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Fostering critical thinking in first-year accounting students: insights from a semester-long intervention

E. A. J. Terblanche [a], C. Joynt [b], M. Stiglingh [b], H. Du Preez [c] and L. Diedericks [d]

[a]Department of Auditing, University of Pretoria, Pretoria, South Africa; [b]Department of Accounting, University of Pretoria, Pretoria, South Africa; [c]Department of Taxation, University of Pretoria, Pretoria, South Africa; [d]Department of Human Resource Management, University of South Africa, Pretoria, South Africa

ABSTRACT

There have been demands in recent years for a focused inclusion of critical thinking in the accounting curriculum to enhance accounting students' critical thinking skills. This has placed the onus on accounting educators to actively explore ways in which accounting courses should be (re)designed to achieve this goal. This exploratory study employed a pre-test, post-test quasi-experimental design over two research cycles (2023 and 2024) to determine whether embedding explicit critical thinking instruction within a first-year course in an accounting degree could support students' development of critical thinking skills. The researchers firstly designed and implemented a one-semester critical thinking intervention aimed at enhancing students' critical thinking. Secondly, the researchers made use of the Abstract Reasoning Test (ART) and Critical Reasoning Test (CRT) to measure participants' abstract reasoning abilities and their verbal and numerical critical reasoning abilities before and after participation in this intervention. Results reveal a statistically significant difference ($p < 0.001$) between the pre-test and post-test scores of participants in both the ART and CRT assessments during both research cycles. These findings demonstrate that a one-semester critical thinking intervention, incorporating explicit critical thinking pedagogies and activities within the accounting curriculum, can provide support for the development of accounting students' critical thinking skills.

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Introduction

This study investigates whether embedding explicit critical thinking instruction within a first-year course in an accounting degree can support students' development of critical thinking skills. Critical thinking remains a contested concept, with no universally accepted definition in accounting education (Wolcott & Sargent, 2021). Paul and Elder (2019a, p. 9) describe it as 'the art of analysing and evaluating thought processes with a view to improving them,' a definition that emphasises its self-regulating and evaluative nature.

CONTACT C. Joynt corlia.joynt@up.ac.za

The significance of this study's research question lies in its alignment with both professional and educational imperatives. Professional frameworks highlight the importance of critical thinking for problem-solving, cultivating professional judgment, and adapting to change (CPA, 2020; IAESB, 2019). The World Economic Forum (WEF, 2025) includes critical thinking among the core skills for future employability, underscoring its salience for the profession. Although critical thinking has been identified as a crucial skill, it remains an underdeveloped competency in accounting graduates (Papageorgiou, 2023; Terblanche & De Clercq, 2021; Wolcott & Sargent, 2021). Employers, professional bodies, and accreditation frameworks have consistently called for the explicit development of critical thinking in higher education to better prepare accounting graduates for the profession's evolving demands (IAESB, 2019; Wilkin, 2017). Yet, there remains limited research into effective interventions that can be embedded in accounting curricula (Rossouw & Steenkamp, 2025). Consequently, this study is of interest to accounting educators, curriculum developers, and professional regulators seeking pedagogical strategies that foster higher-order reasoning and align with evolving competency expectations.

To address this research question, this study employed a quasi-experimental pre-test, post-test design across two research cycles (2023 and 2024). A one-semester intervention explicitly incorporated critical thinking pedagogies and activities within a first-year accounting course. The Abstract Reasoning Test (ART) and the Critical Reasoning Test (CRT) of PsyTech were administered to measure students' reasoning abilities before and after the intervention. Through this design, the study offers empirical evidence on whether targeted, short-term pedagogical interventions can meaningfully improve critical thinking outcomes. It further demonstrates a practical model for embedding explicit critical thinking instruction within the accounting curriculum, contributing both to theory and practice in accounting education.

Contribution

This paper serves as an example of how critical thinking can be meaningfully embedded within the accounting curriculum. The intervention draws on the principles of Paul and Elder's (2019a, 2019b) critical thinking framework, as well as the critical thinking competency framework for accounting students developed by Terblanche and De Clercq (2021). In doing so, it illustrates how educators can align internationally recognised frameworks with local professional requirements, such as those of the South African Institute of Chartered Accountants[1] (SAICA), without being restricted to a single competency model. By integrating these frameworks with explicit pedagogical strategies and assessment practices, the study offers a replicable approach to curriculum development that foregrounds critical thinking. The alignment with both global frameworks and local standards contributes to a curriculum design that supports the development of critical thinking skills relevant to both international and regional contexts.

Second, this study contributes to the accounting education literature and the ongoing discourse on the development of critical thinking in accounting students in two key ways: (i) this study responds to calls by Wolcott and Sargent (2021) and Papageorgiou (2023) for the *(re)design* of accounting curricula to better support critical thinking development. While recent studies such as those by Papageorgiou (2023) and Rossouw and Steenkamp (2025) offer valuable contributions, there remains a need for further research detailing

how critical thinking is explicitly embedded within accounting programmes, and (ii) this study adds to the growing body of empirical research *evaluating* the impact of educational interventions on students' critical thinking development. Unlike previous interventions assessed over a single research cycle, this study provides evidence that even a one-semester intervention – anchored in explicit pedagogical strategies and embedded within the accounting curriculum – can foster the development of critical thinking skills in undergraduate accounting students.

The remainder of this manuscript is structured as follows: the next section provides a background to provide greater context. Thereafter, a review of the literature on critical thinking, its development and measurement follows. The methodology section provides an overview of the study design, the educational intervention, participants and data collection instruments. In the data analysis section, more information is provided in terms of how the data from the data collection instruments was analysed. This is followed by the results section and a discussion of the results. Finally, some limitations of the study are provided with concluding remarks.

Background

The accounting profession continues to grapple with rapid changes in digital technologies, globalisation, and regulatory shifts (Wolcott & Sargent, 2021). Emerging tools such as artificial intelligence and robotic process automation increasingly perform routine functions, leaving accountants to provide value through judgment, analysis, and interpretation (Dickins & Reid, 2023; Wilkin, 2022).

Higher education has thus been called upon to redesign curricula to cultivate the skills that technology cannot replace (Terblanche & De Clercq, 2021). Wolcott and Sargent (2021:, p. 17) note that '… higher-level critical thinking skills will enable tomorrow's accounting graduates to contribute more quickly to their organisations and ensure that the profession maintains relevance and value.' Developing these skills is therefore a strategic imperative for higher education institutions worldwide.

Developing critical thinking in accounting students is not an easy task and presents several challenges for accounting educators worldwide (Dickins & Reid, 2023; Turner & Tyler, 2023). It requires deliberate pedagogy, explicit training in reasoning, and carefully structured learning activities (López et al., 2020; Paul & Elder, 2019a). Accounting educators also face challenges stemming from the multiplicity of definitions of critical thinking across professional and academic domains (Turner & Tyler, 2023). Although competency frameworks guide desired skills, they are less clear on how to achieve these outcomes (Terblanche & De Clercq, 2021). Consequently, researchers have highlighted both the need and the difficulty of designing interventions that consistently support the development of critical thinking skills in accounting students (Niu et al., 2013; SAICA, 2021).

Literature review

Critical thinking and its development

Critical thinking is a cognitive process, also referred to as higher-order thinking (Barnett & Francis, 2012). It is viewed as the ability to make self-regulatory judgments through

evaluating, analysing and interpreting information (López et al., 2020). A critical thinker generally can assess evidence to support or evaluate an argument (Barnett & Francis, 2012). SAICA (2021), in their competency framework, views a critical thinker as a person with the ability to do research, investigate, analyse, evaluate, reflect and make judgements. In the SAICA competency framework, critical thinking forms part of the decision-making acumen, which is considered a cognitive process to decide on actions or choose between alternatives.

Cognitive skills frequently associated with critical thinking include the ability to reason, interpret, analyse, evaluate, make inferences, clarify, make decisions and solve problems (Facione, 1990). A good critical thinker also has certain inherent traits or dispositions which include being open-minded, attentive and inquisitive (Barnett & Francis, 2012). Cloete (2018) asserts that a good critical thinker is not necessarily born with these skills, abilities or traits, but that these need to be taught, developed and reinforced. It is therefore important that educators not rely on students merely progressing through a degree or programme to develop critical thinking skills on their own, but that critical thinking should be explicitly taught or developed (Niu et al., 2013).

Teaching critical thinking has been linked to constructivist approaches to teaching and learning (Thompson, 2011). It is developed through active learning strategies with a student-centred approach to teaching (Dehghanzadeh & Jafaraghaee, 2018) and experiential learning with authentic assessments solving real-world problems (De Klerk et al., 2024). Collaborative activities that facilitate teamwork are considered beneficial for the development of critical thinking as they provide students the opportunity to discuss complex problems with each other, voice their own opinions and listen to the opinions of others (Dehghanzadeh & Jafaraghaee, 2018). It is also crucial for the educator to act as a facilitator or mentor to students in the process of developing this skill as opposed to passively teaching without actively engaging the students (Dehghanzadeh & Jafaraghaee, 2018).

To successfully develop students' critical thinking, accounting subjects should have an integrated design featuring aspects such as active learning and student collaboration to support critical thinking (Terblanche & De Clercq, 2021). Critical thinking should preferably be taught and embedded within the context of a specific discipline as opposed to being taught separately from the discipline content (Wilkin, 2017). To provide general guidance to educators, Paul and Elder (2019a, 2019b) developed a critical thinking framework with guidelines for infusing critical thinking into a curriculum and designing instruction, assignments and assessments for critical thinking development in any subject. Terblanche and De Clercq (2021) developed a critical thinking competency framework for accounting students, drawing on the critical thinking literature and addressing goals set out in SAICA's competency framework. The intervention described in this study uses the work of Paul and Elder, where critical thinking can be developed as a disposition, and the framework developed by Terblanche and De Clercq (2021) as this integrates the foundational dispositions for critical thinking with the list of competencies that is expected of prospective accountants. For first-year students, leveraging this linkage ensures a holistic development. It means students are not only *taught* what critical thinking is, but critical thinking is cultivated through students' accounting-related learning activities.

One benefit of this framework is a common terminology to discuss aspects of critical thinking within the accounting education literature. The Terblanche and De Clercq (2021) framework was used in a study conducted by Turner and Tyler (2023). These authors encouraged other researchers in accounting education to make use of this framework as guidance for developing critical thinking skills in accounting students. Being clear on what critical thinking is and the important competencies or aspects to critical thinking could be beneficial in the discussion between accounting academics concerning specific challenges of supporting accounting students to demonstrate various aspects of critical thinking skills.

Abrami et al. (2008) assert that it is equally important to understand how critical thinking can be measured as it is to understand how critical thinking can be developed. The measurement of critical thinking is, however, considered a complex matter and a major challenge in the literature (Rossouw & Steenkamp, 2025). In the next section, the measurement of critical thinking is discussed in more detail.

Measuring critical thinking

There is a wide range of critical thinking measurement instruments available which include standardised critical thinking tests, skill performance tasks, and questionnaires. Some of the most widely used standardised critical thinking tests are the Watson-Glaser Critical Thinking Appraisal (WGCTA), the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (Abrami et al., 2008; Wolcott et al., 2002). These instruments have some limitations, such as their high costs per student, often making them unfeasible to use in research studies. In developing countries such as South Africa, the higher costs per student are exacerbated due to currency differences. Researchers are then left to either develop their own critical thinking measurement tools (Rossouw & Steenkamp, 2025), make use of questionnaires or assess the effectiveness of interventions by gaining the views and perceptions of students (Papageorgiou, 2023).

There is also a paucity of research in accounting education on critical thinking interventions in accounting courses, particularly interventions aimed at first-year accounting students (Rossouw & Steenkamp, 2025). Rossouw and Steenkamp (2025) designed a critical thinking intervention, with Bloom's Taxonomy as a point of reference, to develop first-year accounting students' critical thinking skills. The intervention formed part of the accounting curriculum with explicit teaching strategies for critical thinking. Action research methodology was used to design the intervention and the effectiveness assessed with a self-designed measurement tool. Although empirical evidence suggests growth in students' critical thinking, a possible limitation of this study could be that the research was only conducted over one research cycle and that an established critical thinking measurement tool was not used to measure the effectiveness of the intervention.

Papageorgiou (2023) provided first-year accounting students with a critical thinking course pack as part of the accounting course material. The intervention was aimed at developing students' critical thinking and communication skills. A possible limitation of this particular study was that it employed a mixed-method design to gain an understanding of students' perceptions and opinions. This provides limited empirical evidence as to the effectiveness of the intervention in developing students' critical thinking skills.

These results could have been supported through the extension of the study over multiple research cycles.

Turner and Tyler (2023) used the Terblanche and De Clercq (2021) critical thinking framework in their study to determine how first-year accounting students demonstrate critical thinking skills and dispositions. The researchers employed phenomenography to examine participants' views and experiences of the intervention. Similar to the study of Papageorgiou (2023), limited empirical evidence as to the effectiveness of the intervention in developing the skills and dispositions is provided.

Cloete (2018) made use of the WGCTA to measure critical thinking of first-year students registered for a diploma in Cost and Management Accounting, offered at a South African university, over one research cycle. This author aimed to explore the impact of integrated assessments in this diploma on students' critical thinking, by employing a quasi-experimental pre-test, post-test, non-equivalent group design. From the findings, it was evident that integrated assessments, based on real-world problems, had a statistically significant impact on participants' critical thinking development from pre- to post-test. One particular limitation of this study was the smaller sample size ($n < 40$).

Quasi-experimental designs are popular for use in socio-economic contexts (such as education) where placing students in a strict experimental design (randomised control) would be considered unethical, costly or not feasible due to logistical constraints (Angrist & Pischke, 2009). Quasi-experiments seek to evaluate relationships but lack the full control achieved through random assignment (Anderson-Cook, 2005). A number of other studies made use of a quasi-experimental pre-test, post-test design (Dehghanzadeh & Jafaraghaee, 2018; Grussendorf & Rogol, 2018; López et al., 2020), however, these studies all included small sample sizes to measure participants' critical thinking. This limits the use of quantitative analyses to achieve robust results.

In this particular study, a similar design was used, with a larger sample size, with quantitative analyses conducted over two research cycles. Due to ethical considerations, all students underwent the treatment (intervention), meaning that everyone participated in the learning exercises. However, participation in the pre-test and post-tests was voluntary with signed consent as required by the approved ethics documentation. Therefore, students in this study were not randomly assigned and no control group was created. The quasi-experiment was conducted as follows: students' level of critical thinking was determined using the tested instrument, then all students in the cohort underwent the intervention. At the end of the year, students' levels of critical thinking were again measured using the same initial instrument. The rest of this section contains a detailed explanation and discussion on the design of the study, the instrument and analytical techniques used.

Methodology

Study design

This exploratory study employed a pre-test and post-test quasi-experimental design over two research cycles (2023 and 2024) to determine whether embedding explicit critical thinking instruction within a first-year course in an accounting degree could support students' development of critical thinking skills. To address the research question in this study, the researchers first designed and implemented a one-semester critical thinking

intervention offered as part of a first-year course in an accounting degree. Secondly, the Abstract Reasoning Test (ART) and the Critical Reasoning Test (CRT) were used to measure students' abstract reasoning abilities, as well as their verbal and numerical critical reasoning abilities before and after participation in this one-semester critical thinking intervention over the two cycles.

A convenience sampling technique was followed. Although the intervention was offered to all students as part of the curriculum, participation in the pre-test and post-test for the purposes of this research was completely voluntary and did not count for marks. All participants completed informed consent forms that explained the research project and its objectives.

Chat GPT4-Turbo was used to conduct language editing and writing improvements in this manuscript.

The critical thinking intervention (the Think Tank)

During 2022, the university at which the study was undertaken, initiated the process of implementing a multi-year plan to align its current curriculum with the SAICA competency framework (SAICA, 2021). At this university, students enrol for the BCom Accounting Sciences undergraduate degree – accredited by SAICA as the first step toward qualifying as a professional accountant – with courses offered exclusively to students registered for this specific programme. Business Acumen, a compulsory 40-credit course, is novel in the curriculum and includes introductions to the core courses (completed as separate courses in later years of study) such as governance and assurance, taxation, strategic decision-making, business value creation and computational thinking. These topics are presented during formal face-to-face lectures for six periods a week, the *full duration* of a student's first year.

Parallel to the content-driven, introductory classes, the business acumen course also includes a 10-week critical thinking module (also referred to as the *Think Tank)* that is presented in two-hour face-to-face contact sessions with students per week for the entire *first semester* of the first academic year.

The Think Tank, the critical thinking component of business acumen course, integrates the principles of the Paul and Elder critical thinking framework (2019a, 2019b) and the critical thinking competency framework for accounting students developed by Terblanche and De Clercq (2021). These frameworks collectively emphasise decision-making proficiency, with a particular focus on critical thinking skills. Whilst Table 1 presents the content of the Think Tank curriculum, a more detailed description of the programme as well as the pedagogy employed to deliver the content, are included in Appendix A:

Table 1. Summary of the topics covered in the Think Tank curriculum.

Session 1, 2 & 3	Elements of reasoning
Session 4:	Evaluation of reasoning using the Standards of Thinking
Session 5:	Development of intellectual traits
Session 6, 7 & 8:	Ethical reasoning
Session 9:	Consolidation of topics and contextualising skills in business
Session 10:	Practical session for honing problem-solving, communication skills, critical comparisons, being systematic and organised and thinking outside the box

Each BCom Accounting Sciences cohort is divided into six smaller groups of approximately 80 students per group to make class sizes more manageable. Six different lecturers from different departments in the faculty were involved in lecturing on the critical thinking module. Each lecturer was responsible for one of the six smaller groups, and these lecturers acted as mentors or facilitators of these sessions as opposed to passively conveying information (Dehghanzadeh & Jafaraghaee, 2018). Students were actively engaged in regular group activities where they had to engage and collaborate with fellow students within smaller groups to solve problems and make informed judgements on smaller tasks provided. This provided students with the opportunity to discuss complex problems with each other, voice their own opinions and listen to the opinions of others (Dehghanzadeh & Jafaraghaee, 2018). An example of the worksheets used in one of the sessions is included in Appendix B.

The course coordinator, who also developed the curriculum, prepared a comprehensive set of class presentation slides, a workbook, and class activities. To ensure consistent pedagogy and uniform development of critical thinking skills across the groups, lecturers met for two hours each week. These meetings provided an opportunity to reflect on class delivery, share experiences, and discuss improvements for subsequent sessions. Additionally, the upcoming lecture was planned and reviewed during these meetings. Facilitators adhered strictly to the prepared materials and followed the planned programme without deviation throughout the course.

The Think Tank used primarily authentic assessments such as case studies with real-world examples and problems (De Klerk et al., 2024), requiring students to use their critical thinking skills to solve ethical and business dilemmas. Critical thinking was therefore infused and embedded within the context of business acumen and accounting, specific disciplines as recommended by Wilkin (2017). As critical thinking has its foundations in constructivism, a student-centred approach was followed with active learning strategies and problem-based learning (Cloete, 2018), contextualised in a South African setting. Students were given ample opportunity to demonstrate critical thinking skills in different situations during lectures, but also in assessments (See Appendix B for an example of a question that was included in an accounting test). Some of these opportunities included verbal or written evaluation of decisions (and thinking) made by companies and political leaders (global and local), recommendations to executives regarding strategies that might have ethical implications (using a fictitious ethical dilemma in a case study on a real South African company) as well as debating on controversial policies issued by the South African government that could have an impact on the economic growth of the country.

The business acumen course, including the Think Tank, was presented in the 2023 academic year for the first time. Only a few logistical changes were made for the 2024 year, but no significant pedagogical and curriculum changes were made.

Participants

In both years (2023 and 2024), more than 470 students were actively enrolled for the business acumen course, and these students were all invited to voluntarily participate in the study. The participants involved accepted the study's invitation, completed the informed consent and took the ART and CRT at the beginning of and the end of the academic year.

Of the 2023 cohort, 359 students (76% response rate) completed the pre-test and post-test of the Abstract Reasoning Test (ART). The cohort consisted of 188 females (52%), and 125 males (35%). The remainder (46, 13%) chose not to disclose their gender. These classifications were self-reported and based on sex assigned at birth. Ten students of this cohort did not complete the Critical Reasoning Test (CRT) post-test which resulted in a sample of 349 students that completed the pre-test, and post-test of the Critical Reasoning Test (CRT) and consisted of 184 females (53%) and 119 males (34%) (the remainder chose not to disclose their gender).

Of the 2024 cohort, 242 students (51% response rate) completed the pre-test and post-test of both the ART and the CRT. Of this cohort, 52% were females, 31% were males, and the remainder chose not to disclose their gender. The average age of participants in both groups was 18.5 years.

Ethical approval for this project was obtained from the Ethics Committee of the relevant faculty of the institution at which the research project was undertaken.

Data collection instruments

At the start of the project, the authors considered using the WGCTA or the CCTST to evaluate the critical thinking intervention. These instruments, however, carry a large cost per student. Due to the larger sample sizes in this study, a pre- and post-test being conducted and the study being repeated over two research cycles, these costs were not feasible. Furthermore, the WGCTA and CCTST are global instruments that were developed in countries such as the United States of America, often making the terminology in the assessments unique to those countries. The terminology used in these instruments have not been adapted for different contexts and countries. Consequently, licences for the Critical Reasoning Test (CRT) and the Abstract Reasoning Test (ART), developed by Psytech International, were acquired. Psytech South Africa is the distributor of these internationally developed psychometric tests, where the terminology has been adapted for the South African environment (Psytech SA, 2024). The CRT and ART are tests suitable to use in combination as they are both considered to be measures of higher-order thinking abilities (Psytech SA, 2024).

First-year accounting students come from diverse backgrounds, that include varying exposure to business and accounting concepts. These concepts are contextualised in the Psytech assessments. The authors furthermore took into account the language abilities of first-year students. In South Africa, a country with 11 official languages, most students are not native English speakers. To address potential language barriers, it was essential to use an assessment instrument with vocabulary and business terminology that would be familiar to the students.

It was therefore important to use an instrument that refers to familiar South African contexts to determine critical thinking in a business environment. Few prior studies have utilised Psytech's instruments (Bux, 2014), and, to the authors' knowledge, none have employed these tools within the context of accounting education. This lack of application may be due to the limited integration of metacognition and psychometric analysis in accounting education research.

Angeli (1999), Ruff (2005) and Nicholas (2011) highlight that critical thinking development is context-dependent, showing that students exposed to context-based

instruction outperform those who are not. In this study, critical thinking was embedded within business acumen, ethical reasoning and accounting case studies, making it essential to first teach critical thinking within this context and then assess it using tools aligned to this domain. Psytech's Critical Reasoning Test (CRT) and Abstract Reasoning Test (ART) met these requirements and were employed across the two-year study.

The ART measures non-verbal abstract reasoning and general mental aptitude, independent of cultural or educational background (Psytech SA, 2024). It comprises 35 items presented as three-by-three matrices with one blank cell, requiring test-takers to identify the underlying pattern. The ART, which takes approximately 30 min to complete, is considered appropriate for graduate student cohorts.

The CRT, administered online in about 45 min, assesses verbal and numerical critical reasoning (Psytech SA, 2024). The verbal sub-test evaluates the ability to interpret semi-technical texts and draw logical conclusions – skills vital in the accounting profession. The numerical sub-test measures the ability to interpret and analyse quantitative data, also critical for accounting practice. Both CRT and ART were administered under the supervision of a registered industrial psychologist.

Data analysis

Descriptive and inferential statistics (including mean and standard deviation) and statistical measures (including paired sample t-tests) were calculated in this study using IBM SPSS version 29 software. A paired sample t-test within-subject analysis compared the participants' pre-test and post-test ART (abstract reasoning) scores as well as their pre-test and post-test CRT (verbal and numerical critical reasoning) scores.

Results

Before analysing the data, the underlying assumptions were validated. Inspection of boxplots revealed no outliers. Additionally, Normal Q-Q plots for each set of variables indicated that the data for all tests were normally distributed.

A paired sample t-test within-subject analysis compared the participants' pre-test and post-test ART (abstract reasoning) scores as well as their pre-test and post-test CRT (verbal and numerical critical reasoning) scores. The level of significance was set at $p < 0.05$.

High reliability was observed across all tests, with Cronbach's Alpha coefficients of 0.84 (ART), 0.82 (numerical CRT), and 0.87 (verbal CRT), exceeding the 0.7 threshold for acceptable internal consistency (Psytech SA, 2024; Taber, 2018). These values confirm that the instruments reliably measured the intended constructs.

Table 2 provides the mean ART score for the 2023 cohort, measuring participants' abstract reasoning abilities, illustrating that it increased from 55.03 in the pre-test to 61.40 (n = 359) in the post-test, which is considered statistically significant ($p < 0.001$) as shown in Table 3. Table 4, representing the 2024 cohort, presents results similar to 2023. Abstract reasoning abilities increased from 57.47 in the pre-test to 66.16 (n = 242) in the post-test, which is also considered statistically significant ($p < 0.001$).

The mean CRT score, measuring participants' verbal critical reasoning abilities, increased from 67.08 in the pre-test to 73.33 (n = 349)[2] in the post-test, as shown in

Table 2. Paired samples statistics (2023).

		Mean	Sample (n)	Standard deviation
Pair 1 (ART)	Post-abstract reasoning	61.40	359	29.170
	Pre-abstract reasoning	55.03	359	28.332
Pair 2 (CRT)	Post-verbal critical reasoning	73.33	349[1]	18.392
	Pre-verbal critical reasoning	67.08	349	22.688
Pair 3 (CRT)	Post-numerical critical reasoning	68.89	349[1]	23.919
	Pre-numerical critical reasoning	61.91	349	24.337

Table 3. Paired samples correlations (2023).

				Significance	
		Sample (n)	Correlation	One-sided *p*	Two-sided *p*
Pair 1 (ART)	Post- and pre-abstract reasoning	359	0.724	<0.001	<0.001
Pair 2 (CRT)	Post- and pre-verbal critical reasoning	349	0.593	<0.001	<0.001
Pair 3 (CRT)	Post- and pre-numerical critical reasoning	349	0.619	<0.001	<0.001

Table 4. Paired samples statistics (2024).

		Mean	Sample (n)	Standard deviation
Pair 1 (ART)	Post-abstract reasoning	66.16	242	25.590
	Pre-abstract reasoning	57.47	242	26.811
Pair 2 (CRT)	Post-verbal critical reasoning	71.90	242	21.812
	Pre-verbal critical reasoning	58.87	242	25.271
Pair 3 (CRT)	Post-numerical critical reasoning	67.20	242	24.520
	Pre-numerical critical reasoning	56.97	242	25.534

Table 2. In Table 2, it is also shown that the mean CRT score, measuring participants' numerical reasoning, similarly increased from the pre-test (61.91) to the post-test (68.89) (n = 349). Both these increases are considered statistically significant ($p < 0.001$) as shown in Table 3. Table 4 provides the mean CRT score for the 2024 cohort, indicating that the verbal critical reasoning abilities increased from 58.87 to 71.90 and the participants' numerical reasoning skills increased from 56.97 to 67.20 (n = 242). These increases were also considered statistically significant ($p < 0.001$) as reported in Table 5, similar to the 2023 results.

Table 6 contains the effect sizes calculated as Cohen's *d*. Although the 2023 results yielded statistically significant improvements, the effect size for this year was small ($d = 0.3$ and $d = 0.33$). This low effect size indicates that the magnitude of the change was modest, even small. However, the same scores for 2024 depict larger effect sizes (varying from $d = 0.45$ to $d = 0.7$). Several factors may account for this, but for the most part, we can only speculate what contributed to this difference. One possible explanation is that the 2023 cohort might have entered university with a higher baseline

Table 5. Paired samples correlations (2024).

				Significance	
		Sample (n)	Correlation	One-sided *p*	Two-sided *p*
Pair 1 (ART)	Post- and pre-abstract reasoning	242	.733	<0.001	<0.001
Pair 2 (CRT)	Post- and pre-verbal critical reasoning	242	.699	<0.001	<0.001
Pair 3 (CRT)	Post- and pre-numerical critical reasoning	242	.727	<0.001	<0.001

Table 6. Paired samples effect sizes per year (2023 and 2024).

		Cohen's *d*	
		2023	2024
Pair 1 (ART)	Post-abstract reasoning – Pre-abstract reasoning	0.3	0.7
Pair 2 (CRT)	Post-verbal critical reasoning – Pre-verbal critical reasoning	0.33	0.5
Pair 3 (CRT)	Post-numerical critical reasoning – Pre-numerical critical reasoning	0.33	0.45

competency. This will limit the observable growth from the start to the end of the year. However, a comparison between the baseline scores of the 2023 and 2024 cohorts is beyond the scope of the aims of this study.

Discussion

This study set out to determine whether embedding explicit critical thinking instruction within a first-year course in an accounting degree could support students' development of critical thinking skills. A pre-test, post-test quasi-experimental design was employed, and participants' abstract reasoning abilities, as well as their verbal and numerical critical reasoning abilities, were measured before and after participation in this critical thinking intervention. Results reveal a statistically significant difference ($p < 0.001$) between the pre-test and post-test scores of participants in both the ART and CRT assessments during both research cycles, with varying effect sizes, depending on the critical thinking construct and cohort.

Small effect sizes, coupled with statistically significant results in educational contexts, do not imply ineffectiveness, since even a small shift in critical thinking can be cognitively and professionally meaningful, especially in the early stages of development. Ferguson (2009) argues for the context-specific interpretation of effect sizes, reasoning that the practical impact of an effect size depends on the outcome being measured.

While the results for both years indicate statistically significant improvements in critical reasoning scores, we acknowledge the importance of interpreting these findings within a developmental, context-sensitive framework. According to SAICA's competency framework and that of Terblanche and De Clercq (2021), first-year students typically (and are expected to) operate at a foundational level of critical thinking maturity. This means that students demonstrate limited awareness of complexity and apply binary reasoning. However, the relative improvement observed in reasoning can thus be interpreted as indicative of movement towards more structured cognitive engagements, and this aligns with Paul and Elder's (2019a, 2019b) definition of critical thinking as having the ability to be a self-directed, disciplined thinker.

The standard deviations for all constructs (ART and CRT) are relatively large in both cohorts (e.g. 29.170 for post-abstract reasoning and 28.332 for pre-abstract on ART (2023) reasoning). This variability suggests significant heterogeneity in participants' performance, which may be attributed to differences in prior exposure, learning abilities, or other individual-level factors. The large spread emphasises the importance of contextualising the mean scores and reinforces the need for a cautious interpretation of the results. We have performed testing for outliers and ensured that the paired t-test assumptions

(e.g. normality of differences) were not violated as measures to confirm the robustness of our findings despite the variability.

The results of this study can be attributed to four strategies that were followed in the design, implementation and assessment of the intervention. First, the intervention was designed as an *intentional synthesis* of Paul and Elder's Critical Thinking Framework (2019a, 2019b), Terblanche and De Clercq's (2021) decision-making pedagogy and SAICAs competency framework (2021). Second, each component of the intervention was mapped to one or more of these frameworks. This provided the pedagogical foundation for the inclusion of specific content and the way that learning was facilitated. Third, the use of contextualised case studies, whether real or fictitious, provided students with the opportunity to apply the theory to real-world scenarios, critically evaluating the decisions made by stakeholders and also to cast professional judgment on the outcome. This operationalised Terblanche and De Clercq's (2021) framework through intentional decision-making scenarios that often involve ethical dilemmas. Lastly, we are of the opinion that the improved critical thinking scores can be attributed not merely to course content, but to intentional pedagogical design. The case studies and business contexts that students were exposed to increased in complexity through the course of the six months. However, it is important to note that great care was taken to provide students with targeted assessments and iterative feedback that supported the development of these skills.

Wolcott et al. (2002) assert that significant improvements in critical thinking may not be observed in a short period, such as in a semester. The results in the current study do, however, demonstrate that a one-semester critical thinking intervention, incorporating explicit critical thinking pedagogies and activities within the accounting curriculum, can provide support for the development of first-year accounting students' critical thinking skills.

Although this study incorporates quantitative analyses, some of the students ' comments, taken from the module and lecturers' evaluations done at the end of the prospective years, were included to triangulate the statistical findings that were reported. Several students commented on how the course was enjoyable and how it changed their thinking:

> This module has been an amazing experience. I have grown so much from it. [The module] has improved my critical thinking, reading and writing skills (2023 Participant)

> I really enjoyed [the] module this year. Amongst many things, it helped me to move out of my comfort zone, especially during think tank. Knowing how other people think/view certain things has really helped to broaden my thinking (2023 Participant)

> I developed critical thinking and I am grateful [for that]

> (2023 Participant)

> Through engaging lectures, stimulating discussions, and hands-on learning experiences, I've gained a deeper understanding of my chosen field and developed critical thinking and problem-solving skills that will serve me well in my future endeavors (sic). (2024 Participant)

> … critical thinking is challenging and very uncomfortable. (2024 Participant)

> One of my greatest highlights this year has certainly been from some of the critical thinking lectures in [the module] as it is the first time in a long time that I have been really forced to think on my feet … (2024 Participant)

> My highlights are mostly the Tuesday Think tank session because i (sic) get to think out of the box and challenge my brain and to see how deep i (sic) can think (2024 Participant)

Limitations and recommendations for future research

The current study did have some limitations, which are noted in this section. This exploratory study employed a pre-test, post-test quasi-experimental design, which did not include a control group. Behar-Horenstein and Niu (2011) note that studies with no control group make it difficult to determine the causal effect of the educational intervention on students' critical thinking development, given that maturity and other factors may have played a role as well. Future research could include a control group, possibly from a different higher education institution to mitigate ethical considerations.

Another possible limitation could be that other factors, such as the socio-economic environment, individual differences between students or just exposure to higher education, could have influenced students' development of critical thinking. It is therefore recommended that future projects of this nature apply the pre-test and post-test for critical reasoning to first-years in other subjects, universities or even other parts of the world.

A future research project includes the exploration of the retention of critical thinking. Students are introduced to the principles of critical thinking in their first year. These principles are contextualised and embedded in courses that form part of the accounting degree programme. Although it is expected and assumed that students will retain this skill and practice becoming critical thinkers, empirical evidence is needed to confirm the retention of these skills, even if these skills are included in assessments in later years of study.

Lastly, this study could benefit from the richness derived from the collection of qualitative data through interviews with both students and facilitators of the intervention. Although some student comments were included that alluded to the learning experience, these comments were made in the programme evaluation of the module (in which the 'Think Tank' was embedded) and not explicitly as questions regarding how the intervention affected their development as critical thinkers.

Conclusion

The development of critical thinking is a much-needed, but difficult to cultivate, pervasive skill of the future accountant (Terblanche & De Clercq, 2021). How should accounting educators go about infusing the curriculum with critical thinking? Which theoretical frameworks need to be incorporated, and what should the pedagogy look like?

The research question addressed by this study was to determine whether embedding explicit critical thinking instruction within a first-year course in an accounting degree could support students' development of critical thinking skills.

To address the research question in this exploratory study, a pre-test–post-test quasi-experimental design was implemented across two research cycles. The study presents

empirical evidence supporting the efficacy of a targeted intervention aimed at enhancing critical thinking in first-year accounting students over a single semester. Statistically significant improvements ($p < 0.001$) were observed in both the Abstract Reasoning Test (ART) and Critical Reasoning Test (CRT) scores across both cycles.

As discussed earlier, the small to moderate effect sizes and relatively large standard deviations observed in the data suggest the need for a contextually sensitive interpretation of the findings. Acknowledging the early developmental stage of critical thinking in first-year students, the intervention was deliberately grounded in a synthesis of three theoretical frameworks – SAICA's competency framework (2021), Paul and Elder's model of critical thinking (2019a, 2019b), and the Terblanche and De Clercq (2021) decision-making framework. Interpreted through the lens of these frameworks, the findings indicate that the intervention not only provided a structured approach to developing critical reasoning but also introduced a pedagogical model for cultivating self-directed, intellectually disciplined thinkers.

While recognising the incremental nature of critical thinking development, the observed gains represent a meaningful pedagogical shift. In the context of first-year accounting education, modest yet statistically reliable progress is a significant outcome. This study contributes to the broader discourse on professional thinking in accounting by demonstrating that structured, theoretically grounded interventions can initiate the early formation of critical thinking competencies within a relatively short time frame.

The current study makes several contributions to accounting education literature and the discourse on developing critical thinking in accounting students. First, it answers calls by Wolcott and Sargent (2021) and Papageorgiou (2023) to redesign accounting courses to foster critical thinking skills. While prior research, such as that of Papageorgiou (2023) and Rossouw and Steenkamp (2025), has advanced understanding of critical thinking in accounting curricula, this study provides a brief description of the content and pedagogy applied to integrate critical thinking into the curricula. Second, the study contributes to the body of empirical research evaluating the impact of educational interventions on critical thinking development. While recent studies, such as those by Papageorgiou (2023) and Rossouw and Steenkamp (2025), have examined students' perceptions of critical thinking interventions or assessed their impact over short research cycles, this study goes further by using validated tools to assess both abstract reasoning and verbal and numerical critical reasoning abilities.

The findings of this study also provide some challenge to the assumption that critical thinking necessarily takes years to develop (at least for some students), as suggested by Wolcott et al. (2002). Our results show that even a one-semester intervention – when guided by explicit pedagogical strategies and supported by aligned frameworks – can lead to meaningful improvements in the critical thinking skills of first-year accounting students. By placing critical thinking within realistic business contexts and assessing its development through established instruments, the study presents a structured and contextually relevant approach to enhancing critical thinking in accounting education.

However, the longer-term retention and transfer of these skills – beyond the first year and into the professional training pathway – remain unknown and should be explored in future research. Within the scope of this intervention, though, the level of improvement observed was appropriate for first-year students and suggests that well-designed,

discipline-specific interventions can support the early development of critical thinking in a meaningful way.

Notes

1. SAICA is the accountancy body in South Africa, that provides accreditation to academic programmes meeting its standards for preparing students for the Chartered Accountant (CA) profession.
2. Ten participants did not complete the CRT test instrument. Consequently, the data was excluded from the analysis.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

E. A. J. Terblanche http://orcid.org/0000-0003-1178-1407
C. Joynt http://orcid.org/0000-0002-4749-7793
M. Stiglingh http://orcid.org/0000-0002-7750-5635
H. Du Preez http://orcid.org/0000-0002-7133-8143
L. Diedericks http://orcid.org/0000-0003-1502-7102

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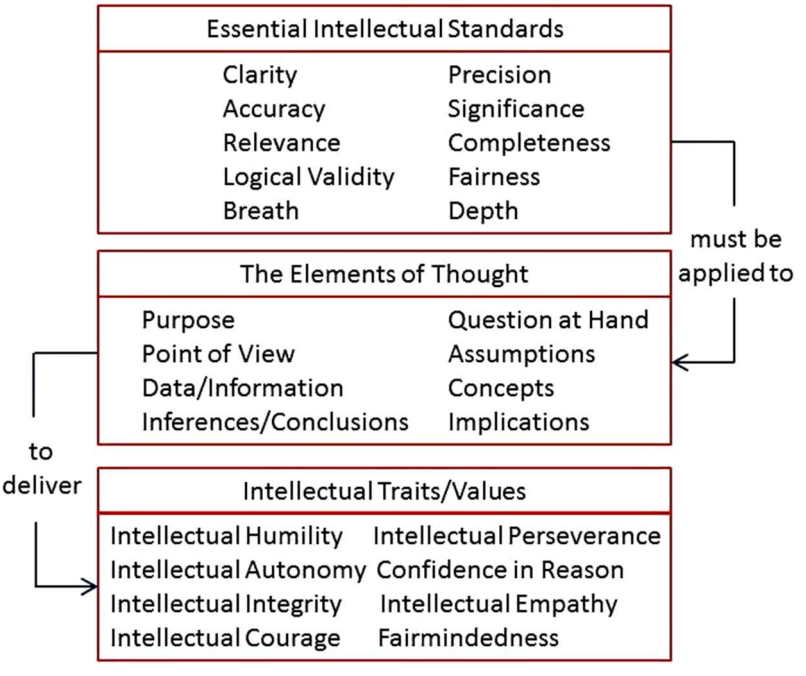
Appendices

Appendix A

The content and structure of the 10-week programme were based on the Critical Thinking Model (Paul & Elder, 2019a, 2019b)



Source: Paul & Elder Critical Thinking Model (2019).

Week	Topic	Detailed description	Pedagogy
1	Topic 1: Elements of reasoning (general overview and in detail: Purpose and Points of view are discussed)	Introduction to critical thinking, including the definition, importance and link to the Pathways commission's explanation of what accounting is. (*Changing the perception of accountants into the reality of their role. (*The Pathways Commission,2013)	Traditional lecture using multimedia, such as videos. The Shein case study is introduced to demonstrate the practical application of elements of reasoning.
2	Topic 1: Elements of reasoning (continued from the previous session)	The remainder of the eight elements of reasoning are discussed in this session. That includes a detailed discussion on assumptions, inferences, implications, concepts and questions.	The lecture started with a brain teaser, and groups had to work together to find the answer and enter it online. Case studies are used to illustrate the theory's application. Case studies are contextualised in everyday business activities derived from news articles that are relevant and current.
3	Topic 1: Elements of reasoning (consolidation)	During this session, the prior sessions are consolidated to ensure a solid foundational understanding.	Watch a video (consolidating the elements' theory) whilst completing the workbook's incomplete sentences. Case studies and questions, and answer sessions, engagement through discussions on topics raised by students.
4	Topic 2: Evaluation of reasoning using the standards of thinking	This session explores the nine (9) standards of thinking as identified by Paul & Elder.	A constructivist approach is followed to deepen students' understanding of the nine intellectual standards of critical thinking. Eighteen large sheets – each labelled with a standard and displayed around the lecture venue – facilitate simultaneous engagement by dividing the class into two large groups. Within these, smaller rotating groups move between sheets, collaboratively writing their interpretations and reflections. This active, peer-driven process fosters the co-construction of knowledge through dialogue and reflection. To consolidate learning, each group presents one standard, drawing on the written contributions to promote shared understanding and critical engagement with diverse perspectives.
5	Topic 3: Development of intellectual traits	During this session, the eight (8) intellectual traits were explained from a theoretical perspective. Then these were illustrated through the use of three short case studies.	Case-Based Learning was employed to facilitate an experiential and inquiry-based learning process grounded in constructivist pedagogy. With the support of generative artificial intelligence, three business scandals were used to explore the presence or absence of intellectual traits. The case studies focused on the Volkswagen emissions scandal,

(*Continued*)

Continued.

Week	Topic	Detailed description	Pedagogy
			Theranos, and the Boeing 737 Max crisis.
6	Topic 4: Ethical Reasoning	This lecture continues to build on ethical theories that were discussed in Business Acumen lectures that covered corporate governance. The application to personal ethics is discussed and illustrated by means of a continuation of the Boeing 737 Max scandal, but from an ethical perspective.	Case-Based Learning using the Boeing 737 Max, applying theories in ethics. This class was conducted as a very engaging class where students were encouraged to share their views on the conduct of Boeing executives.
7	Topic 4: Ethical Reasoning	Application of theories in ethics.	A fictional case study was used that incorporates ethical issues dealing with child labour. A student had to present an argument for one of two choices that needed to be made by the executives. After the formulation of the arguments, students' work was evaluated by peers using the standards of reasoning. A rubric was provided to assist students with a framework for evaluation.
8	Topic 4: Ethical Reasoning	This session deals with six ethical traits. These are the traits that prospective accountants should aspire to foster.	A constructivist approach is followed. Students had to complete a table with concepts used in ethical reasoning, using the SEE (State, elaborate, example) method.
9	Consolidation	Consolidation of the elements of reasoning and ethical conduct.	Various short case studies were provided to students that required an analysis of the problem. Ethical issues were incorporated that required students to identify the issues and make relevant decisions.
10	Practical session	The spaghetti challenge is played with each group competing against other groups in the class. This activity evaluates the importance of problem-solving, communication skills, collaboration, critical comparison and creative thinking.	Gamification

Appendix B

Critical thinking – Lecture 6
ETHICAL REASONING

Introduction

As future accountants, you will play a critical role in ensuring the financial well-being of individuals and organisations alike. With this responsibility comes the need to uphold the highest ethical standards and to make decisions that are not only legal but also morally justifiable.

In today's lecture, we will explore the principles of ethical reasoning. We will examine real-world scenarios and case studies to illustrate the complexities of ethical decision-making in business and to provide you with the tools and frameworks necessary to navigate these situations with integrity.

We will also discuss the importance of building a strong ethical foundation early on in your career, and how this can contribute to your success as a professional accountant. By the end of this lecture, you will have a deeper understanding of the ethical considerations that are essential to the accounting profession and the role you can play in promoting ethical practices in your future career.

Human behaviour has consequences on the welfare of other humans, living creatures, the planet and other stakeholders. Ethical reasoning highlights two kinds of behaviour or acts: those that enhance the well-being of other beings and those that harm the well-being of others. By nature, humans are inclined to act self-centred, with prejudice, using self-justification and self-deception. Sociocentric tendencies are powerful and can shape the way we think, act and behave. Sociocentric tendencies are communicated through various means, including mass media and social media platforms.

To combat these tendencies, we can actively pursue the cultivation of traits that will enhance our ethical decision making, for example, tendencies to be more honest, act with greater integrity, increase your own self-awareness and intentionally develop a deep concern for the welfare of all others.

Definition of important concepts

Watch the video 'What is Ethics' and complete the following activity:
Write one sentence to define each of the following concepts:

Ethics:
Moral reasoning:
Moral decisions:
Moral dumbfounding:
Intuitive, emotional reaction

Intellectual standards

Intellectual standards are critical in ethical reasoning, as they provide a framework for *evaluating the quality and validity of ethical arguments and reasoning*. These standards help us to identify flaws in reasoning and to ensure that our ethical judgments are sound, logical, and consistent.

Several intellectual standards are particularly relevant to ethical reasoning, including clarity, accuracy, relevance, depth, breadth, and fairness.

To evaluate the ethical reasoning in the Boeing scandal using the intellectual reasoning skills developed by Paul and Elder, we can apply their framework of critical thinking, which involves elements such as clarity, accuracy, precision, relevance, depth, breadth, logic, fairness, and significance. Use the following questions to evaluate the ethical dilemmas that Boeing is currently facing:

A. In your own words, describe what the problems are that Boeing is facing after watching the video:

B. Describe the ethical dilemma that Boeing is (was) facing:

C. Let's evaluate Boeing's ethical reasoning. Comment on each of the criteria below:

1. Clarity:
2. Accuracy:
3. Precision:
4. Relevance:
5. Depth:
6. Breadth:
7. Logic:
8. Fairness:
9. Significance:

INFERENCES, ASSUMPTIONS and IMPLICATIONS

Complete the following table to illustrate the difference between the concepts.

Information	Assumption	Inference	Implication of inference
Example: *You see a man in a wheelchair.*	*All people in wheelchairs have a sad life.*	*He must have a sad life.*	*I will go out of my way to do something nice for him.*
Boeing is a market leader in the manufacturing of aircraft.			
The CEO of Boeing has announced that he will step down from his position at the end of 2024.			
Pilots of the Boeing 737 MAX were not made aware of the MCAS system.			
Two Boeings crashed in five months.			
Boeing valued profits over safety.			