DOI:10.26524/jms.2018.27

Assessment Of Quantitative Critical Thinking (Q.C.T) And Academic Performance Of Business Management Students

Dr. P. M . Kulkarni[a] and Prof. Nupur veshne[b]

[a]*KLS, Gogte Institute of Technology, Department of MBA, Udyamabag, Belagavi, 590008, India*

[b]*KLS, Gogte Institute of Technology, Department of MBA, Udyamabag, Belagavi, 590008, India*

ABSTRACT: An attempt is made to assess the quantitative critical thinking and academic performance of business management students using Quantitative Critical Thinking. In this investigation, the teaching methodology involving case study, simulation, live projects are evaluated on its impact on critical thinking. The current study aims at analyzing the relationship between Quantitative Critical Thinking ability and academic performance. Quantitative Critical Thinking (QCT) is applied to understand the relationship between the QCT and academic performance of students. The study also provides information with regards to the comparison of students from six B-schools in India.

Keywords: Quantitative Reasoning; Academic Performance; Teaching Methodology; Management Programme;

1. INTRODUCTION

Quantitative reasoning and critical thinking play a key role in the business process and decisions in today's business scenario (*Ou Lydia Liu, 2014*). Quantitative reasoning supports the business managers with numerical information with regards to the business scenario and provides directions with regards to effective decision-making. (*John Baldoni, 2010*). The inclusion of quantitative reasoning and critical thinking is important in preparing students for the corporate world. (*Taylor, 2008*). Quantitative reasoning and critical thinking is a problem-solving focus. It includes the following six capabilities: reading and understanding information given in various formats; interpreting quantitative information and drawing inferences from it; solving problems using arithmetic, algebraic, geometric, or statistical methods; estimating answers and checking for reasonableness; communicating quantitative information; and recognizing the limitations of mathematical or statistical methods this would provide directions with regards to improving better decision making in management students. (*Shubhakar, 2016*). The present study has been focused on understanding the impact of quantitative critical thinking and academic performance of the student in management program. The present study confined with regards to quantitative critical thinking for management students and their academic performance in management program. Hence the present study has focused on three areas namely (1) To assess and analyze business management students quantitative critical thinking (QCT) ability, (2) To study the relationship between QCT and academic performance of the students and (3) understanding directions with regards to improving academic performance through quantitative critical thinking.

2. LITERATURE REVIEW

Critical thinking in B-School program provides all new dimensions for the decision making which would support perspective employees to understand employability in industry. (*Robbins, 2005*). Quantitative reasoning requires the use of mathematical content for assessment. Quantitative reasoning is, however, fundamentally different from conceptually and practically, from mathematical content knowledge. (*Daryl V. Watkins, 2015*). Studies on understanding the importance of quantitative information for the students of finance and economics indicate that quantitative decision models provide better directions for management students to analysis the goals and relationships amongst the various economic and financial factors in a business scenario. (*Slade, 1991*). Judi Brownell et.al showed that quantitative reasoning enhances the decision-making process with more quantitative information for decisions. (*Judi Brownell, 2004*). Critical thinking and teaching methodology is inter-related variable for developing critical thinking amongst the management students. Nicholas et.al on enhancing critical thinking through Blooms Taxonomy, this tool provides directions in making students self-responsible learners. Management schools teach critical thinking through tools like case studies, live projects, debates, etc, these tools provide a platform to understand the student's critical thinking ability and provide an opportunity to improve critical thinking. (*Braun, 2004*). Students enrolled in B-Schools through entrance examination which includes quantitative reasoning as a component in the entrance examination, this reasoning component provides information on the quantitative reasoning of the student and performance in the B-School. (*Symonds, 2013*). The above studies on both quantitative reasoning and critical thinking indicate that both are important for developing management students for the program. However, most of the studies have focused on either quantitative reasoning or critical thinking; there is a need to understand the importance of the combination of critical thinking in the methodology of quantitative reasoning.

3. METHODOLOGY

3.1 MODEL OF THE STUDY

The model of the study is to understand the relationship between Quantitative critical thinking and academic performance of the students, the study would include a comparison between six management institutes in India. The research gap through a reviewof studies provides an indication with regards to the understanding of the relationship between Quantitative Critical Thinking and academic performance of the students. Studies on evaluation of the relationship between critical thinking and its impact on academic performance have always been the area of research for academic fetidity (*Hanin et.al, 2013*). The study on enhancing critical thinking amongst students and the role of faculty members would also provide directions in this research direction (*Grosser et.al, 2013*), based on the literature and critical finding on the study following model is designed in the study which is depicted in *figure 1* and hypothesis for the study are reflected to understand the impact of QCT and academic performance of management graduates.

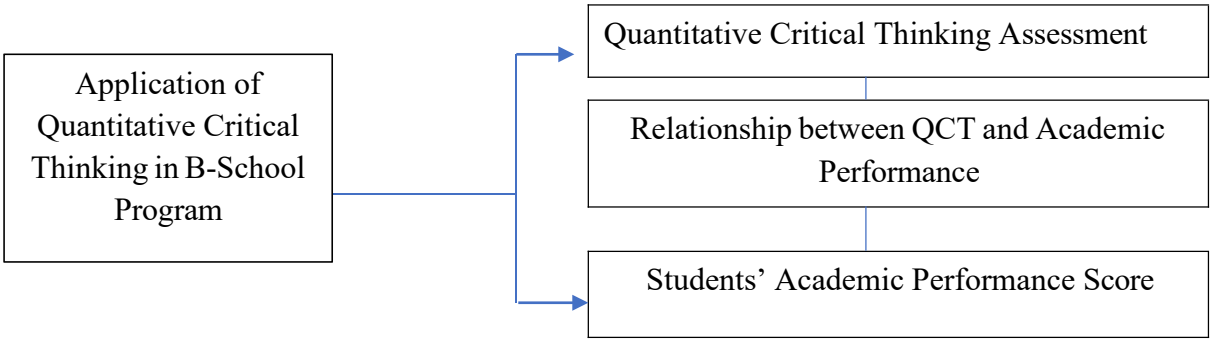

Figure: 1 Study on QCT and Academic Performance

3.2 Research Aims

The present study is undertaken to understand the following aims, they are as under;

1. To understand the impact of quantitative critical thinking on the academic performance of management students
2. To evaluate the role of faculty members in training students in improving quantitative critical thinking

3.3 Hypothesis of the Study

The above literature review and model of the study provides directions in framing the following hypothesis of the study

H1: Relationship between Quantitative critical thinking and academic performance of management students.

H2: Faculty teaching methodology and its impact on the quantitative critical thinking of students

3.4 Profile of the Respondents

The details with regards to profile of the respondents is provided in Table 1. which indicates that 31% of the respondents are in the age group of 40 and above, while 25% are in the age group of 35 - 40 years and in the age group of 31- 35 years and 25-30 years 19% and 25% respondents are included in the study. 78% of the respondents are male and 22% are female faculty members in the study. Majority of the respondents that is 83% of the respondents are qualified with master's degree in management and 17 % with a doctorate degree. As regards the position of the respondents, 61% of the respondents are assistant professors, while 17% are professors, 8% are associate professors and 14% are designated as lecturers in the study.

Table:1 – Profile of the Respondents

Age	**N**	**Percentage**
25-30	9	25%
31-35	7	19%
35-40	9	25%
40 & Above	11	31%
Total	**36**	**100**
Gender	**N**	**Percentage**
Male	28	78
Female	8	22
Total	**36**	**100**
Qualification	**N**	**Percentage**
PhD	6	17
Masters	30	83
Total	**36**	**100**
Position	**N**	**Percentage**
Lectures	5	14
Assistant Professor	22	61
Associate Professor	3	8
Professor	6	17
Total	**36**	**100**

3.5 Data Analysis Process

Data was collected through Harrison Assessments Quantitative Critical Thinking Test which includes following questions related to Quantitative Critical Thinking, there are 40 questions with four options to answer. The respondents of the study underwent this test through online mode, provided by Harrison Assessment, India. The students were evaluated on a scale of 1 to 10 based on the score provided through online assessment. The data with regards to academic performance was collected on final score secured by the students. The data with regards to the faculty teaching methodology was collected through rank order questionnaire. Faculty members were invited to respond with the highest rank on teaching methodology adopted in the teaching management students. The data collected were analyzed through three statistical tools, which include Mean, Chi- Square and rank order. The data with regards to overall score on QCT was analyzed through mean, while mean was also applied to understand the academic performance of the students. The comparison with regards to academic performance and QCT was analyzedthrough Chi-Square analysis and hypothesis was tested with regards to QCT and its impact on Academic Performance. The rank order data collected was analyzed through preferences provided by the respondents, and the count was calculated with the highest preference.

4 RESULTS

The data collected was analyzed qualitatively and quantitatively. Both descriptive and inferential statistics were used for analysis. The entire sample was assessed through QCT and each member's academic performance data was ascertained. It may be noted that QCT score is continuous with each

item having a pre-determined score for a correct and incorrect response. The score of QCT was arrived by depending on a number of correct responses; the values get added as per the norms are given in the manual. For the entire sample, the minimum score is 30 (assumed for this level) and the maximum score is 100. Skills like critical thinking and quantitative reasoning are often highly valued as student outcomes. The studywas conducted on Quantitative Critical Thinking pattern amongst 6 management institutes. The data presented in Table.2 shows the scores of QCT of students in management institutes. The average mean score of QCT of management graduates is 67.31 while the lowest score is 59.8 and 77.87 mean score on the test. Minimum score on the test is 33 and the highest score is 96 which witnessed three institutes. Comparison with regards to students QCT score from Institute 1, 2 and 3 students QCT is higher with 77.87,72.95 and 67.6, while the score of Institute 4,5 and 6 students is 64.86,59.8 and 60.8. The pattern of QCT Score and academic performance is studies and details with regards to scores are presented in the table. 2, the mean score is calculated in the study with regards to academic score and QCT score. The impact of quantitative critical thinking amongst the students on academic performance shows that in institute – 1 QCT score is 77.87 mean academic score is 70.15, while in institute -2, QCT score is 72.95 and the academic score is 78.81. In institute -3, QCT score is 67.6 while the academic mean score is higher at 72.26. Institute – 4 indicated QCT score of 64.86 and an academic mean score of 65.3. Institute – 5 indicated QCT Score of 59.8 and an academic mean score of 66.24. Institute – 6 QCT score is 60.8 and the academic mean score is 77.4. The study shows in Institute – 1, 2, 3 more emphases of academic focus is towards the application of quantitative techniques combined with critical thinking learning methods which include case studies, live projects, debates, and internship which has reflected in higher academic scores. While in institute 4,5 and 6 shows averaged QCT score of 60 while the averaged academic mean score of 70. To understand the relationship of QCT and Academic Performance, Chi-Square Test is applied in the study, the results of the study is as under; The above analysis shows that P value at <0.0001, which is greater than 1which indicates that quantitative critical thinking and academic performance are higher related, hence the null hypothesis is rejected and alternative hypothesis is accepted which shows higher relation between QCT and academic performance. The study when analyzed the academic performance of students, the bell diagram is shown in figure no. 4 indicates that 63 to 72 score on a higher score of 100 marks. The same is compared with the QCT score which also indicates 61 to 72 score, hence the study indicate that QCT score provides a direction with regards to the academic performance of the students in the B-school program. The study collected data with regards to teaching methodology applied by the instructors. The results of the study are indicated in Table.5 and figure 4. The study shows the mean score of 4.72 which is the highest for Blackboard teaching, while group discussion on specific topics on management is scored at the mean value of 4.51. Further, the mean value on live-project is at 4.07 which is ranked third on the response by the respondents. While case study methodology is ranked fourth with a mean score of 2.96, debates at 2.49 and simulation at 2.33 mean score which is the lowest in the methodology of teaching. The study shows that majority of the respondents have applied blackboard and live project to enhance quantitative critical thinking in teaching.

Table:2 – Mean Score on QCT

Management Institute	Sample Size	Minimum Score	Maximum Score	Mean Score
Institute – 1	32	40	96	77.87
Institute – 2	45	40	96	72.95
Institute – 3	96	30	83	67.6
Institute – 4	181	40	96	64.86
Institute – 5	49	40	90	59.8
Institute – 6	41	33	85	60.8
Total	444			67.31

Table: 3– QCT Scores and Academic Performance of Students.

Management Institute	Sample Size	Minimum Score of QCT	Minimum Score Academic Performance	Maximum Score of QCT	Maximum Score Academic Performance	Mean Score QCT	Mean Score Academic Performance
Institute – 1	32	40	65	96	95	77.87	70.15
Institute – 2	45	40	62	96	93	72.95	78.81
Institute – 3	96	30	65	83	93	67.6	72.26
Institute – 4	181	40	65	96	93	64.86	65.3
Institute – 5	49	40	62	90	93	59.8	66.24
Institute – 6	41	33	65	85	95	60.8	77.4
Total	444					67.31	71.71

Table No: 4 – Chi-Square Analysis on QCT and Academic Performance

Chi-square (Observed value)	247.358
Chi-square (Critical value)	14.067
DF	7
p-value (Two-tailed)	< 0.0001
alpha	0.05

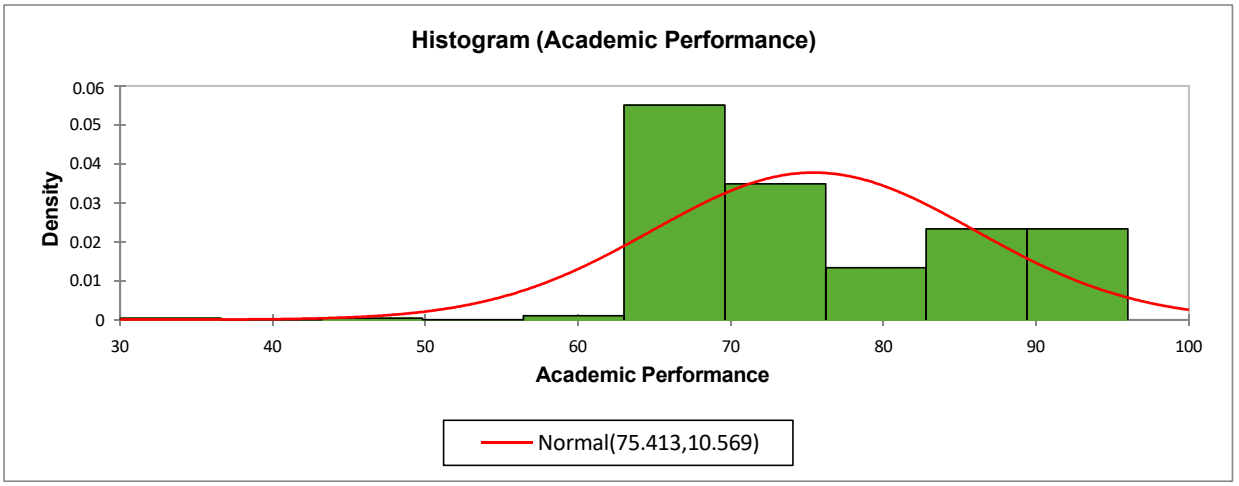

Figure: 2 – Normal distribution curve on the academic performance of students

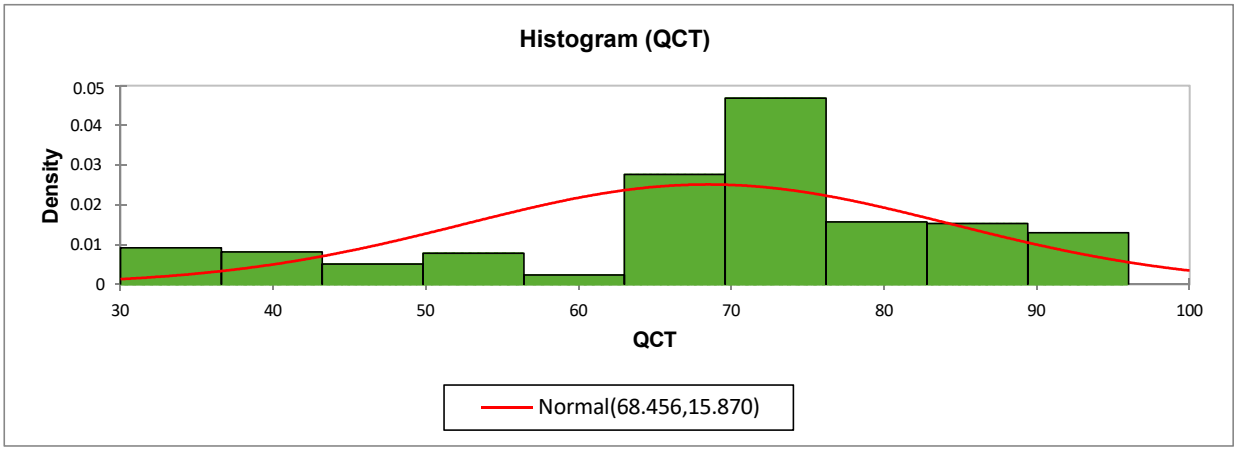

Figure: 3 – Normal distribution curve on QCT performance of students

Table:5- Teaching Methodology in B-School

Teaching Methodology	Mean Score
Case Study	2.96
Simulation	2.33
Debate	2.49
Live-Project	4.07
Group Discussion	4.51
Blackboard	4.72

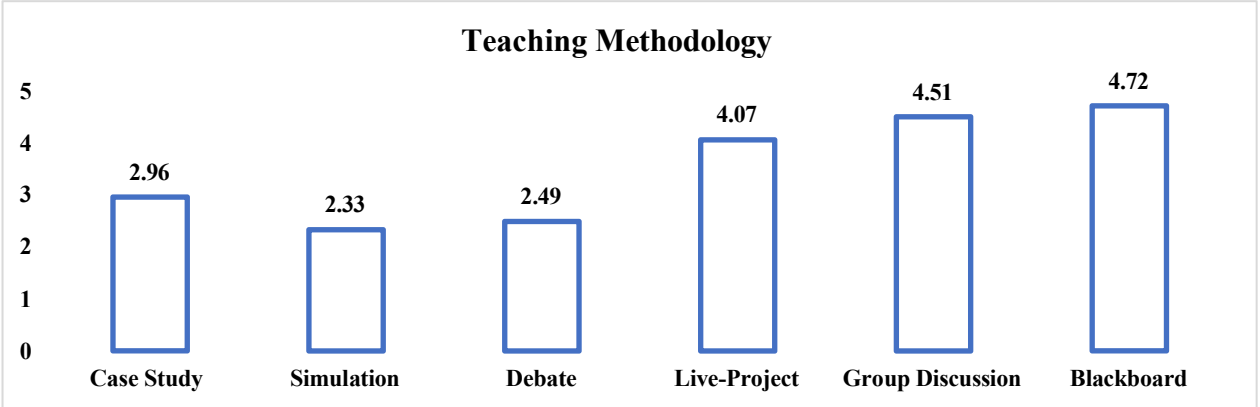

Figure: 4- Teaching Methodology in B-School

5 DISCUSSIONS

An important factor for the success of management graduate is critical thinking, in the study conducted on management graduate with regards to critical thinking; results have shown that this factor needs improvement amongst the students(*Chapman, 2012*). Hence this study provides directions with regards to understanding the importance of quantitative critical thinking and academic performance of the students. The study indicated that the academic curriculum and results showed thatcase-based teaching and live projects would develop critical thinking. The present study

suggests critical thinking and quantitative reasoning as course to be included for developing management graduates critical thinking ability.(*Roger, 2015*), (*White,2012*). Management education needs to provide a platform for students to improve quantitative reasoning and critical thinking drawn from the perspective of reflexive dialogical practice in management learning (Ann.L, 2002). (*Reynolds, 2008*). Special training for students on critical thinking would improve the critical thinking skills of management students, these courses could include training content on case studies and computerized simulations. (*Joanne R, 2012*). Inclusion of courses in Business School on Design Thinking would develop critical thinking amongst students(*Roy Glen, 2014*). Critical thinking competencies can be developed amongst students through leadership program which is focused towards improving leadership competencies with critical thinking ability. (*Daryl, 2015*). The above discussion is supportedby the study which indicated that critical thinking and quantitative analysis would enhance skill-sets of management students (*Chau Thi Minh Ly, 2015*).The present study model can be adopted in B-School to improve the students learning ability through the program on QCT. The study indicates that management programs would provide an opportunity to enhance quantitative reasoning and critical thinking through designing the management program by including quantitative tools Instructors can also enhance critical thinking and reasoning ability amongst students through the application of concepts of lateral thinking (*Jack, 2005*). Role of faculty member play an important rolein creating an environment amongst students to read, question and engage in divergent thinking and compare with real-life situations of business, this provides an opportunity to understand the business situation and evaluate critically and reason with real business issues and scenarios. (*Carr.K, 1988*). Faculty members can also apply descriptive evaluation to enhance critical thinking, (*Heinz, 2013*). Therefore, the present study indicates that for management students Case-Based technology methodology would provide a holistic approach towards developing QCT amongst management students. This shows that curriculum alone is not the only factor in QCT but the methodology of teaching is also very significant for management students. Simulations are growing popular in management education to teaching practical aspects of business through critical thinking and problems solving, the study on application of critical thinking as methodology showed that faculty members and students require technological domain knowledge to demonstrate on simulation (*Pat Neely, 2012*),(*Coleman, 2012*), (*Nguyen Dinh Tho, 2017*), (Bennett, 2014), this study provides an opportunity to management institute to understand QCT and design teaching methodology to meet the industry requirement for jobs.

6. CONCLUSION

Students in business management courses need to be prepared to address the complex scenarios of business and develop practical solutions to business problems.The role of critical thinking and quantitative reasoning influences significantly in business schools. Apart from student's perspective role of faculty members is equally important in creating an environment in the classroom through the application of integrated quantitative methods for management education. The study also provides the scope of future research in understanding the role of QCT in job placement and performance in the industry. Overall the study indicates that QCT inclusion in the management program provides support in grooming management students and preparing them for the industry.

7. LIMITATIONS

The study undertaken to investigate the relationship between quantitative critical thinking and academic performance was only considered from the perspective of academic performance of management students, however, future studies on quantitative critical thinking on engineering education and academic performance would be of great interest for developing employability of engineering students.Role of faculty members in developing quantitative critical thinking is highlighted in the present study, however this study was limited with regards to management education, teaching methodology would change significantly with regards to other educational areas like engineering, medical etc., hence, studies on teaching methodology and its impact on developing quantitative critical thinking would provide directions to faculty member in other academic course and develop students quantitative critical thinking.

8. ACKNOWLEDGMENTS

Our thanks to the experts from Harrison Assessment for supporting the research.

9. REFERENCES

1) *Liu, O. L., Frankel, L.,andRoohr, K. C. (2014), Assessing Critical Thinking in Higher Education: Current State and Directions for Next-Generation Assessment. ETS Research Reports Series, 2014: 1-23. doi:10.1002/ets2.12009*

2) *John Baldoni, How Leaders Should Think Critically, January 20, 2010, Harvard Business Review, 1-2*

3) *Browne, M. N., & Keeley, S. M. (2004). Asking the right questions. A guide to critical thinking. (7th ed.). Boston: Prentice Hall/Pearson.*

4) *Heijltjes, Anita & van Gog, Tamara &Paas, Fred. (2014). Improving Students' Critical Thinking: Empirical Support for Explicit Instructions Combined with Practice. Applied Cognitive Psychology. 28. 10.1002/acp.3025.*

5) *Ann.L, C. A. (2002). Reflexive Dialogical Practice in Management Learning, Management Learning Vol 33, Issue 1, pp. 35 – 61, https://doi.org/10.1177/1350507602331002*

6) *Coleman, B & Mason, Paul & Steagall, Jeffrey & State, Weber. (2012). Does A Business Curriculum Develop Or Filter Critical Thinking?. American Journal of Business Education. 5. 409-415*

7) *Atul Gupta, Sara E. Bennett, (2014) "An empirical analysis of the effect of MBA programs on organizational success", International Journal of Educational Management, Vol. 28 Issue: 4, pp.451-460, https://doi.org/10.1108/IJEM-10-2012-0114*

8) *Bernardi, R. A., A. Downey, D. W. Massey and L. Thorne, 2002, "Critical Thinking and the Moral Reasoning of Intermediate Accounting Students", Research on Accounting Ethics 8: 73–102.*

9) *Braun, N. M. (2004). Critical Thinking in the Business Curriculum. Journal of Education for Business, Vol. 79 , No 4 232-236.*

10) *Carr, Robert A. PhD; Evans-Locke, Kylie PhD; Abu-Saif, Hanan; Boucher, Renee; and Douglas,Karen, Peer-learning to employable: learnings from an evaluation of PASS attendee and facilitator perceptions of employability at Western Sydney University, Journal of Peer Learning,11, 2018, 41-64*

11) *Carr.K. (1988). How can we Teach Critical Thinking? ERIC Digest adapted from Childhood Education, 69-73.*

12) *Dean Roepen, (2017) "Australian business graduates' perceptions of non-technical skills within the workplace", Education + Training, Vol. 59 Issue: 5, pp.457-470, https://doi.org/10.1108/ET-01-2017-0016*

13) *Chau Thi Minh Ly, Margaret H. Vickers, Santha Fernandez, (2015) "Master of Business Administration (MBA) student outcomes in Vietnam: Graduate student insights from a qualitative study", Education + Training, Vol. 57 Issue: 1, pp.88-107, https://doi.org/10.1108/ET-08-2013-0104*

14) *Daryl V. Watkins, E.-R. P. (2015). Developing Critical Thinking within a Master of Science in Leadership Program. Academy of Educational Leadership Journal, Volume 19, Number 184-194.*

15) *Diana Page & Arup Mukherjee (2010) Promoting Critical-Thinking Skills By Using Negotiation Exercises, Journal of Education for Business, 82:5, 251-257, DOI: 10.3200/JOEB.82.5.251-257*

16) *Gregory, H. (2018, April 14). Examples of Quantitative Reasoning for a Business. SmallBusiness - Chron.com. Retrieved fromhttp://smallbusiness.chron.com/examples-quantitative-reasoning-business-30966.html,Diambikembalidari http://smallbusiness.chron.com*

17) *Grosser, Mary &Nel, Mirna. (2013). The relationship between the critical thinking skills and the academic language proficiency of prospective teachers. South African Journal of Education. 33. 246-262*

18) *Grossman, T. A. (2001). Causes of the Decline of the Business School Management Science Course.Informs Transactions on Education, Vol. 1, No.151-61.*

19) *HaninNazihaHasnor, Zaiton Ahmad, NorshidahNordin. (2013). 6th International Conference. University Learning and Teaching (InCULT 2012) (hal. 178-186). Malaysia: Socialand Behavioral Sciences*

20) *Heinz, M. (2013). Tomorrow's teachers-selecting the best: An exploration of the qualityrationale behind academic and experiential selection criteria for initial teacher educationprogrammes. Educational Assessment, Evaluation and Accountability, 25(2), 93-114doi:http://dx.doi.org/10.1007/s11092-013-9162-1*

21) *Jack, P. (2005). Critical Thinking Concepts. Professional Safety, 26-32.Joanne R. Reid & PhyllisR. Anderson (2011) Critical Thinking in the Business Classroom, Journal of Education for Business, 87:1, 52-59, DOI: 10.1080/08832323.2011.557103*

22) *Judi Brownell, D. A. (2004). Problem-based Learning in Graduate Management Education: An Integrative Model and Interdisciplinary Application. Journal of Management Education, Vol 28, Issue 5, 558-577, https://doi.org/10.1177/1052562904266073*

23) *Nguyen DinhTho, (2017) "Using signals to evaluate the teaching quality of MBA faculty members: fsQCA and SEM findings", Education + Training, Vol. 59 Issue: 3, pp.292-304, https://doi.org/10.1108/ET-03-2016-0060*

24) *Nicholas Athanassiou, J. M. (2003). Critical Thinking in the Management Classroom: Bloom's Taxonomy as a Learning Too. Journal of Management Education, Vol 27, Issue 5, 533 – 555https://doi.org/10.1177/1052562903252515*

25) *Pat Neely, J. T. (2012). Using Business Simulations As Authentic Assessment Tools. AmericanJournal Of Business Education, Vol. 5, Issue. 4, 449-455*

26) *Reynolds, M 1998, 'Reflection and critical reflection in management learning' ManagementLearning, vol 29, no. 2, pp. 183-200. DOI: 10.1177/1350507698292004Robbins, S. (2005, May 30). https://hbswk.hbs.edu/archive/the-path-to-critical-thinking. Diambilkembalidarihttps://hbswk.hbs.edu.*

27) *Roger David Hall, C. A. (2015). Leadership development for managers in turbulent times. Journal of Management Development, Vol. 35 No. 8, 942-955.Rothstein, M. G. (1994,Dec).Personality and cognitive ability predictors of performance in graduate business school. Journal of Educational Psychology, Vol 86(4) 516-530.*

28) *Roy Glen, C. S. (2014). The Need for Design Thinking in Business Schools. Academy of Management Learning & Education, Vol. 13, No. 4, 653–667.http://dx.doi.org/10.5465/amle.2012.0308*

29) *Slade, S. (1991). Case-based reasoning for financial decision making. Proceedings First International Conference on Artificial Intelligence Applications on Wall Street, 232-237.*

30) *Smith, G. F. (2003). Beyond Critical Thinking and Decision Making: Teaching Business Students how to Think. Journal of Management Education, Vol 27, Issue 1, 24-51, https://doi.org/10.1177/1052562902239247*

31) *Snyder, L. G. (2008). Teaching Critical Thinking and Problem Solving Skills. The Delta Pi Epsilon Journal, Vol: 50 No:2, 90-99.*

32) *Subankar, D. (2016). Analysis of Quantitative Critical Thinking and Academic Performanceof Students. Bangalore: Harrison Assessment.*

33) *Symonds.M(2013May29).https://www.forbes.com/sites/mattsymonds/2013/05/29/heading-to-business-school-an-essential-pre-mba-strategy-to-hit-the-ground-running. Diambikembalidari https://www.forbes.com.*

34) *Taylor, C. (2008). Preparing students for the business of the real (and highly quantitative) world. In Calculation vs. context: Quantitative literacy and its implications for teachereducation. Washington, DC: Mathematics Association of America.*

35) *Timothy W.W. Yuen, A. C. (2012). A study of the impact of the first phase of the curriculum reform on student learning in Hong Kong. International Journal of Educational Management, Volume 13, Issue 2, 710-728.*

36) *White, T. (2012). Employer responsive provision: workforce development through work-based learning. Higher Education, Skills and Work-Based Learning, Vol. 2 No. 1, 6-21.*

*****