JOURNAL OF RESEARCH, INNOVATION, AND STRATEGIES FOR EDUCATION
VOL. 2, NO. 4, PP. 19-29, AUGUST 2025
https://doi.org/10.70148/rise.v2i4.2

Academic Performance and Critical Thinking Among Secondary Students: A Conceptual Exploration of Disposition and Demographic Influences

Ying Ying, Chin *[1] and Fung Lan, Loo [2]

[1,2] Faculty of Education, Open University Malaysia

ABSTRACT

Malaysia's performance in international assessments, such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS), remains a critical concern, with national scores consistently lagging behind many participating countries. The 2022 PISA report identified Malaysia among the five countries with the steepest declines in reading, mathematics, and science. Despite extensive educational reforms, particularly the promotion of 21st-century learning to cultivate Critical Thinking Skills (CTS), student outcomes remain stagnant. This raises questions about factors beyond instruction or curriculum quality that may influence achievement. CTS are essential for enhancing cognitive abilities, improving academic outcomes, and preparing learners for the complexities of the Fourth Industrial Revolution. However, prior studies in Malaysia have rarely examined how Critical Thinking Disposition (CTD) and demographic factors interact with CTS to shape academic performance. This study addresses that gap by investigating CTD as a mediator between CTS and academic performance among Form Two students and examining whether demographic variables, specifically gender and socioeconomic status, moderate these relationships. By explicitly linking CTS, CTD, and demographic influences, the study provides a comprehensive understanding of the mechanisms underlying academic performance. The findings offer evidence-based insights for educators and policymakers to design targeted interventions, curricula, and policies that not only develop critical thinking skills but also foster dispositions and address demographic disparities, thereby enhancing student outcomes in Malaysia.

ARTICLE HISTORY
Received 20 August 2025
Revised 20 September 2025
Accepted 22 Accepted 2025

KEYWORDS
Critical Thinking Skills; Critical Thinking Disposition; Academic performance; Demographic factors; Secondary schools

CONTACT Ying Ying, Chin yingyingchin@oum.edu.my Faculty of Education, Open University Malaysia. **ISSN : 3030-6582 (Printed), eISSN : 3030-5330 (Online).** DOI rise.v2i4.2.

1. Introduction

The development of critical thinking skills (CTS) has attracted increasing scholarly attention in recent years (Schmaltz, Jansen, & Wenckowski, 2017; Walker, 2003), reflecting its importance in preparing learners for 21st-century challenges (Ataizi & Donmez, 2014). CTS are a central component of higher-order thinking skills (HOTS), which encompass advanced cognitive processes such as creativity and problem-solving. This study focuses specifically on CTS as a key element for equipping students to navigate complex, real-world situations.

CTS involve observing, assessing, communicating, generating ideas, and solving problems through higher-level reasoning (Florea & Hurjui, 2015; Tempelaar, 2006). They include analysing, inferring, interpreting, evaluating, and explaining information to draw conclusions and resolve conflicts (Flores et al., 2012; Halpern, 2001; Rhodes, 2010; Widiandari & Redhana, 2021). Unlike intelligence, which often measures memory, vocabulary, or logical reasoning, CTS represent a broader capacity for reasoned judgement (Stanovich & West, 2008; Butler & Halpern, 2020).

Globally, education systems such as those in Finland, Singapore, Australia, Canada, and New Zealand have embedded 21st-century learning elements to ensure national competitiveness. Malaysia has responded with substantial reforms, including revising assessment frameworks to emphasise CTS. By 2021, up to 50% of Sijil Pelajaran Malaysia (SPM) examination items required CTS-based responses (Supramani, 2006; Malaysian Examination Board, 2013).

Despite these reforms, Malaysian student performance remains uneven. Persistent gaps exist between urban and rural schools, across socioeconomic groups, and among school types. International benchmarks such as PISA and TIMSS continue to show Malaysian students underperforming relative to global averages (Ministry of Education Malaysia, 2013). In PISA 2022, national averages again fell below the OECD mean, with scores and rankings showing further stagnation (Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, Ministry of Education Malaysia, 2023). Similarly, fewer than 30% of SPM candidates in 2023 produced strong responses in analysis, evaluation, and creation (Lembaga Peperiksaan, 2023).

Malaysia's School-Based Assessment (Pentaksiran Berasaskan Sekolah, PBS) framework, including the End of Academic Session Examination (Ujian Akhir Sesi Akademik, UASA), seeks to balance formative and summative evaluation. Yet high-stakes exams such as SPM and STPM still dominate academic outcomes. These persistent gaps in performance suggest that revising assessment formats alone is insufficient. Students must not only develop but also consistently apply critical thinking skills. This underlines the need to examine why some students fail to transfer CTS effectively, highlighting the role of critical thinking disposition (CTD).

While many students acquire CTS, their consistent application depends on their critical thinking disposition (CTD), which is the willingness and motivation to think critically. Scholars emphasise that critical thinking comprises both skills and dispositions (Ennis, 1987; Halonen, 1995; Halpern, 1998; McPeck, 1981; Kennedy, Fisher, & Ennis, 1991). Neglecting CTD risks undermining skill development efforts, as skills alone may not translate into performance (Pascarella & Terenzini, 1991; Paul & Elder, 2001; Siegel, 1998, as cited in Orhan, 2022).

Demographic factors such as gender and socioeconomic status (SES) further shape students' opportunities and outcomes (Bradley & Corwyn, 2002; Sirin, 2005; Macionis, 2017). In Malaysia, girls tend to outperform boys in language-based subjects and overall SPM results (Ministry of Education Malaysia, 2023). Students from higher SES backgrounds benefit from enriched learning environments, while lower SES peers face persistent disadvantages (OECD, 2019; Sirin, 2005; UNESCO, 2020).

Most national reforms have concentrated on strengthening CTS, yet insufficient attention has been paid to cultivating CTD. However, prior studies have largely focused on CTS or CTD in isolation and have rarely examined their combined effect on academic performance, particularly considering demographic influences such as gender and SES. These patterns suggest that academic performance cannot be explained by CTS alone. This study offers insights not yet explored by investigating how CTD mediates the relationship between CTS and academic achievement, with gender and SES serving as moderating variables.

2. Literature review

2.1. Past studies

2.1.1. Critical thinking

Critical thinking supports sound decision-making and problem-solving (Facione, 2013) and is central to 21st-century education, where complex thinking skills prepare students for real-life challenges (Daemicke et al., 2020). It promotes independent thought, personal responsibility, and thoughtful choices (Latif et al., 2019), making it essential for academic and career success (Bandyopadhyay & Szostek, 2018).

Theories frame critical thinking in varied ways. Bloom's Revised Taxonomy positions it at higher-order levels: analysing, evaluating, creating (Anderson & Krathwohl, 2001). Paul and Elder (2014) distinguish logical, scientific, and reflective thinking. Subject contexts also matter: philosophical approaches emphasise logic and ethics, while scientific thinking relies on evidence and testing (Facione, 1990). Sternberg's triarchic theory highlights analytical, creative, and practical dimensions for real-world application (Sternberg, 1985).

Critical thinking develops through deliberate instruction and practice rather than automatically (Halpern, 1998; Kuhn, 1993). Yet many students struggle to acquire these skills, and teachers find them challenging to teach. Studies show benefits: Butler et al. (2017) found higher CTS linked to fewer negative life events, while Huber and Kuncel (2015) observed university students improve over time, albeit less than in earlier decades. However, Butler (2024) and Arum and Roksa (2010) questioned whether universities sufficiently nurture critical thinking.

While skills are vital, willingness to apply them, critical thinking disposition (CTD) is equally important (Pascarella & Terenzini, 1991). Skills without motivation, or motivation without skills, rarely lead to critical thought (Paul & Elder, 2001). Facione et al. (1995, 1997) identified seven key traits of a critical thinker: truth-seeking, open-mindedness, analyticity, organisation, self-confidence, curiosity, and maturity, forming the basis of the California Critical Thinking Disposition Inventory. Later models adapted these traits for specific contexts (Yoon, 2004; Sosu, 2013; Bravo et al., 2020), with Quinn et al.'s (2020) 21-item Student–Educator Negotiated Scale and Liu and Pásztor's (2022) workplace-focused inventory offering broader perspectives. Although these tools validate disposition structures, Zhao et al. (2023) noted unresolved questions about how components interrelate, particularly outside higher education.

Researchers agree that strong dispositions enhance the application of critical thinking skills (Bell & Loon, 2015), and both can be fostered simultaneously through effective teaching. Yet CTD has been less studied because it is harder to measure than CTS (Bravo et al., 2020). Even trained students may not apply skills consistently due to exam-oriented teaching and limited authentic practice (Choy & Cheah, 2009; Kwan & Wong, 2015). Building dispositions is therefore crucial for sustaining critical thinking beyond formal schooling (Liu & Pásztor, 2022).

2.1.2. Academic performance

Academic performance, commonly measured through grades or GPA, reflects students' mastery of learning objectives and informs decisions by educators and policymakers (Asiah et al., 2019; Camelo & Elliott, 2019). In Malaysia, the Ujian Akhir Sesi Akademik (UASA) as an important component under the Pentaksiran Berasaskan Sekolah (PBS) system ensure that assessments capture higher-order thinking, not rote memorisation. Converting UASA marks to GPA offers a stable indicator for monitoring progress and targeting interventions (Miguéis et al., 2018; Richardson et al., 2012).

While GPA is often used in scholarships and employment screening (Kuncel & Hezlett, 2007), its determinants remain contested. Factors like motivation, feedback, and engagement influence performance (Denton, 2014; Paloș et al., 2019), but their interactions are unclear. Some researchers treat GPA as an objective benchmark (Miguéis et al., 2018), while others highlight broader influences such as educational goals and SES (Sirin, 2005).

2.1.3. Demographic factors

Demographics such as gender and SES shape learning opportunities and academic achievement (Bradley & Corwyn, 2002). Globally, girls often outperform boys in reading, while boys may initially excel in mathematics, though gaps narrow over time (UNESCO, 2022; Mullis et al., 2020; Reardon et al., 2018). Malaysian data show progress in reducing gender and SES achievement gaps (Ministry of Education Malaysia, 2024), yet disparities persist. SES continues to influence access to resources and support, although effective schools can mitigate disadvantages (Perry & McConney, 2010). In critical thinking research, gender and SES act as moderators affecting how students develop and apply CTS and CTD (Halpern, 1998; Facione, 1990). Recognising these contextual factors is vital for understanding variations in academic performance.

2.2. Halpern's Four-Part Model and Bronfenbrenner's Ecological Systems Theory

Halpern's Four-Part Model (1998) integrates critical thinking skills and dispositions across four components: dispositions for thinking, instruction in skills, structure for transfer, and metacognitive monitoring. It underscores the interplay between abilities and willingness to think critically. Bronfenbrenner's Ecological Systems Theory (1979, 2005) situates this development within interacting environmental systems, where gender and SES moderate opportunities and expectations. Together, they provide a comprehensive framework for examining cognitive processes and environmental influences on academic achievement.

2.3. Relationship between variables

Students with strong CTS typically perform better academically (Abrami et al., 2008; Dwyer et al., 2014; Wicaksana et al., 2020). Asian studies confirm these links in STEM subjects (Zubaidah et al., 2018; Aini et al., 2021), while meta-analyses find moderate correlations (Fong et al., 2017). Yet some scholars report weak or context-dependent effects (Gellin, 2003; Richardson et al., 2012), suggesting CTS alone may not explain performance.

Positive correlations between CTS and CTD are common (Facione et al., 1995; Shin et al., 2006) but not universal: some studies find weak or even negative relationships (Facione & Facione, 1997; Ricketts, 2004). Similarly, CTD often predicts better grades and problem-solving (Tiwari et al., 2003; Ren et al., 2020) but with mixed findings across contexts (Sepahi et al., 2014; Shakurnia et al., 2021). Gender and SES also show inconsistent effects. Female students may score higher in CTD traits, while SES advantages correlate with higher achievement but can be offset by supportive learning environments (Albarracín-Vivo et al., 2024; Pascarella et al., 2013).

These inconsistencies suggest that academic performance cannot be explained by CTS or CTD alone. Instead, disposition may mediate the skill–performance relationship, while demographic factors moderate how these relationships unfold across student populations.

3. Conceptual framework

CTS, drawing from the Watson-Glaser model, is conceptualised as comprising five key abilities: inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments. These elements form the basis for evaluating students' critical thinking skill levels. Critical thinking skills are posited to exert both direct effects on academic performance and indirect effects through critical thinking disposition (CTS → CTD → Academic Performance).

CTD, framed as a set of attitudinal tendencies identified by Facione (1990), encompasses key dimensions such as open-mindedness, analyticity, inquisitiveness, self-confidence, and systematicity. These attributes reflect a learner's willingness to engage thoughtfully and persistently with problems and ideas. Within this framework, CTD serves as a mediating variable, complementing critical thinking skills to influence academic performance.

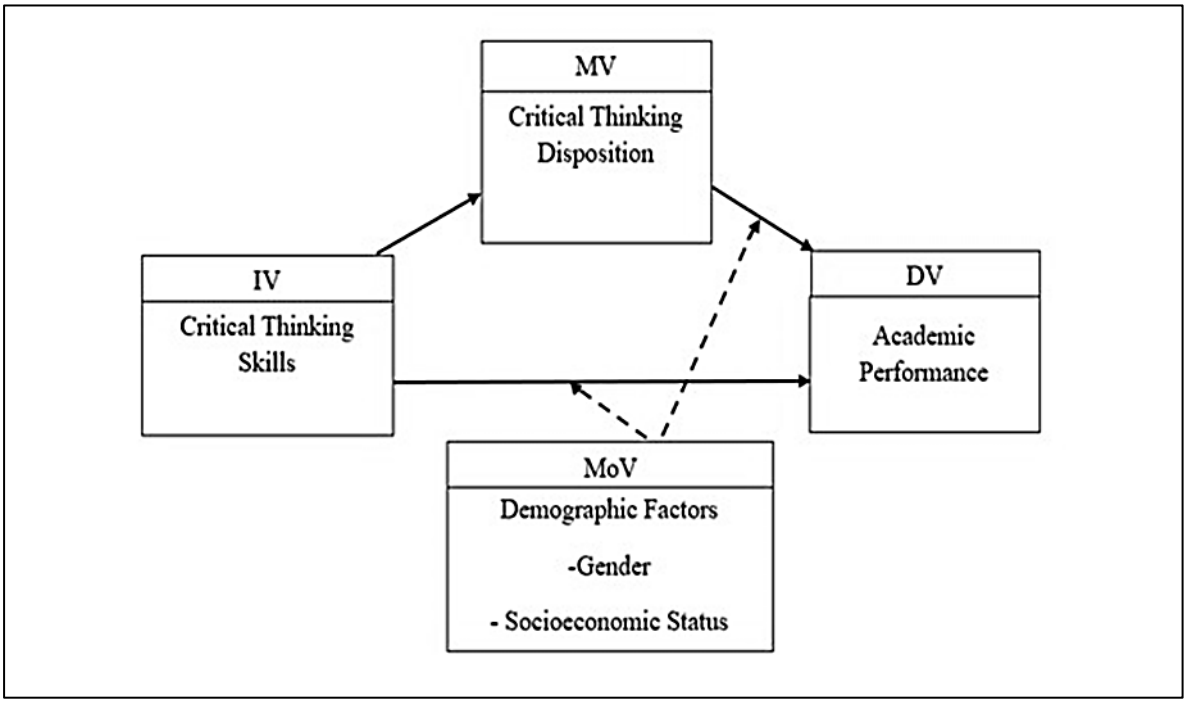
Gender serves as the first moderating variable. Shubina and Kulakli (2019) found that female students often exhibit stronger critical thinking performance, and a recent Malaysian study by Omar and Awang (2022) provides local

evidence for gender-related differences in CTS. SES functions as the second moderating variable. Consistent with Macionis (2017), socioeconomic status shapes learning opportunities, cognitive development, and achievement. Krishnan, Reston, and Sukumaran (2021) further highlight SES-related disparities in Malaysian educational contexts, reinforcing the relevance of SES in this study.

These relationships are grounded in Halpern's Four-Part Model, which integrates critical thinking skills and dispositions in predicting academic outcomes. Bronfenbrenner's Ecological Systems Theory further supports the inclusion of gender and SES as moderating factors. The primary focus is to conceptualise and examine the interplay between the independent variable (critical thinking skills), the dependent variable (academic performance), the mediating variable (critical thinking disposition), and the moderating variables (gender and SES). Figure 1 depicts these relationships in a conceptual model, positioning CTS as the independent variable, CTD as the mediator, academic performance as the dependent variable, and gender and SES as moderators.

Figure 1

Conceptual framework of the paper



4. Implications

This paper addresses a crucial gap in understanding the mediating role of CTD and the moderating effects of demographic factors (gender and SES) on the relationship between CTS and academic performance among secondary school students. By examining these connections, it identifies key contributors to persistent educational challenges and offers actionable insights for students, teachers, and policymakers.

For students, the discussion underscores the importance of critical thinking in academic success. Dispositions such as open-mindedness and curiosity can strengthen their ability to analyse and evaluate information effectively. Recognising this can encourage more active engagement with learning, improve problem-solving skills, and better prepare students for future academic and professional demands.

For teachers, the implications extend to instructional strategies, particularly the integration of critical thinking development into classroom practices. Given the focus on Form Two students, the recommendations emphasise tailoring interventions to this critical stage of cognitive and skill development. Teachers can design teaching approaches that reflect diverse student backgrounds, considering demographic factors such as gender and socioeconomic status. Identifying groups that require additional support enables equitable and personalised learning experiences. Early detection of gaps can also guide targeted interventions to prepare students for international assessments like PISA at age 15. Fostering CTS in this way not only enhances academic performance but also cultivates independent thought and lifelong learning.

For policymakers, the findings provide evidence-informed recommendations for shaping education policy and practice. Beyond embedding CTS and CTD in the national curriculum and teacher training programmes, assessment reforms could prioritise evaluating students' critical thinking processes rather than rote memorisation, while teacher appraisal systems may include indicators of how effectively educators foster CTS and CTD. Additionally, targeted resource allocation for disadvantaged schools, such as providing modern learning tools, smaller class sizes, or specialised training, can help close persistent achievement gaps. Recognising demographic influences, particularly SES, can further reduce disparities and promote fairness in access to high-quality education. Collectively, these insights emphasise the significance of informed policy decisions and practical interventions, contributing to more effective, evidence-based strategies that improve student outcomes and strengthen Malaysia's education system.

5. Summary

Education serves as a pillar of Malaysia's national development, shaping citizens' knowledge, values, and competencies while driving economic growth and improving living standards.

The challenge in strengthening critical thinking may not stem from a lack of reform efforts but from an unbalanced focus. Existing initiatives have emphasised skill-building, yet they have paid less attention to critical thinking disposition, which is the willingness and motivation to apply those skills. Overlooking this element risks limiting the impact of skills-based interventions on students' academic achievement.

This paper's proposed framework positions disposition as a mediating link between critical thinking skills and academic performance, while acknowledging that demographic factors such as gender and socioeconomic status can moderate these relationships. To enhance critical thinking in Malaysia, education reforms should adopt a more balanced strategy: teachers must not only teach critical thinking skills but also nurture students' readiness to apply these abilities in meaningful, real-world contexts.

Finally, further research should extend and validate this framework while informing assessment reforms, teaching practices, and policy decisions that support both skill and disposition development. Strengthening this dual emphasis is vital for preparing Malaysian students to innovate, thrive in the Fourth Industrial Revolution, and sustain the country's competitiveness in a rapidly changing global landscape.

Declarations

Acknowledgements
No funding was received for this work.

Competing Interests
None.

Ethical Approval

This paper was granted an exemption from requiring ethics approval as it does not involve human participants or the collection of sensitive personal data. The work is based on secondary sources and is intended solely as an academic project, in accordance with institutional guidelines that classify this type of work as low-risk and not subject to formal ethics approval.

Author's Contribution

Ying Ying, Chin[1]: Conceptualization, Literature review, Writing – original draft
Fung Lan, Loo[2]: Supervision, Guidance, Critical feedback – review and editing

Data availability

No new data were generated for this paper. All information discussed is drawn from previously published sources, which are cited in the reference list.

References

Abrami, P. C., Bernard, R. M., Borokhovski, E., Waddington, D. I., Wade, A., & Persson, T. (2008). Instructional interventions affecting critical thinking skills and dispositions: A Stage 1 meta-analysis. *Review of Educational Research, 78*(4), 1102–1134.

Aini, N., Yasin, R. M., & Sahabudin, N. A. (2021). The impact of critical thinking skills on science and mathematics performance among Malaysian secondary school students. *Journal of Education and Learning, 10*(3), 45–58.

Albarracín-Vivo, D., Encabo-Fernández, E., Jerez-Martínez, I., & Hernández-Delgado, L. (2024). Gender differences and critical thinking: A study on the written compositions of primary education students. *Societies, 14*(7), 118. https://doi.org/10.3390/soc14070118

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of educational objectives.* Longman.

Arum, R., & Roksa, J. (2010). *Academically adrift: Limited learning on college campuses*. University of Chicago Press.

Asiah, M., Nik Zulkarnaen, K., Safaai, D., Nik Nurul Hafzan, M. Y., Mohd Saberi, M., & Siti Syuhaida, S. (2019). A review on predictive modeling technique for student academic performance monitoring. *MATEC Web of Conferences, 255,* 1–7.

Ataizi, M., & Donmez, M. (2014). Book review: 21st century skills: Learning for life in our times. *Contemporary Educational Technology, 5*(3), 272–274.

Bandyopadhyay, A., & Szostek, J. (2018). Employers' expectations of soft skills in graduates: A study of U.S. business schools. *Journal of Higher Education Theory and Practice, 18*(6), 29–36.

Bell, R., & Loon, M. (2015). The impact of critical thinking disposition on learning using business simulations. *The International Journal of Management Education, 13*(2), 119–127. https://doi.org/10.1016/j.ijme.2015.01.002

Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*, 371–399. https://doi.org/10.1146/annurev.psych.53.100901.135233

Bravo, A., Estrada, M. A., & Sosu, E. M. (2020). A unidimensional model of critical thinking dispositions: Evidence from Chilean high school students. *Thinking Skills and Creativity, 38*, 100722. https://doi.org/10.1016/j.tsc.2020.100722

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.

Bronfenbrenner, U. (2005). *Making human beings human: Bioecological perspectives on human development*. SAGE Publications.

Butler, 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. https://doi.org/10.1016/j.tsc.2017.06.005

Butler, H. A., & Halpern, D. F. (2020). Critical thinking impacts our everyday lives. In R. J. Sternberg & D. F. Halpern (Eds.), *Critical thinking in psychology* (2nd ed., pp. 152–172). Cambridge University Press. https://doi.org/10.1017/9781108569905.012

Butler, H. A. (2024). Predicting everyday critical thinking: A review of critical thinking assessments. *Journal of Intelligence, 12*(2), 16. https://doi.org/10.3390/jintelligence12020016

Camelo, K., & Elliott, M. (2019). Food insecurity and academic achievement among college students at a public university in the United States. *Journal of College Student Development, 60*(3), 307–318. https://doi.org/10.1353/csd.2019.0028

Choy, S. C., & Cheah, P. K. (2009). Teacher perceptions of critical thinking among students and its influence on higher education. *International Journal of Teaching and Learning in Higher Education, 20*(2), 198–206.

Daemicke, E. F., Galt, N. J., Samonds, K. E., & Bergan-Roller, H. E. (2020). Teaching higher-order thinking: Using primary literature to teach science literacy. *Journal of College Science Teaching, 50*(1), 32–41.

Denton, D. W. (2014). Using screen capture feedback to improve academic performance. *TechTrends, 58*(6), 51–56. https://doi.org/10.1007/s11528-014-0803-0

Dwyer, C. P., Hogan, M. J., & Stewart, I. (2014). An integrated critical thinking framework for the 21st century. *Thinking Skills and Creativity, 12*, 43–52. https://doi.org/10.1016/j.tsc.2013.12.004

Ennis, R. H. (1987). A taxonomy of critical thinking dispositions and abilities. In J. Baron & R. Sternberg (Eds.), *Teaching thinking skills: Theory and practice* (pp. 9–26). W. H. Freeman.

Ennis, R. H. (2011). *The nature of critical thinking: An outline of critical thinking dispositions and abilities*. University of Illinois.

Facione, P. A. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. The Delphi Report*. American Philosophical Association. https://files.eric.ed.gov/fulltext/ED315423.pdf

Facione, P. A., Sánchez, C. A., Facione, N. C., & Gainen, J. (1995). The disposition toward critical thinking. *The Journal of General Education, 44*(1), 1–25. https://doi.org/10.1353/jge.2008.0021

Facione, P. A., Facione, N. C., & Giancarlo, C. A. F. (1997). *The California Critical Thinking Disposition Inventory (CCTDI): Test manual*. California Academic Press.

Facione, N., & Facione, P. (1997). *Critical thinking assessment in nursing education programs: An aggregate data analysis*. California Academic Press.

Facione, P. A. (2013). *Critical thinking: What it is and why it counts* (2013 ed.). Insight Assessment. https://www.insightassessment.com/wp-content/uploads/ia/pdf/whatwhy.pdf

Florea, N. M., & Hurjui, E. (2015). Critical thinking in elementary school children. *Procedia – Social and Behavioral Sciences, 180*, 565–572. https://doi.org/10.1016/j.sbspro.2015.02.161

Flores, K. L., Matkin, G. S., Burbach, M. E., & Quinn, C. E. (2012). Deficient critical thinking skills among college graduates: Implications for leadership. *Educational Philosophy and Theory, 44*(2), 212–230. https://doi.org/10.1111/j.1469-5812.2010.00657.x

Fong, C. J., Kim, Y. W., Davis, C. W., Hoang, T., & Kim, S. Y. (2017). A meta-analysis on critical thinking and community college student achievement. *Thinking Skills and Creativity, 26*, 71–83. https://doi.org/10.1016/j.tsc.2017.06.002

Gellin, A. (2003). The effect of undergraduate student involvement on critical thinking: A meta-analysis of the literature 1991–2000. *Journal of College Student Development, 44*(6), 746–762. https://doi.org/10.1353/csd.2003.0066

Halonen, J. S. (1995). Demystifying critical thinking. *Teaching of Psychology, 22*(1), 75–81. https://doi.org/10.1207/s15328023top2201_23

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist, 53*(4), 449–455. https://doi.org/10.1037/0003-066X.53.4.449

Halpern, D. F. (2001). Assessing the effectiveness of critical thinking instruction. *The Journal of General Education, 50*(4), 270–286. https://doi.org/10.1353/jge.2001.0024

Huber, C. R., & Kuncel, N. R. (2015). Does college teach critical thinking? A meta-analysis. *Review of Educational Research, 86*(2), 431–468.

Kennedy, M., Fisher, M. B., & Ennis, R. H. (1991). Critical thinking: Literature review and needed research. In L. Idol & B. P. Jones (Eds.), *Educational values and cognitive instruction: Implications for reform* (pp. 11–40). Lawrence Erlbaum Associates.

Krishnan, S., Reston, E., & Sukumaran, S. (2023). The relationship between Malaysian students' socio-economic status and their academic achievement in STEM education. *International Journal of Learning, Teaching and Educational Research, 22*(6), 533–551. https://doi.org/10.26803/ijlter.22.6.28

Kuhn, D. (1993). Connecting scientific and informal reasoning. *Merrill-Palmer Quarterly, 39*(1), 74–103.

Kuncel, N. R., & Hezlett, S. A. (2007). Standardized tests predict graduate students' success. *Science, 315*(5815), 1080–1081. https://doi.org/10.1126/science.1136618

Kwan, Y. W., & Wong, A. F. L. (2015). Effects of the constructivist learning environment on students' critical thinking ability: Cognitive and motivational variables as mediators. *International Journal of Educational Research, 70,* 68–79. https://doi.org/10.1016/j.ijer.2015.02.006

Latif, R. A., Yusuf, S. A. M., Tarmezi, N. A., Rosly, R. M., & Zainuddin, N. M. (2019). Critical thinking skills among students: A review of literature. *Journal of Critical Reviews, 6*(6), 77–82.

Lembaga Peperiksaan. (2023). *Laporan analisis keputusan peperiksaan Sijil Pelajaran Malaysia*. Kementerian Pendidikan Malaysia.

Liu, O. L., & Pásztor, A. (2022). Development of a workplace-oriented critical thinking disposition inventory: 2ES-CTDI. *Assessment & Evaluation in Higher Education, 47*(6), 845–860. https://doi.org/10.1080/02602938.2021.1988626

Macionis, J. J. (2017). *Sociology* (16th ed.). Pearson Education.

Malaysian Examination Board. (2013). *Higher-order thinking skills framework*. Ministry of Education Malaysia.

McPeck, J. E. (1981). *Critical thinking and education*. Martin Robinson.

Miguéis, V. L., Freitas, A., Garcia, P. J. V., & Silva, A. (2018). Early segmentation of students according to their academic performance: A predictive modelling approach. *Decision Support Systems, 115,* 36–51. https://doi.org/10.1016/j.dss.2018.09.001

Ministry of Education Malaysia. (2013). *Malaysia Education Blueprint 2013–2025*. https://www.moe.gov.my/menumedia/media-cetak/penerbitan/dasar/1207-malaysia-education-blueprint-2013-2025/file

Ministry of Education Malaysia. (2023). *Preliminary report on Malaysia's performance in PISA 2022*. Educational Planning and Research Division.

Ministry of Education Malaysia. (2024). *Malaysia Education Blueprint 2013–2025: Annual report 2023*. https://www.moe.gov.my/storage/files/shares/Dasar/PPPM/PPPM%20Laporan%20Tahunan%202023%20%28BI%29.pdf

Mullis, I. V. S., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). *TIMSS 2019 international results in mathematics and science*. TIMSS & PIRLS International Study Center, Boston College. https://timssandpirls.bc.edu/timss2019/international-results/

OECD. (2019). *PISA 2018 results (Volume II): Where all students can succeed*. OECD Publishing. https://doi.org/10.1787/b5fd1b8f-en

Omar, M. S., & Awang, M. I. (2022). Differences between gender and higher-order thinking skills. *Journal of Metrics Studies and Social Science, 1*(1), 1–10. https://doi.org/10.56916/jmsss.v1i1.39

Orhan, A. (2022). The relationship between critical thinking and academic achievement: A meta-analysis study. *Psycho-Educational Research Reviews, 11*(1), 283–299. https://doi.org/10.52963/PERR_Biruni_V11.N1.17

Paloș, R., Maricuţoiu, L. P., & Costea, I. (2019). Relations between academic performance, student engagement and student burnout: A cross-lagged analysis of a two-wave study. *Studies in Educational Evaluation, 60,* 199–204. https://doi.org/10.1016/j.stueduc.2019.01.005

Pascarella, E. T., & Terenzini, P. T. (1991). *How college affects students: Findings and insights from twenty years of research*. Jossey-Bass.

Pascarella, E. T., Wang, J. S., Trolian, T. L., & Blaich, C. (2013). How the instructional and learning environments of liberal arts colleges enhance cognitive development. *Higher Education, 66*(5), 569–583. https://doi.org/10.1007/s10734-013-9622-z

Paul, R., & Elder, L. (2001). *Critical thinking: Teaching students to think critically*. Foundation for Critical Thinking.

Paul, R., & Elder, L. (2014). *The miniature guide to critical thinking concepts and tools* (7th ed.). Foundation for Critical Thinking Press.

Perry, L. B., & McConney, A. (2010). School socio-economic composition and student outcomes in Australia: Implications for educational policy. *Australian Journal of Education, 54*(1), 72–85.

Quinn, V., Fynes-Clinton, S., & Waring, R. (2020). Developing critical thinking dispositions in students: Reflections on the role of teacher education. *Australian Journal of Teacher Education, 45*(9), 1–17.

Reardon, S. F., Fahle, E. M., Kalogrides, D., Podolsky, A., & Zárate, R. C. (2018*). Gender achievement gaps in U.S. school districts* (CEPA Working Paper No. 18-13). Stanford Center for Education Policy Analysis. https://cepa.stanford.edu/content/gender-achievement-gaps-us-school-districts

Ren, X., Tong, Y., Peng, P., & Wang, T. (2020). Critical thinking predicts academic performance beyond general cognitive ability: Evidence from adults and children. *Intelligence, 82*, 101487. https://doi.org/10.1016/j.intell.2020.101487

Rhodes, T. (Ed.). (2010). *Assessing outcomes and improving achievement: Tips and tools for using rubrics.* Association of American Colleges and Universities.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin, 138*(2), 353–387. https://doi.org/10.1037/a0026838

Ricketts, J. C., & Rudd, R. D. (2004). The relationship between critical thinking dispositions and critical thinking skills of selected youth leaders in the National FFA Organization. *Journal of Southern Agricultural Education Research*, 54(1), 21–33.

Schmaltz, R. M., Jansen, E., & Wenckowski, N. (2017). Redefining critical thinking: Teaching students to think like scientists. *Frontiers in Psychology, 8,* Article 459. https://doi.org/10.3389/fpsyg.2017.00459

Sepahi, V., Khazaei, M. R., Khoshay, A., Iranfar, S., & Timare, M. (2014). The correlation between critical thinking disposition and academic achievement of preclinical and clinical medical students at Kermanshah University of Medical Sciences. *Educational Research in Medical Sciences, 3*(1), e81198.

Shakurnia, A., Fazelinia, T., & Khajeali, N. (2021). The trend of critical thinking disposition in medical students and its relationship with their academic performance. *Journal of Education and Health Promotion, 10,* Article 479.

Shubina, I., & Kulakli, A. (2019). Critical thinking, creativity and gender differences for knowledge generation in education. *Literacy Information and Computer Education Journal, 10*(1), 3086–3093.

Shin, K., Jung, D., Shin, S., & Kim, M. S. (2006). Critical thinking dispositions and skills of senior nursing students in associate, baccalaureate, and RN to BSN programs. *Journal of Nursing Education, 45*(6), 233–237. Shin, S.,

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*(3), 417–453. https://doi.org/10.3102/00346543075003417

Sosu, E. M. (2013). The development and psychometric validation of a Critical Thinking Disposition Scale. *Thinking Skills and Creativity, 9,* 107–119. https://doi.org/10.1016/j.tsc.2012.09.002

Stanovich, K. E., & West, R. F. (2008). On the failure of cognitive ability to predict myside and one-sided thinking biases. *Thinking & Reasoning, 14*(2), 129–167. https://doi.org/10.1080/13546780701679764

Sternberg, R. J. (1985). *Beyond IQ: A triarchic theory of human intelligence*. Cambridge University Press.

Supramani, S. (2006). Penyoalan guru: Pemangkin pemikiran aras tinggi murid [Teachers' questions: Catalyst for HOTS]. *Jurnal Pendidikan, 26,* 225–247.

Tempelaar, D. T. (2006). The role of metacognition in business education. *Industry and Higher Education*, *20*(5), 291–297.

Tiwari, A., Avery, A., & Lai, P. (2003). Critical thinking disposition of Hong Kong Chinese and Australian nursing students. *Journal of Advanced Nursing*, *44*(3), 298–307. https://doi.org/10.1046/j.1365-2648.2003.02805.x

UNESCO. (2020). *Global education monitoring report 2020: Inclusion and education – All means all*. UNESCO Publishing.

UNESCO. (2022). *Global education monitoring report 2022: Gender report, deepening the debate on those still left behind* (Équipe du Rapport mondial de suivi sur l'éducation [947], Ed.). UNESCO. https://doi.org/10.54676/RCZB6329

Walker, S. E. (2003). Active learning strategies to promote critical thinking. *Journal of Athletic Training, 38*(3), 263–267.

Wicaksana, Y. D., Widoretno, S., & Dwiastuti, S. (2020). The use of critical thinking aspects on module to enhance students' academic achievement. *International Journal of Instruction, 13*(2), 303–314. https://doi.org/10.29333/iji.2020.13221a

Widiandari, L. A., & Redhana, I. W. (2021). Students' critical thinking skills in case study-based learning. *AIP Conference Proceedings, 2330*, Article 050019. https://doi.org/10.1063/5.0043204

Yoon, J. (2004). Development of a critical thinking disposition scale for nursing students. *Journal of Korean Academy*

of Nursing, 34(7), 1151–1159.
Zhao, Y., Xie, Q., & Liu, O. L. (2023). Conceptualizing critical thinking dispositions: A systematic review and integrative framework. *Thinking Skills and Creativity, 50*, 101251.
Zubaidah, S., Corebima, A. D., & Mistianah, A. (2018). Critical thinking skills of students in different learning strategies. *Journal of Physics: Conference Series, 947*, 012013.