CRITICAL THINKING ASSESSMENTS: AN ANALYSIS

Bawani Selvaraj[1*]

[1] Academy of Language Studies, Universiti Teknologi MARA Kedah
Email: wani190@uitm.edu.my

[*] Corresponding Author

Abstract:

Critical thinking skills and dispositions are crucial for an individual and society at large. Research has shown that it has an impact on our ability to make decisions pertaining to education, employment, health, finances, rejecting fake conspiracy theories, pseudoscientific claims to name a few. It is also one of the primary objectives of higher education which is often stated implicitly or explicitly as an intended learning outcome. Critical thinking serves as a reliable prognostic tool of academic performance and has been demonstrated to be a more inclusive construct than cognitive ability or intelligence. This paper will highlight some of the critical thinking assessments available which can be used to measure critical thinking skills and dispositions. In the wake of artificial intelligence (AI) the ability to think critically as well as dispositions to do so is of paramount importance. The need to critically assess information using knowledge, expertise, judgement and creativity can avoid the pitfall known as AI hallucination and at the same time promotes empathy, ethics, informed citizenship among others. Hence these assessments should be used in a discerning manner to measure the educational outcomes required by the university and faculty.

Keywords:

Critical Thinking Assessments, Critical Thinking Skills, Critical Thinking Dispositions

Introduction

The paradigm shift in education underscores the vital need for critical thinkers in higher education institutions around the world (Puig et al., 2020). Previous research has revealed that university students in Western Europe, the United States, and Malaysia have low levels of

critical thinking skills (Guest, 2000; Van Gelder, 2005; Rosnani & Suhailah, 2003; Ghadi et al., 2015; Hanim & Lin, 2020). Dumitru and Halpern (2023) claim that advances in internet technology will make critical thinking increasingly important, and these skills are valued by employers. According to Hart Research Associates (2018), more than 1000 business managers and hiring executives favour individuals who can think critically when solving work-related issues. Furthermore, critical thinking skills can be employed to tackle real-world problems that conventional measures like intelligence may not be able to accomplish (Halpern & Dunn, 2021).

The transformative landscape of employment and labour market sees AI (Artificial Intelligence) as the dominant force. AI is a technology that allows computers and machines to mimic human intelligence and problem-solving abilities (Dumitru & Halpern, 2023). Integrating AI into education is a novel way of teaching and learning in which AI modifies instructional content based on students' requirements, ensuring a personalised learning experience. However, there are downsides to AI, as described in the case of Steven A. Schwartz (Weiser & Schweber, 2023). A judge grilled Mr. Schwartz, a lawyer, after he produced a legal brief with false judicial opinions and citations generated by Chat Generative Pretrained Transformer (ChatGPT). He did not understand how Chat GPT tricked him by fabricating the case. This situation demonstrates that critical thinking skills are of paramount importance to discern false or inaccurate information in the digital era (Halpern & Dunn, 2021; Butler, 2024).

Literature Review

Critical Thinking
Critical thinking in education can be traced back to John Dewey, a philosopher and educational reformer who coined the term 'reflective thinking' (Greenberger, 2020). The complexity of defining critical thinking is indeed daunting. Facione and 46 other experts defined critical thinking as "the purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (Facione, 1990, p.2).

It is clear that critical thinking is more than just thinking about something; it is an integrative process that examines numerous perspectives before reaching a conclusion (Dumitru & Halpern, 2023). A critical thinker's characteristics include rationality, openness to various points of view, introspective reflection, and non-egocentric processing (Flores et al., 2012; Facione, 1990).

The need to think critically is not new, but it has become more crucial as social media and other forms of communication have facilitated the deliberate spread of inaccurate or false information (Halpern & Dunn, 2021). Besides that, in today's increasingly complex environment, media literacy and communication skills are essential for making informed decisions. Nonetheless, critical thinking goes beyond the classroom and workplace. A true democracy requires educated citizens who can think critically about societal issues like war, poverty, climate change, mental health, unemployment, and the likes.

Critical Thinking Dispositions
Dewey referred to the dispositional characteristics of thinking as personal attributes (Hitchcock, 2020) while Facione (2000) defined critical thinking dispositions as consistent

internal motivations to act toward or respond to persons, events, or circumstances in habitual, yet potentially malleable ways. It entails attributes such as open-mindedness, fair-mindedness, inquisitiveness, a desire to be well-informed, adaptability, and a willingness to consider other people's perspectives (Facione, 2000; Rear, 2019). Critical thinking dispositions are often overlooked since a person who understands critical thinking skills but does not apply them cannot be considered a critical thinker (Rear, 2019; Butler, 2024). For example, Andrew Wakefield and his colleagues reported in the Lancet journal (1998) that the measles, mumps, and rubella (MMR) vaccine increased the risk of gastrointestinal problems and autism in children (Hasnain, 2023). Although the study had a small number of participants (n=12), lacked control measures, and produced speculative results, it received a lot of attention, resulting in a drop in MMR vaccination rates due to parental concerns about the potential relationship between immunisation and autism (Hasnain, 2023). The paper was retracted in 2010 but concerns regarding vaccine and vaccination still persist and this illustrates that critical thinking disposition is required in order to become a critical thinker.

The Need for Critical Thinking Skills and Dispositions in the Digital Age
One cause of concern about using social media as a source of information is its authenticity. The Pew Research Institute (2023) conducted a survey to determine Americans' preferred social media platforms as seen in Table 1. It can be concluded that YouTube is the most popular online video sharing platform among Americans followed by Facebook and Instagram.

Table 1: Online Video Sharing Platform Among Americans

SOCIAL MEDIA PLATFORMS	AGE			
	18-29	30-49	50-64	65+
Facebook	67	75	69	58
Instagram	78	59	35	15
LinkedIn	32	40	31	12
Twitter (X)	42	27	17	6
Pinterest	45	40	33	21
Snapchat	65	30	13	4
YouTube	93	92	83	60
WhatsApp	32	38	29	16
Reddit	44	31	11	3
TikTok	62	39	24	10
BeReal	12	3	1	<1

Source: (Survey Of US Adults Conducted 19 May-5 September 2023. https://www.pewresearch.org/internet/fact-sheet/social-media/)

As a result, mainstream media and websites upload content based on our viewing preferences. These social algorithms offer us with information that aligns with our interests, opinions, and beliefs (Butler, 2024). Therefore, information obtained may come from sources that are either reliable or unreliable. Butler (2024) found it worrying that these content providers were freely dispensing inaccurate medical advice, and many people were embracing it. If a person is sceptical about science and medicine, the algorithms will recommend more content that criticises the medical field. In similar vein, echo chambers promote group polarisation, which

occurs when people who share similar values become more extreme in their viewpoints during discussions or debates (Halpern & Dunn, 2021; Dumitru & Halpern, 2023; Butler, 2024). This does not foster critical thinking, and it is imperative for educators to caution their students about the dangers of sharing and disseminating information without verifying its authenticity.

Measuring Critical Thinking Skills and Dispositions in Higher Education

Why do we need critical thinkers, and what role do institutions of higher learning (IHL) play in achieving this goal? The common assumption is that the educational system has failed to consistently produce critical thinkers, which is a challenge for most IHL around the world (Abrami et al., 2008). The gap between employers' expectations and the readiness of workforce was more pronounced in the domain of critical thinking than in any other area (Butler, 2024). Teaching content and expanding knowledge base appear to be the primary concerns in IHL. Students are graduating with more extensive knowledge bases, which hampers their ability to engage in critical thinking once they enter the workforce (Flores et al., 2012). According to a study conducted by Hart Research Associates (2018), 78% of 501 corporate executives polled said critical thinking/analytic reasoning is the most important quality they look for in employees, however, the survey found that just 34% of college graduates have adequate preparation in critical thinking.

Malaysian employers are similarly concerned about the lack of critical thinking abilities among fresh graduates (Aziz Yahya et al., 2011; Cheong et al., 2016). The ability to think critically and a good command of the English language are highly sought after by employers (Ain Nadzimah & Rosli Talif, 2001; Rosyati Abdul Rashid & Rosna Awang Hashim, 2008; Cheong et al., 2016). So, who is accountable for teaching critical thinking? Employers believe that colleges and universities are responsible for doing so (Flores et al., 2012). As a result, many IHL programs have attempted to integrate thinking into their curricula (Barnes, 2005; Elder, 2005; Tiwari et al., 2006).

Critical Thinking Assessments

Many colleges and universities emphasise the importance of critical thinking in education, yet there is insufficient data to support this (Butler, 2024). The development of critical thinking skills in the Malaysian classroom is definitely a matter of concern. This is particularly worrying because more often than not, there is a direct relationship between learning and critical thinking skills (Zhaffar et al., 2017). In Malaysia, critical thinking skills are taught using either as a stand-alone or embedded model, and universities are given the freedom to incorporate these skills within their curriculum (Aziz Yahya et al., 2011). Portfolios, notebooks, reflections, self-assessments, peer assessments, and checklists are some of the tools that can be used to evaluate students' critical thinking abilities. This paper looks at some of the available and extensively used critical thinking assessments, namely:

•   California Critical Thinking Dispositions Inventory (CCTDI)
•   California Critical Thinking Skills Test (CCTST)
•   Cornell Critical Thinking Test (CCTT)
•   Watson Glaser Critical Thinking Appraisal (WGCTA)
•   Ennis–Weir Critical Thinking Essay

Measuring complicated constructs such as critical thinking is challenging. The process by which a test developer sets critical thinking parameters is important in assessing the validity and reliability of a particular assessment. The subscales employed to generate the total scores

vary according to the construct's definition established by the test developer. Some utilise a conceptual framework based on Delphi Report's definition of critical thinking, while others are influenced by the psychometric properties. Psychometric qualities ensure that the assessments are objective, impartial, standardised, and non-discriminatory. Nevertheless, most critical thinking assessments measure some form of argument analysis, questioning assumptions as well as inductive and deductive reasoning. It is also worth noting that most critical thinking assessments come with a price tag, therefore, universities can allocate financial resources to purchase and grade the assessments.

California Critical Thinking Skills Test (CCTST; Insight Assessment)
As one of the widely used assessment, the California Critical Thinking Skills Test (CCTST) measures cognitive abilities of undergraduates and post-graduates in relation to reflective decision-making (Facione, 1990). It provides valid and reliable data for individuals and groups. The test items are different based on the test taker group. The metrics include scores for eight cognitive skills: analysis, interpretation, inference, evaluation, explanation, induction, deduction, and numeracy, as well as an overall rating (Insight Assessment, n.d.). All CCTST parameters are scored on a 100-point scale, with qualitative ratings of Superior, Strong, Moderate, Weak, and Not Manifested (Insight Assessment, n.d.). The duration is 55 minutes, with 40 scenario-based questions. CCTST is offered in 18 languages and is conducted online (Insight Assessment n.d.). The CCTST validation procedure included college students, employees, military individuals, K-12 students, health experts, and the general public (Butler, 2024). It also underwent tests to determine its vulnerability to social desirability and cultural prejudice. Face validity is based on the Delphi Report's definition of critical thinking. For construct validity, CCTST scores were compared to Graduate Record Examination (GRE) results (r=0.719). Butler (2024) reports an internal consistency of 0.70 and test-retest reliability of 0.80. CCTST is a paid assessment (Insight Assessment n.d.).

California Critical Thinking Dispositions Inventory (CCTDI; Insight Assessment)
The CCTDI is an inventory of critical thinking dispositions. This test was first developed by Facione & Facione (1992) to gauge one's ability to think critically. The CCTDI assesses the following dispositions: truth-seeking, open-mindedness, analyticity, systematicity, reasoning confidence, inquisitiveness, and cognitive maturity (Insight Assessment n.d.). The seven factors measured are based on Delphi Report's definition of critical thinking. It is intended for use by undergraduate, postgraduate, and adult learners (Insight Assessment n.d.). It takes about 30 minutes to complete the 75-item inventory of Likert-style agree/disagree items (Insight Assessment n.d.). It is available in digital version in 22 languages (Insight Assessment n.d.). All CCTDI measurements are scored on a 60-point scale, with corresponding qualitative ratings of Superior, Strong, Moderate, Weak, and Not Manifested (Insight Assessment n.d.). The Cronbach's alpha for CCTDI is 0.91, but it varies with population (Butler, 2024). CCTDI is a paid assessment (Insight Assessment n.d.).

Cornell Critical Thinking Test (CCTT; The Critical Thinking Co)
This assessment measures critical thinking skills and abilities (Ennis et al., 1985). The assessment is available in two versions: level X is designed for students from grades 5 to 12, and level Z is aimed for advanced and gifted high school students, college students, graduate students, and adults (The Critical Thinking Co n.d.). Level X is a 71-item multiple-choice test that can be completed in 50 minutes, either timed or not (The Critical Thinking Co n.d.). Level X evaluates inductive reasoning, deduction, credibility, and assumption identification (The Critical Thinking Co n.d.). Level Z is a 52-item multiple-choice test. It can be conducted as a

50-minute timed or untimed evaluation. Level Z evaluates induction, deduction, believability, assumption identification, semantics, definition, and prediction in planning experiments (The Critical Thinking Co n.d.). The reliability and validity are available upon purchase of the manual but peer reviewed research reveal internal consistency ranging from 0.52 to 0.77 and split-half reliability ranging from 0.55 to 0.76 (Bart, 2010). The validity of the association between students' grades and evaluation scores was low, with r = 0.15-0.17 (Michael et al., 1980). The assessment's psychometric properties were revised in 2005 (Butler, 2024). There is a fee for the use of this inventory (The Critical Thinking Co n.d.).

Watson Glaser Critical Thinking Appraisal (W-G III ; Pearson)

The Watson Glaser Critical Thinking Appraisal is a globally recognised test that assesses an individual's ability to analyse, reason, interpret, and derive logical conclusions from written information. Since the first version of Watson-Glaser was developed in 1920s, it has been extensively studied till today (Watson & Glaser, 1980). This test is designed for individuals who are 16 years and above. WGCTA has undergone subsequent revisions since its initial introduction with the latest being W-G III (Pearson n.d.). It assesses the ability to draw inferences, identify assumptions, deductive reasoning, interpretation and evaluating arguments (Pearson n.d.). It consists of 40 multiple-choice and can be administered online in 30 minutes (Pearson n.d.). It is available in at least seven languages. Along with individual percentile results for the three subscales – recognizing assumptions, evaluating arguments and drawing conclusions, an overall percentile score is also shown (Pearson n.d.).

A correlation coefficient of 0.62 was observed between the scores on the Watson-Glaser test and the average final exam grade in a sample of 123 trainee barristers. In a subsequent study involving 988 individuals, a correlation of 0.51 was found between average final exam grade and scores on items from the Watson-Glaser Unsupervised. These studies provide strong evidence in support of WGCTA (Pearson n.d.).

Ennis–Weir Critical Thinking Essay (Ennis & Weir, 1985)

This assessment evaluates critical thinking skills, namely in the areas of argumentation and evaluation by requesting respondents to assess fictional letters addressed to newspaper editors. The test takers address the inaccuracies and provide counter- arguments to support of their views. According to Ennis and Weir (1985), this reduces the artificiality of the testing environment. The assessment's psychometric qualities have been thoroughly investigated in 24 studies (Ennis 2005; Ennis &Weir 2005). Bart (2010) found that the assessment's external and content validity were both satisfactory, but criterion validity has yet to be proven. The college student sample has high interrater reliability (r = 0.86 to 0.99), but low internal reliability (Cronbach's α = 0.59). The assessment's lack of internal reliability and criteria validity raises issues regarding its application in evaluating critical thinking skills. This assessment is free, making it a viable option for instructors who have limited financial resources.

Discussion and Conclusion

Standardised critical thinking examinations are gaining traction as one of the key educational tools in IHL however there is limited evidence that it is occurring (Butler, 2024). Given that critical thinking skills are transferable in a variety of settings, generic evaluations can be considered an appropriate way for assessing students' critical thinking abilities. The analysis of these assessments clearly shows that the test developers' concept of critical thinking determines the specific features examined. Most critical thinking tests measure core competencies such as

argument analysis and reasoning. However, the same cannot be said for critical thinking disposition assessments, as the subscales tested exhibit a high degree of heterogeneity.

Critical thinking is a contested terrain. Problems arise when we evaluate the effectiveness or relevance of academic programmes through the use of standardised tests. Concerns over the reliability and validity of these tests must be addressed. As it takes time to assess critical thinking skills and dispositions, it may be viewed as additional work by the faculty or university (Butler, 2024). The financial aspect should also be given due consideration, as most assessments must be purchased from test developers.

A practical approach will be by implementing programmes that undergo rigorous review at faculty level and are led by teaching professionals trained in critical thinking pedagogies (Rear, 2019). This can avoid the limitations associated with standardised testing. Efforts to enhance critical thinking skills among university students in different academic fields can be facilitated by engaging with relevant stakeholders. Through these interactions, stakeholders can highlight the skills required by graduates. The strong collaboration between universities and stakeholders should be able to reduce discrepancies when transitioning to the labour market.

Acknowledgements

References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Wade, A., Surkes, M. A., Tamim, R., & Zhang, D. (2008). Instructional Interventions Affecting Critical Thinking Skills and Dispositions: A Stage 1 Meta-Analysis. *Review of Educational Research, 78*(4), 1102-1134. https://doi.org/10.3102/0034654308326084

Ain Nadzimah Abdullah., & Rosli Talif. (2001). *Bilingualism is Portable*. In Jayakaran Teh Chee Seng (Eds). Trends in English Language : Selected papers from the Malaysian International Conference on ELT. UPM: Serdang.

Aziz Yahya., Safiah Sidek., & Zanariah Jano. (2011). *Critical Thinking Skills among Final Year.Students Of Malaysian Technical Universities*. Malaysian Technical Universities International Conference On Engineering and Technology.

Barnes, C. A. (2005). *Critical thinking revisited: Its past, present, and future.* New Directions for Community Colleges (130), 5-13.

Bart, William. (2010). *The Measurement and Teaching of Critical Thinking Skills*. Tokyo: Invited colloquium given at the Center for Research on Education Testing.

Butler, H. A. (2012). Halpern Critical Thinking Assessment predicts real-world outcomes of critical thinking. *Applied Cognitive Psychology, 26*(5), 721-729.

Butler, H. A. (2024). Predicting Everyday Critical Thinking: A Review of Critical Thinking Assessments. *Journal of Intelligence*, 12(2), 16.

Cheong, K. C., Hill, C., Fernandez-Chung, R., & Leong, Y. C. (2016). Employing the'unemployable': employer perceptions of Malaysian graduates. *Studies in Higher Education, 41*(12), 2253-2270. Community Colleges. 130.

Dewey, J. (1933) *How We Think: A Restatement of the Relation of Reflective Thinking to the Educational Process*. Lexington, MA: Heath Publishing. Originally published in 1910.

Dumitru, D., & Halpern, D. F. (2023). Critical Thinking: Creating Job-Proof Skills for the Future Of Work. *Journal of Intelligence, 11*(10), https://doi.org/10.3390/jintelligence11100194

Dwyer, Cristopher P. (2017). *Critical Thinking: Conceptual Perspectives and Practical Guidelines. Cambridge*: Cambridge University Press.

Elder, L. (2005). *Critical Thinking as the Key to the Learning College: A Professional Development Model*. New Directions for Community Colleges. 130.

Ennis, R. H., & Weir, Eric. (1985). *The Ennis–Weir Critical Thinking Essay Test*. Pacific Grove, CA: Midwest Publications.

Ennis, R. H., J. Millman, & T. N. Tomko. (1985). *Cornell Critical Thinking Tests*. Pacific Grove, CA: Midwest Publications

Ennis, Robert., & Weir, Eric. (2005). *Ennis-Weir Critical Thinking Essay Test*. Seaside: The Critical Thinking Company. Available online: https://www.academia.edu/1847582/The_Ennis_Weir_Critical_Thinking_Essay_Test_An_Instrument_for_Teaching_and_Testing (accessed on 20 July 2024).

Ennis, Robert. (2005). *The Ennis-Weir Critical Thinking Essay Test*. Urbana: The Illinois Critical Thinking Project.

Facione, P. A. (2000). "The Disposition toward Critical Thinking: Its Character, Measurement, and Relation to Critical Thinking Skill." *Informal Logic 20, (1):*61–84.

Facione, P. A., and N. C. Facione. (1992). *The California Critical Thinking Dispositions Inventory*. Millbrae, CA: California Academic Press.

Facione, P.A. (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction*. California Academic Press.

Facione, Peter; Facione, Noreen & Giancarlo Gittens, Carol. (2000). The Disposition Toward Critical Thinking: Its Character, Measurement, and Relationship to Critical Thinking Skill. *Informal Logic. 20*. 10.22329/il.v20i1.2254.

Flores, K., Matkin, G., Burbach, M., Quinn, C., & Harding, H.(2012). Deficient Critical Thinking Skills among College Graduates: Implications for Leadership: *Educational Philosophy and Theory, 44*(2), 212-230.

Ghadi, I.N., Bakar, K.A., & Njie, B. (2015). Influences of critical thinking dispositions on critical thinking skills of undergraduate students at a Malaysian Public University. *Journal of Educational Research and Reviews, Vol. 3*(2)

Greenberger, S. W. (2020). Creating a guide for reflective practice: applying Dewey's reflective thinking to document faculty scholarly engagement. *Reflective Practice, 21*(4), 458-472.

Guest, K. (2000). Introducing critical thinking to non-standard entry students: The use of a catalyst to spark debate. *Teaching in Higher Education*. 5.

Halpern, D.F., & Dunn, D.S. (2021). Critical Thinking: A Model of Intelligence for Solving Real-World Problems. *Journal of Intelligence*, 9.

H. A., Pentoney, C., & Bong, M. P. (2017). Predicting real-world outcomes: Critical thinking ability is a better predictor of life decisions than intelligence. *Thinking Skills and Creativity, 25*, 38-46.

Halpern, Diane F., and Dana S. Dunn. (2023). *Thought and Knowledge: An Introduction to Critical Thinking, 6th ed*. New York: Routledge Taylor & Francis.

Hanim, N., Aripin, N., & Lin, N. M. (2020). Exploring the connection between critical thinking skills and academic writing. *International Journal of Asian Social Science, 10*(2), 118-128.

Hart Research Associated. (2018).Fulfilling the America Dream: Liberal Education and the Future of Work. [(accessed on 10 August 2024)].

Hasnain, Z. (2023). The MMR vaccine and autism. https://repository.rcsi.com/articles/journal_contribution/The_MMR_vaccine_and_auti

sm/23522913?backTo=%2Fcollections%2FRCSIsmj_2012-13%2F6771753&file=41253003

Hitchcock, D. (2020). Seven philosophical conceptions of critical thinking: themes, variations, implications. *In Critical Thinking and Reasoning* (pp. 9-30). Brill.

https://insightassessment.com/ (n.d)

https://www.criticalthinking.com/ (n.d)

https://www.pewresearch.org/internet/fact-sheet/social-media/ (n.d)

https://www.talentlens.com/recruitment/assessments/watson-glaser-critical-thinking appraisal.html (n.d)

https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(97)11096-0.pdf (n.d)

Insight Assessment, Inc. (n.d). *Critical Thinking Attribute Tests: Manuals and Assessment Information*. Hermosa Beach.

https://www.pewresearch.org/internet/fact-sheet/social-media/ (2023).

Michael, Joan., Roberta Devaney., &William Michael. (1980). The factorial validity of the Cornell Critical Thinking Test for a junior high school sample. *Educational and Psychological Measurement 40*: 437–50.

N. M. Zhaffar., M. I. Hamzah., & K. A. Razak.(2017). Elemen pemikiran kritis dalam konteks kemahiran berfikir aras tinggi, *ASEAN Comparative Education Research Journal on Islam and Civilization, 1*(2), pp. 92-101.

Puig, B., Blanco Anaya, P., & Bargiela, I. M. (2020). A systematic review on e-learning environments for promoting critical thinking in higher education. *Handbook of research in educational communications and technology*: *Learning design*, 345-362.

Rear, D. (2019). One size fits all? The limitations of standardised assessment in critical thinking. *Assessment & Evaluation in Higher Education, 44*(5), 664-675.

Rosnani Hashim., & Suhailah Hussein. (2003). *The teaching of thinking in Malaysia. Research Centre*. International Islamic University Malaysia. Kuala Lumpur.

Rosyati Abdul Rashid., & Rosna Awang. (2008). *The Relationship between Critical Thinking and Language Proficiency of Malaysian Undergraduates*. Retrieved 19 July 2024 http://ro.ecu.edu.au/cgi/viewcontent.cgi?article=1035&context=ceducom

Tiwari, A., Lai, P., So, M., & Yuen, K. (2006). A Comparison of the Effects of Problem-Based Learning and Lecturing on the Development of Students' Critical Thinking. *Medical Education, 40*(6).

Van Gelder, T. (2005). Teaching Critical Thinking: Some lessons from cognitive science: *College Science Teaching, 53* (1). 41-46.

Watson, G., & E. M. Glaser. (1980). *Watson–Glaser Critical Thinking Appraisal, Forms A and B Manual*. San Antonio,TX: The Psychological Corporation

Weiser, B & Schweber, N (2023, June 8.) *The ChatGPT Lawyer Explains Himself*. The New York Times. https://www.nytimes.com/2023/06/08/nyregion/lawyer-chatgpt-sanctions.html