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Prior knowledge as a limiting factor in critical thinking skills development

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Recently, advances in generative AI have highlighted the importance of skills that (currently) are exclusively human characteristics, of which insightful critical thinking is one. Critical thinking is vital for many professional careers where technological advances, outsourcing, globalisation, and more recent global pandemic impacts on the business world have made higher-level cognitive skills essential at the entry level in disciplines such as accounting. Yet despite critical thinking being a common university graduate attribute, accounting graduates are not meeting employers' expectations in relation to thinking skills. This study investigates whether a pedagogical intervention that emphasises knowledge construction could stimulate student critical thinking skills.

Keywords: Critical thinking, accounting education, business education, graduate employability

Introduction

It is both easy and wrong to anthropomorphise generative AI such as ChatGPT. Generative AI is excellent - superhuman, perhaps - at gathering and synthesising text from a huge range of sources. However, since it is machine-based not human, it cannot reflect, reason, or apply critical thinking to the words that it finds and generates (Zaphir and Lodge, 2023). Generative AI is the latest in a long line of innovations that are automating the routine aspects of an accountant's work. As they are relieved of the need to perform routine tasks, accountants' roles are changing to encompass critical evaluation of automated output and providing higher-level strategic advice.

Context

Professional accountants touch every aspect of our global economy, providing a broad range of services and operating across public practice, finance and banking, commerce and industry, government and public sector, not-for-profit, and academia (IFAC, 2014, p.20).

This breadth, coupled with the evolution of job functions, necessitates an adaptable toolkit of skills and knowledge that meet professional demands. Skills development has been an ongoing concern in accounting education that has reached a point where some accounting firms are sourcing graduates from other disciplines (CAANZ, 2017). Calls for accounting education to meet changing professional skills demands have been echoed for three decades with little effect. Indeed, curriculum and pedagogy bear many similarities to classroom practices of the 1980s (AECC, 1990; Pathways Commission, 2012).

Critical thinking is so broad and complex that many scholarly attempts have been made to separate critical thinking into inventories of skills, dispositions, cognitive processes, traits, and behaviours that represent various aspects of the practice of critical thought. For example, Facione (1990, p.3) describes critical thinking as

purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based.

Definitions like this often focus on the high-level cognitive skills associated with critical thinking yet do not make explicit the implied but fundamental need for prior knowledge upon which to exercise many such cognitive skills. Yet cognition is required to utilise and apply existing knowledge to new situations (Ennis, 1985; Pintrich et al., 1991). Therefore, possessing and recalling prior knowledge is an essential initial step, one that has received insufficient attention in the literature compared with the more advanced cognitive components that feature in countless definitions of critical thinking that are beyond the scope of this study.

While this investigation is grounded in the discipline of accounting, it could be applicable to any area of specialised study where learning is incremental or sequential. It acknowledges the important role of critical thinking in knowledge construction, while simultaneously understanding that knowledge is necessary for critical thinking to occur. Piaget's assimilation and accommodation drive knowledge construction through both integrating new knowledge and changing existing knowledge structures (von Glasersfeld, 1995), such as when students progress through learning a particular discipline. Individuals create knowledge via cognitive functioning as information filters through sensory experiences of the individual's world (Kant, 1770). According to Biggs' (2003) model of student learning which distinguishes between 'deep' and 'surface' approaches, it is only when students adopt deep learning that critical thought may be facilitated.

Accounting has a technical syllabus that students tend to learn by memorisation of rules and procedures (Wynn-Williams et al., 2016; Everaert et al., 2017). However, such surface learning does not lead to deep understanding of accounting rules and procedures as it fails to integrate prior knowledge to inform new situations, key aspects of critical thinking in the accounting profession identified by Baril et al. (1998). In a degree course, intermediate-level accounting students need to draw on their prior disciplinary knowledge and experiences, recalling and integrating prerequisite introductory accounting concepts as they construct new knowledge and solve problems. A consequence of failing to do so means students' understanding of later content will be limited, hampering their ability to think critically within the discipline (Novak, 1998; Bailin et al., 1999) with consequent deleterious effects on later studies and their professional futures as graduates. The extent to which intermediate-level accounting students are aware of this cognitive process, and are practising it, is unknown. This investigation explored accounting students' experiences with tasks that required them to draw upon their prior accounting knowledge to exercise critical thinking skills. The intervention tasks were structured in two parts to initially draw upon students' prior accounting knowledge, then assist them to integrate such knowledge with new topics being learned. There is little empirical literature in accounting education investigating the development of critical thinking skills, with the exception of a small number of studies that involve assignments without critical thinking instruction, or where such instruction is very limited (for example, Phillips and Nagy, 2014; Wilkin, 2017; Cloete, 2018). This study addresses part of that gap.

Accordingly, we ask: Can intermediate-level students demonstrate an ability to both recall prior accounting knowledge and utilise more cognitively challenging critical thinking skills?

Method

Recognising the inherent link between critical thinking and deep learning, the Biggs et al., (2001) Revised Two Factor Study Process Questionnaire (R-SPQ-2F) was used to assess the extent to which respondents initially report deep or surface approaches to learning accounting. After implementing the intervention, semi-structured interviews and focus group sessions were conducted with 19 students to explore their perceptions of the intervention, why they did or did not engage with it, and whether they believed it influenced their orientation towards the study of intermediate accounting. Further data was also sourced from the learning management system in relation to the quality and quantity of student submissions to the intervention questions, as well as students' responses to theoretical questions in the final examination. An analysis of students' theoretical knowledge on more complex questions is considered to be an appropriate proxy for deep learning where a high level of knowledge and reasoning skills are required (Nutt, 1998; Davidson, 2002), especially in a practical discipline such as accounting where a basic level of knowledge may be gained and demonstrated without students necessarily understanding the rationale for such rules and procedures (Sharma, 1997).

Set in a large, research-intensive university, the intervention was designed to encourage the approximately 500 students in a second-year accounting unit to draw upon their prior knowledge when learning new topics. This elaboration strategy (Pintrich, 1991) provided a scaffolded view of each weekly topic that linked to prerequisite accounting knowledge. Intended to encourage students to consciously develop their discipline knowledge over the course of the semester, it provided both formative and summative feedback to students as part of their formal assessment. The semester-long weekly intervention centred on questioning around accounting concepts and procedures that students had learned in their previous study of introductory financial accounting. Since the critical thinking process commences with the organisation of existing knowledge, questioning that focused on earlier learning might stimulate students into bringing prior knowledge into their working memory as a starting point for further critical thinking skills development and learning to occur (Sternberg, 1986; Eley, 1992; Baril et al., 1998; Halpern, 2014).

Results and discussion

This study investigated whether a pedagogical intervention could stimulate critical thinking in intermediate-

level accounting students. Critical thinking encompasses awareness of the thinking processes associated with learning, along with a disposition to utilise such processes. It requires the ability to recall previously-learned information, along with high-level cognitive skills to integrate such prior knowledge with new learning. The intervention was designed as a scaffolded weekly component of students' internal assessments, and was split into two parts. Task A focused entirely on questions about introductory accounting content that was taught in their prior studies, while Task B asked students to integrate new and old knowledge in building deeper understanding of the intermediate syllabus they were currently learning. Students could complete both parts, neither part, or just one part.

Task A focused on prior knowledge recall. In most weeks, around 80% of the cohort completed the tasks satisfactorily, with only a small proportion (around 2%) providing incorrect answers to the tasks (the remaining proportion of the cohort did not complete them at all). Of the students who engaged with the Task A questions, a significant majority did so satisfactorily. What cannot be determined from the data, however, is the extent to which students remembered the content, made a guess in responding, or undertook research to answer the questions.

At the conclusion of Task A each week, students were asked to respond to a statement rating their familiarity with the introductory accounting topic that was represented in the questions they had just answered. This question was completed by all participants who engaged in the Task A activities in a particular week. Answers were on a five-point scale where 5 was most familiar and 1 was least familiar.

Descriptive statistics of students' responses to this question by week are presented in Table 1.

Table 1: Reported familiarity with weekly intervention Task A topics

Topic	1	2	3	4	5	6	7	8	9	10	11
Mean	3.53	3.84	3.66	3.72	3.25	3.27	3.52	3.17	3.77	3.73	3.66
St Dev	0.88	0.89	0.89	0.99	1.11	1.15	1.12	1.25	1.11	1.02	1.03

Table 1 shows that there was little variation by weekly topic in the cohort's self-ratings of their ability to remember the content from their earlier accounting study, suggesting that in students' minds they had reasonable and consistent knowledge of topics from introductory accounting. Support for the ability of Task A activities to prompt recall of prior accounting knowledge was provided by comments from interview and focus group participants. Some participants reported that the Task A activities were 'easy', helped to 'refresh' their memories, and 'remind' them of what they had earlier studied. However, other students indicated that the information was not readily available in their minds, reporting that they 'didn't necessarily remember', or 'forgot', sometimes prompting them to 'look up old notes'.

Participants' sentiments relating to the prior knowledge tasks were not all favourable, especially when their ability to recall was limited. For example,

I just found the part A like, in my opinion, quite useless, because it was trying to gauge like what you already know in the past but a lot of what I like remembered isn't a lot.

This may also be related to the notion that the tasks were novel to students in the sense that they may not have been specifically asked to draw on prior knowledge in such a way before:

I think that in my previous units I've had similar tasks where we have the weekly things on Moodle, but all of them are just kind of a recap of what we just learnt rather than previous units integrating them into the newer knowledge. That was definitely a new experience for me.

While bringing students' prior accounting knowledge into their working memory was a prerequisite for knowledge integration, whether students did anything with the knowledge they recalled is not known. Bailin et al. (1999) highlight the importance of thinking quality rather than thinking process; mindless recall of earlier disciplinary content to answer the questions may represent process rather than quality.

The Task B activities were designed to be more cognitively demanding of students than the questions in Task A, including an open-ended question that sought to evaluate deep understanding. They also required a greater time commitment by students, since they involved both an activity to integrate knowledge and an open-ended theoretical question. Student completion rates in Task B were slightly lower than Task A, although a large majority of the cohort still completed them satisfactorily. The highest level of satisfactory engagement occurred

in week 2, with 84% of the cohort completing the Task B activities to an acceptable standard. In week 10, the lowest proportion of students (65% of the cohort) completed the tasks satisfactorily; this week had a number of competing activities such as major assignment due dates.

The intervention activities were included as a component of the internal assessment, weighted at 10% of the final grade. The activities spanned eleven weeks of the semester, and students could miss one week and still obtain full marks if all other weeks were completed satisfactorily. The mean score (out of 10) was 7.17 with a standard deviation of 2.91. To score the mark for any weekly topic, students must have satisfactorily completed both the Task A and Task B component in that week. Around one third of the cohort (32%) scored the full ten marks for the intervention tasks, while a much smaller proportion (1.7%) scored zero.

Interview and focus group participants reported greater value in the Task B component of the intervention, associated with higher perceived relevance to students' current study of the intermediate accounting syllabus. Comments from interview participants reinforced the value in Task B activities, especially in the sense that the open-ended question pushed the boundaries of their knowledge and understanding. Strong themes around 'deepening their understanding' of the intermediate syllabus emerged, as the Task B activities 'helped clarify' concepts and helped them to realise 'why' certain procedures were recorded. The rigour of the questions was also affirmed, with participants reporting that they had to 'know the material' to be able to answer the questions and some were prompted to 'go into the textbook' to seek answers. These reports suggest that some students may have been undertaking deep learning (Eley, 1992; Ramsden, 2003), but it is not possible to estimate the proportion of these since focus group and interview participants may not be representative of the whole cohort.

Effective critical thinking should result in the ability to demonstrate understanding of the syllabus through answering challenging theoretical questions. The final examination comprised five questions. Question one was the only part of the examination that required theoretical answers, defined as asking about accounting principles and rules without a practical example. All remaining questions on the exam were of a practical or numerical nature, mostly concerning journal entries. Performance on the theoretical question was poor compared with the remainder of the examination. The mean score for the theoretical question was 34.7% (Sd = 17%) while for the practical questions the mean score was 69.8%, (Sd = 16%). Students' lesser ability to demonstrate theoretical knowledge suggests that any critical thinking skills they may have exercised by engaging in the weekly tasks did not fully manifest in learning and knowledge construction.

There were small, positive correlations between intervention score and theoretical question exam score ($r = 0.218$, $p < 0.001$), theoretical and practical responses on the exam ($r = 0.284$, $p < 0.001$) and intervention score and practical exam responses ($r = 0.312$, $p < 0.001$). This suggests that the students who practised critical thinking in the intervention tasks performed better than those who did not, but did so on all aspects of the examination, not only the theory component. However, the small size of the correlation suggests other factors were driving performance beyond engagement with the intervention, especially since some students scored highly on the intervention tasks but poorly in the exam.

Further investigation was undertaken with the 125 respondents who completed the week one questionnaire derived from Biggs' R-SPQ-2F. The questionnaire asks students to self-report their motivations and strategies towards study, with a score range between 10 to 50 for surface and deep approaches. Respondents self-reported a greater tendency towards deep approaches ($M = 31.69$, $Sd = 6.44$) to studying accounting than surface approaches ($M = 24.83$, $Sd = 7.16$). However, self-report data should be interpreted with caution.

A comparison of self-reported study approaches and intervention performance showed a small, positive correlation between students reporting a deep motivation towards their study and their scores for the intervention tasks ($r = 0.204$, $p < 0.05$). Further, there was a small, negative correlation between students' surface motivation and scores for the intervention tasks ($r = -0.205$, $p < 0.05$). A more statistically significant negative correlation was found between students' performance on the theory aspects of the final exam, and self-reported surface motivations towards their study ($r = -0.279$, $p < 0.001$).

Conclusions

Accounting educators - and those in similarly procedurally-based disciplines - must rethink and redesign their courses to encourage deep learning and skills development to students so they can offer differentiated value to employers when they graduate. Beyond the important goal of building skills for lifelong learning, weak foundations could be hampering students' ability to practise and develop critical thinking throughout their undergraduate courses (and we can assume later on in their professional careers). With generative artificial

intelligence such as ChatGPT (the strength of which is in re-presenting previously published work, not creatively and critically analysing that information) now readily available, this long-standing issue of students' approaches to learning is becoming even more significant.

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