom's Taxonomy**

Bloom's taxonomy comprises three overlapping domains, namely the cognitive (knowledge-based), the affective (attitude-based) and the psychomotor (skills-based) consisting of five to six levels in each, which are believed to be crucial in the process of learning (Forehand, 2010). Originating from Bloom's taxonomy of learning, HOTS is defined by three upper levels of cognitive skills in the learning hierarchy: analysis (the lowest), synthesis and evaluation (the highest). Analysis refers to the ability of learners being able to deconstruct the structure of knowledge and categorise them into their respective groups, as well as identifying the relationship among the components of the knowledge structure (Marzano & Kendall, 2006). Synthesis can be illustrated using the following verbs: assemble, design, formulate and develop (Narayanan & Adithan, 2015). Evaluation requires learners to justify the value of a certain statement or piece of information for its relevance and consistency. Often, higher-order skills that occur late in the hierarchies are not introduced until after pre-requisite skills have been mastered. This is due to the traditional concept of learning being sequential and linear. The set back of this traditional concept of learning is that students never get to the point where they have the opportunity to engage in higher-order skills (Zohar, Degani, & Vaaknin, 2001).

### Related Past Studies

Researchers such as Schacter and Fagnano in their American study (1999) and Wegerif and Dawes (2004) have indicated that the use of ICT is appropriate for university students because it can lead to enhanced students' engagement and achievement when teachers use it effectively. Similarly, Lincoln (2008) stated that by putting greater emphasis on using ICT, it motivates and excites students' interest. In Lincoln's Australian study, ICTs were used to engender effort and persistence for sustained engagement in thinking and learning. According to Lincoln (2008, p. 56), "it was found that students expect to acquire clear educational or social values when incorporating technologies in their learning".

Furthermore, Costello and Chapin (2000) supplemented that Web-based instruction associated with hands-on activities promotes students' problem-solving skills by increasing their understanding of subject matter, learning motivation and HOTS. Similarly, Green's (2001) study to assess the effectiveness of the use of the wireless laptop at Latrobe High School, Australia found that the use of ICT could stimulate the classroom climate and improve collaborative learning and inquiry learning among students. In addition, analysing the students' desire from insider's perspective, Weaver, Spratt and Nair (2008) indicate that Australian students also appear to be discerning users of new technologies in education.

Research by Majumdar (2015), in collaboration with UNESCO-UNEVOC

International Centre, illustrated the fact that ICT changes the traditional educational approach (teacher-centred learning) into a more interactive and engaging environment to facilitate authentic knowledge transmission where students become producers of knowledge under the guidance from the lecturers (student-centred learning). ICT impacts the interactive aspect of learning. The change brought about by ICT was discussed by Razak and Lee (2012) in their study involving respondents from a tertiary level institution in Malaysia, which examined the impacts of a technological application called Wiki in relation to the promotion of HOTS within the teaching and learning of literary text. The study reports that Wiki can be very helpful in fostering HOTS for the following reasons: a) it possesses an open-editing feature which allows lecturers to further expand their instructions on the students' work whenever necessary and provide positive feedback, b) it has a structured layout of discussion posts which enables students to review others' texts and have successive in-depth interaction with the teacher, and c) it comes with multimedia embedding to stimulate evaluation reviews from the students.

Furthermore, the following two Malaysian based studies researched on the effectiveness of Web 2.0 and the perception of students toward HOTS. Subran (2011) mentioned three main components of Web 2.0 that would support interactivity among users and allow people to collaborate and share information online: Blogs, Wikis and Social Networks. In this context, students

may develop a wide range of HOTs through the use of carefully designed learning tasks in an ICT based- environment. A study by Heong, Yunos, Hassan, Othman, and Kiong (2011) analysed the views of students of a technical and vocational faculty at a higher education institution in Malaysia towards HOTs. In this study, the researchers found that students did not think they possess high levels of thinking skills as they had rated themselves as 'moderate' for investigation, experimental inquiry and invention and 'poor' for decision making and problem solving.

Literature review presented in this study highlights the importance of HOTs and ICT in promoting meaningful learning among students at all levels such as primary and tertiary. However, the literature presented focussed individually on either HOTs or ICT. In summation, the current study has taken a step further to investigate the promotion of HOTs through ICT among English major undergraduates in their daily learning experiences.

## **METHODOLOGY**

This study is part of a larger longitudinal research study that compares the practices of a selected group comprising of 199 tertiary English majors in a Malaysian university. The study aimed to analyse the students' perceptions about promoting HOTs while using ICT in their curricula. The quantitative data were collected using survey methodology which relates to the students' experiences on the application

of ICT in their learning process to engage with HOTs.

### **Purpose of the Study**

The purpose of this study was to investigate tertiary English majors use of ICT to learn, tertiary English majors engagement with HOTs learning activities, the extent to which tertiary English majors use ICT to promote HOTs in their learning practices and the challenges experienced by tertiary English majors in engaging with HOTs using ICT.

### **Research Questions**

The following research questions were posed in order to investigate the students' practices regarding the use of ICT in the learning process in promoting HOTs:

1. How often do tertiary English majors use ICT to learn?
2. To what extent do tertiary English majors engage in HOTs learning activities during their lessons?
3. To what extent do tertiary English majors use ICT to promote HOTs in their learning practices?
4. What are the challenges experienced by tertiary English majors in engaging with HOTs using ICT?

### **Sampling**

Purposeful sampling was utilised to select 199 university students who are from different

years of study and faculties at Universiti Sains Malaysia (USM). A questionnaire was administered to these students enrolled in the English for Professionals (145 students), English Language and Literature Studies (23 students) and English Language Studies degree programmes (31 students).

### **Instruments**

The questionnaire was adapted from Ali (2012) for its relevance towards the study. The reliability of the questionnaire was determined using the Cronbach's alpha test, which has a 0.93 overall consistency score. The questionnaire consisted of 71 items in five sections. The questionnaire was validated through a pilot study that was carried out at Universiti Malaya among English major students. Section A consists of 7 items which ask for the demographic information of the students. Section B comprises two sub-sections. Part I asks for the students' experiences in using ICT, while Part II asks for their exposure towards ICT in their classroom. Both parts have 8 identical items respectively. Section C consists of 25 items relating to the types of learning activities that the students engage in during classes. Section D consists of 13 items that questions the students about their frequency in using ICT tools to promote HOTS learning. Section E consists of 10 items that intends to reveal the challenges faced by students in using ICT to engage in HOTS learning.

### **Data analysis**

The research questions are directed at understanding the practices of a selected group of Malaysian university English majors on the importance of promoting HOTS, while using ICT in their curricula. In order to gain a better understanding of the situation, descriptive statistics such as frequency, mean score and standard deviation were generated through the Statistical Package for the Social Sciences (SPSS) Version 20.

### **RESULTS**

In relation to the tertiary English major students' usage of ICT in their academic degree programme, the mean scores of most of the items in this construct (Table 1) show that in general, the students habitually do use ICT. On the contrary, a significant number of students are only sometimes in the practice of using certain ICT applications. A significant showcase ( $M=2.0$ ) of mean scores reflect students' high engagement with learning activities that promote HOTS (Table 2). A positive trend was also recorded in terms of students using ICT tools and resources to engage in activities that facilitate HOTS (Table 3). An average mean score in Table 4 shows some of the challenges that students are confronted with when they learn HOTS using ICT.

The results presented in Table 1 show that students frequently use desktop applications (73.4%) for their academic studies as English

Table 1  
*Students' ICT activities*

Usage of ICT to learn English	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean
Desktop Application (Word, Excel, Publisher etc.)	41.2	32.2	15.1	9.0	2.5	1.99
Databases (Access, Open Educational Resource etc.)	12.1	25.6	32.7	23.1	6.5	2.86
Presentation Software (Power Point, Prezi etc.)	51.3	28.6	10.6	7.0	2.5	1.81
Hypermedia/Multimedia Software/ Web Design	11.1	19.1	26.1	30.2	13.6	3.16
Internet (Google, Bing, Yahoo etc.)	83.4	12.1	3.5	0.5	0.5	1.23
E-learning Portal	39.2	35.7	15.6	6.0	3.5	1.99
Digital telecommunication (Computer-mediated communication, telegraphy, computer networks etc.)	23.6	34.2	25.1	9.5	7.5	2.43
Web 2.0 (Blogs, Wikis, YouTube etc.)/ Social Network (Facebook, WhatsApp, Instagram etc.)	65.3	23.1	9.5	0.5	1.5	1.50

Scale: 1- Always 2- Often 3- Sometimes 4- Seldom 5- Never

majors at the university. Most students often use various software (M=1.81) for presentation and internet (M=1.23) for reference. Digital telecommunications (57.8%) and Web 2.0 applications (88.4%) are very popular among students too. However, students are only sometimes in the practice of using databases (M= 2.86) and Hypermedia software (M= 3.16). A significant proportion (2.43) of the students seemed to use digital telecommunication (Computer-mediated communication, telegraphy, computer networks, etc.) in their courses. About 30.2% of the students seldom and a proportion of 13.6% never engaged in Hypermedia/Multimedia Software/ Web Design. The most popular ICT activity carried out by students are Hypermedia/ Multimedia Software/ Web Design, with a mean score 3.16. These results are not

surprising in view of the fact that young people in the 21st century are dealing with a myriad of technological tools to interact with others. Due to the vast growth of internet technology in the 21st century, e-learning via the use of ICT tools is increasingly used in many learning environments to enhance teaching and learning activities.

The results in Table 2 display an interesting trend which indicates that a significant proportion of students undertake various activities that promote HOTS when learning English courses in their degree programme at the university. Quite a high proportion (66.9%) of students have the opportunity to discuss higher level questions, while 27.6% of students sometimes experience it. Another 4.5% seldom engage in it and only 1% never do it at all. Although majority of the students



Table 2  
*HOTs activities*

Learning Activities that promote HOTs	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean
Brainstorming	36.2	41.2	19.1	3.5	0	1.90
Problem solving	41.2	39.7	13.6	4.0	1.5	1.85
Interactive lectures	27.1	43.7	22.1	7.0	0	2.09
Project-Based Learning	26.1	39.7	24.6	9.5	0	2.18
Discuss higher level questions	36.2	30.7	27.6	4.5	1.0	2.04
Engage in oral presentations	44.2	37.2	13.6	5.0	0	1.79
Reflect on their experiences	24.6	32.7	35.7	7.0	0	2.25
Participate in small group activities	25.1	34.7	33.2	5.5	1.5	2.24
Engage in idea exploration	25.6	38.7	27.1	8.0	0.5	2.19
Sequence questions from concrete to abstract	17.1	28.1	37.2	13.6	4.0	2.59
Engage in thinking beyond reading	30.2	40.2	23.1	6.0	0.5	2.07
Make hypotheses	20.1	33.7	29.1	16.1	1.0	2.44
Debate analytically to challenge pre-existing beliefs	15.1	32.2	35.2	11.6	6.0	2.61
Apply newly taught skills in varying contexts	18.6	44.2	28.6	6.5	2.0	2.29
Analyse functionally (to understand the purpose of something)	22.6	51.3	21.1	4.0	1.0	2.10
Analyse critically (to understand the consequences/implications of something)	31.2	41.7	22.1	4.5	0.5	2.02
Synthesise information	23.1	43.2	26.1	6.5	1.0	2.19
Evaluate information	27.1	46.7	20.6	3.5	2.0	2.07

Scale: 1- Always 2- Often 3- Sometimes 4- Seldom 5- Never

engage in idea exploration, only 27.1% sometimes experience it. Students who seldom have the chance to make hypotheses comprise of 16.1%. The HOTs activity “debate analytically to challenge pre-existing beliefs” seems to be students’ most practised activity with a mean score of 2.61 but 6% never had the opportunity to engage in it. A significant mean score reflects students’ activities that enable them to analyse functionally (M= 2.10) and analyse critically (M= 2.02). With regard to students’ activity pertaining to applying newly-taught skills in varying contexts, 28.6% of them

only sometimes have the opportunity to practise this activity that promotes HOTs. Similarly, for making hypotheses, 29.1% of the students only sometimes have the opportunity to apply HOTs related to this activity. In terms of synthesising information, 26.1% sometimes engage in this learning activity that promotes HOTs and 20.6% too are only sometimes given the chance to evaluate information.

The general trend in Table 3 highlights that the majority of English major students use ICT in their activities which promote HOTs. However, 20.6% of students only

Table 3  
*ICT activities that promote HOTS*

Usage of ICT tools and Resources to:	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean
Analyse information	38.7	41.7	18.1	1.5	0	1.82
Interpret information	40.7	39.2	19.1	1.0	0	1.80
Present information	58.3	30.2	11.1	0.5	0	1.54
Synthesise information	34.7	38.7	20.6	5.0	1.0	1.99
Evaluate information	33.2	41.7	20.1	4.0	1.0	1.98
Report on group activities/assignments	53.8	35.7	10.1	0.5	0	1.57
Facilitate problem solving	34.2	38.7	20.1	6.5	0.5	2.01
Facilitate critical thinking	30.2	39.7	23.6	6.0	0.5	2.07

Scale: 1- Always 2- Often 3- Sometimes 4- Seldom 5- Never

Table 4  
*Challenges faced by English majors in learning HOTS using ICT*

Challenges in learning HOTS using ICT	1 (%)	2 (%)	3 (%)	4 (%)	Mean
I lack ICT skills.	6.0	30.2	48.2	15.6	2.73
I lack technological guidance from the lecturers.	4.5	39.2	45.2	11.1	2.63
I find it difficult to change from my current learning practice to integrate ICT tools in learning.	6.0	20.6	55.3	18.1	2.85
Extra time and effort is spent after integrating ICT tools in learning.	5.5	42.7	42.7	9.0	2.55

Scale: 1- Always 2- Often 3- Sometimes 4- Seldom 5- Never

sometimes use ICT tools to synthesise information. An almost similar proportion (20.1%) of students only sometimes use ICT tools to evaluate information and facilitate problem solving activities. The highest mean score of 2.07 highlights that the students have the opportunities to use ICT tools and resources to facilitate critical thinking skills.

The challenges that students experience when learning HOTS using ICT is much of a surprise according to Table 4. Although the majority have no problems in using ICT because they have sufficient skills, quite a

high proportion (36.2 %) of the students conveyed their lack of ICT skills. Similarly, 43.7% highlighted that they lack technology guidance from their lecturers. The greatest challenge seems to be that students find certain software difficult to use and it affects their learning of HOTS (78.4 %). Almost the same number of students (42.7%) agree and disagree that extra time and effort is spent after integrating ICT tools in their learning. On the other hand, 41.2% of the students reported that they do not really need to depend on ICT to learn HOTS.

## DISCUSSION

While the findings of this small-scale study in one public university cannot be generalised to the learning practices of the entire population of tertiary English majors in Malaysia, the students' report of ICT practices suggests that Malaysian tertiary students generally do use a variety of ICT activities in their learning environment. The students reported frequently using desktop applications, softwares for enhancing their learning, digital technologies and Web 2.0. This is indeed encouraging and reflects a common trend of learning in other global tertiary contexts. Such tools provide avenues for tertiary learners to engage with each other for learning activities as such activities motivate students and increase their enthusiasm (Stroupe, 2006). Students' practices of using ICT to promote their HOTS is vital in relating to constructivism as a theory of learning to the practice of instruction which is an important factor in terms of identifying the current central principles in learning and understanding (Savery & Duffy, 2001).

With regard to commonly used HOTS activities in their degree programmes, it was encouraging to note that a majority of the tertiary English majors (66.9%) reported having the opportunity to discuss high-level questions, as well as explore ideas in their academic learning context. Such participation and engagement with learning seems to be consistent with the findings of other researchers (Zuraina, 2009; Razak & Lee, 2012), where it concurs with the constructivism theory as to learning, in this

context, is an active process of constructing rather than acquiring knowledge. The use of learning spaces, e-learning activities and the collaboration with other peers in the degree programme proved to be activities that were reportedly enjoyed by a majority of the English majors. Flexibility and connectivity appeared to be significant factors that promoted higher usage of ICT tools among the learners. In a similar vein, a majority of students stated that they used a wide range of ICT tools in their learning activities in the university and affirmed that these tools promoted the development of their HOTS. Students acknowledge that such skills aid their problem solving and critical thinking skills.

The findings of the study also raised numerous challenges that have to be considered when inculcating HOTS using ICT tools. A significant percentage of students admit that they lack ICT skills ( $M=2.73$ ) and they lack technological guidance from their lecturers ( $M=2.63$ ). According to the tertiary English majors, their greatest challenge was changing from their current learning practice to integrate ICT tools ( $M=2.85$ ). Several researchers point out that learning and technology can take time depending on students' prior learning experience (Stroupe, 2006; Moir, 2013; Orszag, 2015). As such, this can have an impact on the time available in the contact learning environment and lecturers need to factor this into their planning time. In order to accommodate learning activities using ICT in tertiary classrooms, care needs to be taken to ensure that the learning

activities promote successful higher order thinking skills among learners.

The findings of this small-scale study have some implications for effective teaching and learning environments of the current and future tertiary English majors. Without being prescriptive, course lecturers in similar BA degree programmes can use ICT tools to foster quality learning. It is essential for tertiary course lecturers to engage learners in meaningful learning experiences towards further developing students' critical and higher order thinking repertoires in various linguistics and literature courses offered in the degree programme. Besides increasing their own use of technological tools during lectures, course lecturers can also encourage their students to use various technological tools when searching for information for their academic courses. Indeed, many public universities in Malaysia have e-learning portals which are frequently used by course lecturers to communicate a range of learning functions such as sharing of lecture notes, discussion questions and posting of assignment topics among other functions.

While such recommendations are made, it is also incumbent on educators and university educators to realise that altogether teachers, students and university administrators play important roles in creating a quality learning context that fosters HOTS among learners. The role of the teacher can include raising awareness in terms of making available activities using a variety of ICT tools when designing course assignments, semester essays and oral presentations. Teachers too can role

model such technological behaviours in their course lectures so students can head along the path towards becoming more knowledgeable about learning in such a medium.

## **CONCLUSION**

Today's learners exist in a digital world where access to and range of social web tools and software technologies provide gateways to a multiplicity of interactive sources for information, learning, interaction and communication. There are indeed many benefits for tertiary learners to hone their learning practices using ICT tools. Among others, one clear benefit is that students who are adept at learning by using a range of ICT tools become more open-minded, active and strategic when they engage in academic learning. This study shows that the students' experiences in their degree programmes have revealed several successes, as well as poignant challenges, related to the use of ICT in inculcating higher order thinking skills among learners. In other words, student learning experience through the facilitation of a constructivism paradigm has the potential of yielding positive learning outcomes once challenges in using and integrating technology in the learning environment can be tackled by course lecturers and university administrators.

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## REFERENCES

- Abdal-Haqq, I. (1998). Constructivism in Teacher Education: Considerations for Those Who Would Link Practice to Theory. *ERIC Digest*.
- Ali, S. N. (2012). Malaysian polytechnic lecturers' teaching practices with ICT utilization to promote higher-order thinking skills. *Doctor of Philosophy Thesis Published*. IOWA State University. Retrieved from <http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=3630&context=etd>
- Chan, D. (2002). *The role of ICT in a constructivist approach to the teaching of thinking skills*. e-library CLD, SAFTIMI.
- Costello, R. W., & Chapin, D. W. (2000). *Problem solving within a changing Indiana state testing program*. (ERIC Document Reproduction Service No: ED445 054). Retrieved from <http://www.eric.ed.gov/PDFS/ED445054.pdf>
- Cunningham, D., & Duffy, T. (1996). Constructivism: Implications for the design and delivery of instruction. *Handbook of Research for Educational Communications and Technology*, 51, 170-198.
- Derry, S.J. & Lajoie, S.P. (1993). A middle camp for (un)intelligent computing. In S.P. Lajoie and S.J. Derry (Eds.), *Computers as Cognitive Tools*, (Vol. 5, pp. 1–11). Hillsdale, NJ: Erlbaum.
- Forehand, M. (2010). Bloom's taxonomy. *Emerging perspectives on learning, teaching, and technology*, 41-47.
- Fosnot, C.T. (1996). Constructivism: A psychological theory of learning. In C.T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 8-33). New York: Teachers College Press.
- Ganapathy, M. (2016). Transformation of Malaysia's Higher Education System: Malaysia Education Blueprint (2015-2025). In Kabilan, M. K. (Ed), *Bulletin of Higher Education Research. National Higher Education Research Institute*, 5(1), 10-11.
- Ganapathy, M. & Kaur, S. (2014). ESL Students' Perceptions of the use of Higher Order Thinking Skills in English Language Writing. *Advances in Language and Literary Studies*, 5(5), 80-87.
- Green, M. (2001). *The Wireless Revolution: Latrobe Junior High project*. National Education Association. Retrieved from <http://www.nea.org/neatoday/0103/cover.htm>
- Heong, Y. M., Yunos, J. M., Hassan, R. B., Othman, W. B., & Kiong, T. T. (2011). The Perception of the Level of Higher Order Thinking Skills among Technical Education Students. *International Journal of Social Science and Humanity*, 1(2), 1-5.
- Kundi, G.M., & Nawaz, A. (2010). From objectivism to social constructivism: The impacts of information and communication technologies (ICTs) on higher education. *Journal of Science and Technology Education Research*, 1(2), 30-36.
- Lincoln, M.E. (2008) Thinking through ICT: What do middle years teachers think really matters? In *AARE 2008 International Education Conference: Changing Climates: Education for Sustainable Futures*, 30th November - 4<sup>th</sup> December 2008, Queensland University of Technology, Brisbane, Queensland.
- Majumdar, S. (2015). Emerging Trends in ICT for Education & Training. Retrieved from <http://www.unevoc.unesco.org/fileadmin/up/emergingtrendsinictforeducationandtraining.pdf>

- Malaysia Education Blueprint (2013-2025). *Ministry of Education Malaysia*. Retrieved from <http://www.moe.gov.my/en/pelan-pembangunan-pendidikan-malaysia-2013-2025>.
- Marzano, R.J., & Kendall, J.S. (Eds.). (2006). *The new taxonomy of educational objectives*. Thousand Oaks, CA: Corwin Press.
- Moir, T. (2013). FIR System Identification Using Feedback. *Journal of Signal and Information Processing (JSIP)*, 4(4), 385-393.
- Narayanan, S., & Adithan, M. (2015). Analysis Of Question Papers In Engineering Courses With Respect To HOTs (Higher Order Thinking Skills). *American Journal of Engineering Education (AJEE)*, 6(1), 1-10.
- Orszag, A. (2015). Exploring Finnish university students' perceived level of critical thinking. *Master of Education Thesis Published, University of Jyväskylä*. Retrieved from [jyx.jyu.fi/dspace/handle/123456789/46039](http://jyx.jyu.fi/dspace/handle/123456789/46039)
- Petko, D. (2012). Lecturers' pedagogical beliefs and their use of digital media in classrooms: Sharpening the focus of the 'will, skill, tool' model and integrating lecturers' constructivist orientations. *Computers and Education*, 58(4), 1351-1359.
- Razak, R.A., & Lee, C.M. (2012). Promoting Higher Order Thinking In Chinese Language Literary Text via Online Social Network. *Journal of Education and Practice*, 3(16), 199-209.
- Savery, J.R., & Duffy, T.M. (2001). Problem based learning: An instructional model and its constructivist framework. *Educational Technology*, 35(5), 31-38.
- Schacter, J., & Fagnano, C. (1999). Does computer technology improve student learning and achievement? How, when, and under what conditions? *Educational Computing Research*, 20(4), 329-343.
- Stroupe, R.R. (2006). Integrating critical thinking throughout EFL curricula. *TESL Reporter*, 39(2), 42-61.
- Subran, D. (2011). Developing higher-order thinking with ICT. *Tenth Malaysia Plan, 2011-2015*. Retrieved from <http://hdl.handle.net/2139/15701>.
- Tenth Malaysia Plan. (2011). Putrajaya: Economic Planning Unit, Prime Minister's Department.
- Weaver, D., Spratt, C., & Nair, C. S. (2008). Academic and student use of a learning management system: Implications for quality. *Australasian Journal of Educational Technology*, 24(1), 30-41.
- Wegerif, R., & Dawes, L. (2004). Thinking and learning with ICT: Raising achievement in primary classrooms. New York: Routledge Falmer.
- Zohar, A., Degani, A., & Vaaknin, E. (2001). Lecturers' beliefs about low-achieving students and higher order thinking. *Teaching and Teacher Education*, 17(4), 469-485.
- Zuraina, A. (2009). A Case Study on Collaborative Learning to Promote Higher Thinking Skills (HOTS) among English as a Second Language (ESL) Learners. *Journal UMP Social Sciences and Technology Management*, 1(1), 23-38.