CORRELATION BETWEEN LOTS AND HOTS SCORES AMONG UUM STUDENTS

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ABSTRACT

Higher order of thinking skills (HOTS) and lower order of thinking skills (LOTS) have shown to be important goals in education. Many countries and learning institutions around the world have realised the importance of having workers who are both knowledgeable and have advanced thinking skills to increase the number and quality of innovations to compete globally. These two thinking skills are pivotal in improving the quality of one's education and life. General opinion from scholars and educationist tend to assume that HOTS is superior to LOTS by implementation and relevance. However, as much as HOTS is complex, its foundational elements and practices rely heavily on LOTS. This study seeks to analyse the correlation between LOTS and HOTS by carrying out an analytical measure between students. A number of 120 students from the Cognitive Science and Ethics course in UUM comprising of 82 female and 38 male students took part in the study. The data collected was analysed using the SPSS software, and the findings are discussed in relation to the positive correlation established between the two orders of thinking skills. The results of the study have shown that LOTS is important in providing a foundational platform for the application of HOTS.

Keywords: LOTS, HOTS, Correlation.

INTRODUCTION

It can be said that the levels of thinking were first discussed by Bloom in 1956 when he established the Bloom Taxonomy. The 1956 version is now referred to as the Original Taxonomy as Krathwohl (2002) who was one of the founders of the taxonomy made a revision of it. The new revised taxonomy is now referred to as the Revised Taxonomy (Krathwohl, 2002). At the time of this study, the Original Taxonomy was used.

The Original Taxonomy had six categories in the Cognitive Domain (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). The first three categories (knowledge, comprehension and application) were considered to be lower-order thinking skills (LOTS) while the other three categories (analysis, synthesis and evaluation) were considered to be higher-order thinking skills (HOTS) (Zohar & Dori, 2003).

Scholars and educationist across the world believe that both levels of thinking are essential for every student. However, LOTS is considered to be core and very important as it helps the students develop their line of thoughts, acquire knowledge on different topics and apply the knowledge effectively. Once these lower levels of thinking skills are cultivated, they create a

passage to HOTS whereby a student can now be able to make comparison and create original content based on the acquired knowledge (Mansbach, 2015). Therefore, both levels are critical in the learning process.

The HOTS is considered as a significant level because an individual is able to contribute to the advancement of education which proceeds to generate solutions to existing problems and to apply new concepts to existing structures (Nagayar, Ahmad & Kanniah, 2015). Therefore, a strong belief of a positive correlation between LOTS and HOTS is likely in that one needs to excel in the lower level of learning in order to successfully apply HOTS at a more advanced level (Collins, 2014). Results from similar studies suggest the same thought (see Mohammad Shah & Ahmad Jelani, 2015; Mohammad Shah & Ahmad Jelani, 2016). Since a significant correlation between the two levels of thinking has yet to be shown by any related study, this study would like to provide a statistical reading for that matter. Thus, the research question is "Is there a significant positive correlation between LOTS and HOTS?"

LITERATURE REVIEW

There has been a constant debate on whether it is necessary for all learners to achieve higher level of thinking skills. This discussion is supported by the notion that some students only seek to achieve the basic level of thinking as in LOTS and assume that HOTS to be complicated and complex (Carter, 1996; Klimova, 2009). Similarly, teachers and educationist emphasize that it is not important for students who do not wish to pursue advanced level of thinking to be forced in to higher level of thinking as it can lead to lack of motivation and personal development (Zohar & Dori, 2003). Zohar and Dori (2003) note that teachers may also have a negative perspective towards the low achieving students in their attempts to gain high order of thinking skills and this may discourage the low achieving students from pursuing HOTS.

Zohar and Dori (2003) also suggest that basic knowledge was not necessary for initiating higher level of thinking but agree with a number of other studies which recommended that having a certain command of LOTS can help in the development of higher-order thinking skills. Dewey (1993) explains that the application of thinking skills is not only relevant in the field of learning and education rather, it is pivotal in contributing to the growth and development of the general society. Therefore, it is important to consider both levels of thinking skills as essential in the day to day life. Questions still linger on whether individuals can be able to survive with the lower order of thinking and researchers continue to investigate the query and generating various reasons for and against having just lower thinking skills without intending to advance. McCoubrie (2004) explains that it is however possible to progressively direct the LOTS learner towards HOTS practices once their strengths and weaknesses are identified.

METHODOLOGY

This study was conducted to determine the significance of the relationship between LOTS and HOTS among university students.

Sample of study

For the purpose of this study, 120 students (38 males and 82 females) from the Cognitive Science and Ethics course in UUM was asked to participate in this study. The sample was chosen

because the course is comprised of students from various programs and different semesters taught by the same lecturer. This condition allowed a good representation of UUM's student population while at the same time to minimize the effects of extraneous variables if students were taught by different lecturers.

Data collection and procedure

Students' scores on LOTS and HOTS were obtained from the lecturer at the end of the semester. 50 final examination test items that tested the first 3 levels of Bloom's Taxonomy was used to measure students' LOTS. These items were chosen as the items were reviewed for reliability and validity by the exam committee. A separate and different test was used to measure students HOTS. The study did not apply a multiple-choice item test as it does not show the required level of HOTS. The study opts for a 2 item essay test instead. The lecturer agreed to implement the essay test and construct the items as the lecturer would also like to use it as part of the course assessment. Essay tests have been shown to be more accurate in capturing the learner's genuine idea (Paul, 1993; Paul & Nosich, 2009). Scores for the HOTS essay type question were given based on the Washington State University Critical Thinking Rubric (WSUCTR) which was developed based on the works of critical thinking experts (e.g. Toulmin, Paul and Facione) and had been used in the Washington State University since 2001 (Kelly-Riley, 2003, pp. 5-7, see Appendix E).

Data analysis

All calculations for data analysis were performed using the SPSS software. The normality of data must be determined to identify the best tool for further analysis. The normality of data was determined using the Kolmogorov-Smirnov test as the number of cases for study is 120 which is more than 100 (Coakes, Steed & Ong, 2010, p.41). The test showed a significance value of .20 for both LOTS and HOTS data sets. A significance value greater than .05 shows that the data set is normal (Coakes, Steed & Ong, 2010, p.41).

RESULTS

Once the data sets were shown to be normal, based on Coakes, Steed & Ong (2010), the Pearson product-moment correlation analysis was used to determine the correlation for the variables studied. Table 1 shows that there is a significant positive but moderate correlation between LOTS (M = 35.48, SD = 5.93) and HOTS (M = 22.96, SD = 3.26), r = .43, p = < .05, n = 120.

Table 1: Pearson Correlation results between LOTS and HOTS scores

Level of thinking skills	n	Mean	SD	r	Sig.
LOTS	120	35.48	5.927	.43*	.00
HOTS	120	22.96	3.258		

*$p < .05$

DISCUSSION

The results show that LOTS is important in developing HOTS which are in line with a number of studies (Dewey, 1933; Gagné, Briggs & Wager, 1988; Sternberg & Davidson, 1995; Bloom et

al., 1956; McDavitt, 1993; Crowl, Kaminsky & Podell, 1997; Kauchak & Eggen, 1998; Nicol & Anderson, 2000; McCoubrie, 2004). The analysis carried out through the SPSS program showed a higher relativity of LOTS as a foundational element in attaining success if HOTS. This continues to prove the importance of achieving a successful level of LOTS before indulging in HOTS.

The number of the participants in the study showed that they depended on LOTS to make decisions that facilitated the application of HOTS especially when it came to carrying out technical tasks. Nicol and Anderson (2000) further note that the correlation between LOTs and HOTS is often assumed and ignored when people are achieving HOTS. This is mainly true when the perception towards lower thinking skills is biased and assumed to be less significant in the learning process. Descriptive statistics showed a standard deviation variation of approximately 2.669 where LOTS was considered as an important element in thinking and in influencing the success of HOTS.

Limitations of the study

The first limitation of the study was the high variance between the female and the male participants. The female study participants were double the size of the male participants, and this could have affected the summary of the results. This is because the male participants were under-represented and it is assumed that having a balanced gender would have given more unbiased gender results.

The second limitation would be the test items used for the study is fully constructed and evaluated by one lecturer. A more accurate set of scores could be obtained if more content experts were available in giving the students' marks.

CONCLUSIONS

HOTS is essential not only in the field of education and learning but also in the field of daily applications. Some of the innovations that are in application today came to be with the help of successful application of HOTS strategies of analytical, critical and creative thinking. HOTS has also been credited with increasing the productivity that has benefited the way of life for many scientist, scholars, and researchers. As noted in the test, it is impossible to draw viable conclusions if one is not capable of analysing facts, providing solutions and to making conclusions. Therefore, it is established that the higher order of thinking skills is essential in developing and supporting new ideas as well as improving the way of life. On the other hand, LOTS is critical in providing foundational truths and structures that support the implementation of HOTS. Low order of thinking being the most basic is considered essential in providing guidelines of approach and application. Enabling individuals to harness their lower order thinking skills should be pivotal to educationists and teachers with a view to facilitating the success of HOTS.

RECOMMENDATIONS

Based on the findings of this study, the educational community should focus on LOTS with the same interest and magnitude as HOTS on every level. It is therefore important for learners to seek success in LOTS before venturing in to activities that require HOTS. Similarly, educators should seek to encourage learners to develop their HOTS at the basic levels of learning to increase the success of application later on in life.

REFERENCES

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain*. New York: Longman Inc.

Carter, R. (1996). Look both ways before crossing: developments in the language and literature classroom. In C. Carter & J. McRae (Eds.*), Language, Literature and the Learner: Creative Classroom Practice* (pp. 1-15). London: Longman.

Coakes, SJ, Steed, L & Ong, C. (2009). *SPSS version 16.0 for Windows: Analysis without anguish*, John Wiley & Sons Australia, Ltd, Australia

Collins, R. (2014). Skills for The 21st Century: Teaching Higher-Order Thinking. *Curriculum& Leadership Journal,* 12 (14)

Crowl, T. K., Kaminsky, S., & Podell, D. M. (1997). *Educational psychology: Windows on teaching*. Madison, WI: Brown and Benchmark.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. Boston: D. C. Heath and Company.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1988). *Principles of instructional design.* New York: Holt, Rinehart and Winston, Inc.

Hayikaleng, N., Nair, A.M. & Krishnasamy, H, N. (2016). Thai Students' L2 Reading Comprehension Level for Lower Order Thinking Skills and Higher Order Thinking Skills Questions. *Journal of Applied Linguistics and Language Research,* 3 (5), 83-91.

Kauchak, D. P., & Eggen, P. D. (1998). *Learning and teaching: Research-based methods* (3rd ed.). Boston: Allyn and Bacon.

Kelly-Riley, D. (2003). Washington State University Critical Thinking Project: Improving student learning outcomes through faculty practice. *Assessment Update, 15*(4), 5-14.

King, F.J., Goodson, L. and Rohani, F. (n.d). Higher order Thinking Skills. *Educational Services Program.*

Klímova, B. F. (2009). Thinking skills in the teaching and learning of the English language. *Problems of Education in the 21st Century,* 18, 97-101.

Krathwohl, D. R. (2002). A revision of Bloom's Taxonomy: An overview. *Theory into Practice,* 41(4), 212-218.

Mansbach, J. (2015).Using Technology to Develop Students' Critical Thinking Skills. Retrieved from https://dl.sps.northwestern.edu/blog/2015/09/using-technology-to-develop-students-critical-thinking-skills/

McCoubrie, P. (2004). Improving the Fairness of Multiple-Choice Questions: A Literature Review. *Medical Teacher,* 26 (8), 709-712.

McDavitt, D. S. (1993). *Teaching for understanding: Attaining higher order learning and increased achievement through experiential instruction.* (ERIC Document Reproduction Service No. ED 374 093).

Mohammad Shah Kamarulzaman & Ahmad Jelani Shaari. (2015). Comparing the effect of EDPA and FDPA on university students' examination results. *Malaysian Online Journal of Educational Technology*, 3(1), 28-34.

Mohammad Shah Kamarulzaman & Ahmad Jelani Shaari. (2016). Comparing the effect of EDPA and FDPA on university students' HOTS. *Asian Journal of Educational Research*, 4(1), 36-41.

Nagayar, S., Ahmad, A. A. & Kanniah, M. N. (2015). Young Adult Literature and Higher-order Thinking Skills: A Confluence of Young Minds. *International Journal of Language Education and Applied Linguistics (IJLEAL)*, 51-61.

Nicol, M. M. & Anderson, A. (2000). Computer-assisted vs. teacher-directed teaching of numeracy in adults. *Journal of Computer Assisted learning*, 16 (3), 184-192.

Paul, R. (1993). *Critical thinking: What every person needs to survive in a rapidly changing world*. Santa Rosa, CA: Foundation for Critical Thinking.

Paul, R., & Nosich, G. M. (2009). Model for the National Assessment of Higher Order Thinking. Retrieved from http://www.criticalthinking.org/print-page.cfm?pageID=591.

Sternberg, R. J., & Davidson, J. E. (Eds.). (1995). *The nature of insight*. Cambridge, MA: The MIT Press.

Zohar, A., & Dori, Y. J. (2003). Higher Order Thinking Skills and Low Achieving Students: Are They Mutually Exclusive? *Journal of the Learning Sciences*, 12, 145-181.