The Australian Educational Researcher
https://doi.org/10.1007/s13384-024-00714-3

# Australian teachers' adoption of critical and creative thinking as curriculum

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Received: 17 October 2023 / Accepted: 14 March 2024


## Abstract

Critical and creative thinking (CCT) was introduced as a General Capability in the Australian Curriculum in 2010, heralded as a call for more explicit teaching of CCT. This study was an online survey of 259 Australian teachers, exploring how they have adopted CCT as curriculum, including how confident they feel about this area of their teaching and what aspects of Australia's CCT curriculum they teach and how. Most respondents believed it was important to teach CCT, but only a minority could recall professional learning in this area, and their confidence levels tended to be only moderate. The teachers were asked to provide examples of what they 'say' and 'do' in their teaching that best reflect their 'typical' approaches to teaching CCT. The examples indicated that they typically incorporated CCT into their teaching of other learning areas. However, the examples were mostly focused on only a few of the CCT General Capability sub-elements and were mostly of teachers providing students *opportunities* to engage in CCT skills, rather than explaining, modelling, scaffolding, or reinforcing the skills. For teachers to teach CCT more confidently and impactfully, improved professional learning and a more conducive CCT curriculum would assist.

**Keywords** Critical and creative thinking · Teacher confidence · Teacher education · Pedagogy · Primary schooling · Secondary schooling

## Introduction

Critical thinking and creative thinking, respectively, are broad and variably defined constructs. Definitions have been collated and discussed elsewhere (e.g. Ab Kadir, 2018; Heard Scoular et al., 2020; Ramalingam et al., 2020), but common to most notions of creative thinking is that it is exploratory, productive thinking, and common to most notions of critical thinking is that it is evaluative, reasoned thinking.

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Published online: 26 April 2024

Combined, these two types of thinking can lead to better outcomes than each type of thinking alone. Alghafri and Ismail (2014) describe critical and creative thinking as being two sides of the same coin, each of little use without the other. Critical thinking can both facilitate and utilise creative thinking, and vice versa. For this reason, the two constructs tend to be bundled together.

There is wide support for promoting critical and creative thinking (CCT) skills to meet individual, societal, and global priorities. CCT skills are argued to be key for individual employability and earning capacity (Foundation for Young Australians, 2016) and for the creation of a more just and sustainable world (Vincent-Lancrin et al., 2019). They are also prominent in international education movements, including 21st-century skills (Borrowski, 2019) and STEM education (Murphy et al., 2019). There is now widespread recognition in Australia and abroad that teachers should aim to develop students' CCT skills (e.g. Australian Curriculum, Assessment and Reporting Authority [ACARA], n.da; Davies & Willing, 2023; Organisation for Economic Cooperation and Development, 2019). The importance of developing CCT in teachers themselves is also recognised (Loughland & Bostwick, 2023). In addition to CCT skills being worthy learning objectives in their own right, to promote careful and constructive *use* of knowledge, the cognitive processing that CCT involves can also strengthen the *learning* of knowledge itself (Australian Education Research Organisation [AERO], 2023a; Ellerton, 2017; Evidence for Learning, 2023; Fiorella & Mayer, 2015; Kirschner & Hendrick, 2020; National Research Council, 2000; Rosenshine, 1995; Rosenshine, 2012; Weinstein et al., 2018; Willingham, 2021).

CCT is now included in the official curricula of many countries (Taylor et al., 2020), but not always as a distinct area. CCT features as a distinct area of curriculum in countries such as Australia (ACARA, n.d.a), Canada (British Columbia Curriculum, n.d.), and Singapore (Ministry of Education, Singapore, n.d.). Where specific teachable skills are articulated in curricula, they include analysing, evaluating, reasoning, drawing conclusions, and connecting, generating, testing, and/or modifying ideas (e.g. see Table 1, for CCT concepts and skills drawn from the CCT general capability in the Australian Curriculum; ACARA, n.d.a). In cases where CCT does not feature as a distinct area of curriculum, typically CCT skills are embedded within traditional learning domains (e.g. Department for Education, 2014; Education Scotland, 2013). For example, in the UK's national curriculum, Citizenship and Design and Technology include skills such as analysing evidence, evaluating viewpoints, presenting reasoned arguments, substantiating conclusions, using imagination, and designing and refining solutions to problems (Department for Education, 2014).

These concepts and skills are drawn from Australia's CCT general capability (ACARA, n.d.a). 'Ideas' may refer to concrete or abstract concepts, propositions, tools, methods, products, or outcomes.

In 2010, ACARA introduced the Australian Curriculum, designed to 'help all young Australians to become successful learners, confident and creative individuals, and active and informed citizens' (ACARA, 2023a). Although implementation of this curriculum is the responsibility of Australia's state and territory authorities and implementation can vary between these jurisdictions, the Australian Curriculum

**Table 1** Teachable concepts and skills involved in critical and creative thinking

| **Creative thinking** | **Critical thinking** |
|---|---|
| Exploratory and productive thinking | Evaluative and reasoned thinking |
| **Connect ideas** | **Clarify information** |
| · Similar to & different from | · Identify objective aspects |
| · Includes or is part of | · Identify subjective aspects |
| · Is an example of | · Ask relevant questions |
| · Can be transferred to | · Check understanding |
| **Generate ideas** | **Evaluate ideas** |
| · Imagine possibilities | · Develop criteria for judgement |
| · Combine ideas | · Assess accuracy and logic |
| · Build on ideas | · Identify strengths and limitations |
| · Propose ideas | · Invite and consider feedback |
| **Test ideas** | **Draw conclusions** |
| · Plan to test ideas | · Acknowledge knowledge gaps |
| · Predict outcomes | · Identify possible bias |
| · Put ideas into action | · Consider context and relevance |
| · Observe effects | · Phrase conclusions carefully |
| **Modify ideas** | **Reason decisions** |
| · Consider alternatives | · Identify possible options |
| · Refine ideas | · Use information for decisions |
| · Adapt ideas | · Explain decision reasoning |
| · Recommend changes | · Evaluate decision outcomes |

describes to teachers, parents, and students 'what is to be taught' (ACARA, 2023a). For details about the development of the Australian Curriculum, see ACARA (2023b).

The Australian Curriculum includes CCT as one of seven 'general capabilities' (ACARA, n.d.a). Like the other six general capabilities (Literacy, Numeracy, Information and Communication Technology, Personal and Social, Ethical Understanding, and Intercultural Understanding), CCT is presented as a distinct area of curriculum (ACARA, 2023c), but the intention remains that all seven general capabilities be pedagogically embedded by teachers across the disciplinary domains (called the 'learning areas' in the Australian Curriculum) of English, Mathematics, Science, Humanities and Social Studies, The Arts, Technologies, Health and Physical Education, and Languages. (For a discussion of pros and cons associated with the general capabilities in the Australian Curriculum, see Gilbert, 2019).

Australia's CCT general capability is complex. It is comprised of 'elements' and 'sub-elements' with associated content descriptions (i.e. broad learning outcomes) from Level 1 (Foundation) to Level 6 (Years 9–10). Although there have been minor changes to its structure and content since its introduction, the CCT general capability has retained the same four-element structure: inquiring, generating, analysing, and reflecting. The current sub-elements for each of these elements and the associated content descriptions (Version 9; ACARA, n.d.b) are presented in Table 2. Though not shown in Table 2, the Australian Curriculum presents a learning continuum for each sub-element, which 'describes the knowledge, skills, and behaviours that students can reasonably be expected to develop from Foundation to Year 10' (ACARA, 2023c).

**Table 2** The elements and sub-elements in the Australian curriculum CCT general capability (version 9)

| |
|---|
| **Inquiring** |
| Develop questions—students narrow or expand the focus of their thinking and develop different kinds of questions to find more information about a topic and form a better understanding of how something works or why it is the way it is |
| Identify sources, and process and evaluate information—students seek information from a range of sources, make decisions about expert or personal opinion, and understand which sources are trustworthy, relevant and useful |
| **Generating** |
| Create possibilities—students explore and combine ideas to create innovative solutions, and adapt and present ideas in new ways, as they engage with learning area content |
| Consider alternatives—students examine different and creative ways to approach tasks and make recommendations on preferred options and actions |
| Put ideas into action—students experiment with ideas, modify and adapt approaches, and evaluate options and actions in a range of situations |
| **Analysing** |
| Interpret concepts and problems—students interpret concepts, ideas, theories and problems, and deconstruct them into their component parts, to gain a deeper understanding of the context or situation |
| Draw conclusions and provide reasons—students reach a conclusion or make a choice for action by connecting to learning area knowledge and understanding. Justifying a conclusion also requires the provision of a reason or the development of an argument in support of the conclusion or action |
| Evaluate actions and outcomes—students consider the choices made when they solve problems or attempt learning area tasks and evaluate solutions and outcomes to help plan for future action |
| **Reflecting** |
| Think about thinking (metacognition)—students identify, describe, and evaluate the thinking and learning strategies that they use to complete activities. They reflect on the ways that their thinking, and the approaches they take, may be influenced by external contributions or viewpoints |
| Transfer knowledge—students make connections between their current knowledge and skills, and new contexts where they can adapt and use what they already know and can do. New contexts can include other learning areas of the curriculum |

The introduction of CCT as a general capability in the Australian Curriculum was heralded as an imperative for Australian teachers to teach CCT skills more *explicitly* (e.g. McIlvenny, 2013). ACARA called on Australian teachers to *explicitly* develop CCT skills (Organising Elements for Critical and Creative Thinking [Version 8.4], ACARA, n.d.a) and to *explicitly* teach CCT throughout the learning areas (Critical and Creative Thinking in the Learning Areas [Version 8.4], ACARA, n.d.a).

Given the apparent emphasis on the *explicit* teaching of CCT, it is relevant to define this term. Explicit teaching is typically defined as explaining and modelling the concepts and skills intended to be learned and providing guided practice and feedback (Archer & Hughes, 2011; AERO, 2023b). Explicit teaching of CCT skills in domain-specific ways and across year levels is important because CCT skills are 'hard won' over the long term and not readily transferrable between domains (Willingham, 2019, pp. 13, 14). While an intention of Australia's CCT general capability was to facilitate explicit teaching of CCT skills at every level of schooling, there is currently little published research on the extent to which Australian teachers are explicitly teaching CCT concepts and skills.

The limited relevant evidence suggests that CCT is poorly or inconsistently understood by teachers both in Australia (Carter & Buchanan, 2022; Pithers & Soden, 2000) and internationally (Davies & Willing, 2023; van der Zanden et al., 2020). The limited research on CCT teaching in Australia includes an ACARA-commissioned consultation report about the general capabilities by The University of Queensland's Institute for Social Science Research (ISSR, 2021) and a general capability focused teacher survey by Carter and Buchanan (2022).

Commissioned by ACARA, the ISSR (2021) report suggests issues associated with the CCT curriculum. The ISSR surveyed 94 teachers and school leaders, parents, academics, and professional associations. Open-ended comments were submitted by 32 respondents and were primarily negative/constructive. The comments mainly focused on the need for greater clarity of the content (e.g. elements, sub-elements, and learning continua), including the distinction between 'critical' and 'creative' thinking. For example, a national association submitted that it was 'still not clear to the teachers we work with how creative and critical thinking are 2 different things in the elements and sub-elements' (p. 26). Other comments concerned implementation issues, including those around teacher capability and expertise and the methods and practices associated with teaching and assessing CCT.

Carter and Buchanan (2022) surveyed 185 NSW primary teachers about all the general capabilities in the Australian Curriculum, highlighting concerns with the implementation of this curriculum more broadly. They found that while the teachers viewed all the general capabilities as important, the teachers were not confident in their knowledge of these capabilities. Almost half of the teachers reported that they did not understand the general capabilities, and most reported teaching these capabilities only occasionally or not at all. Of the 37 teachers who were interviewed in the study, only two said they taught general capabilities explicitly and none mentioned teaching CCT (i.e., only other general capabilities were mentioned). The participants in the study explained that a lack of professional learning was an impediment to their understanding of the general capabilities.

## Current study

To address the lack of published research on the extent to which Australian teachers are teaching CCT as concepts and skills, the present study was a survey of Australian primary and secondary teachers. The survey was designed to explore to what extent and how Australian teachers have adopted CCT as a general capability *curriculum* (summarised in Table 2) as part of their teaching of other parts of the curriculum. Although we acknowledge other valuable ways of supporting the development of CCT (e.g. Harris et al., 2023; Maksić & Jošić, 2021), our focus was on the explicit teaching of the CCT concepts and skills identified in the Australian Curriculum's CCT general capability. Our focus was on whether and how teachers were 'enacting' the Australian Curriculum CCT general capability as an 'intended' curriculum, but not whether or how they had accessed or worked with that curriculum (for a discussion of the processes that mediate intended and enacted curriculum, see Ross, 2023). Finally, our focus was on general capability CCT concepts and skills

that can be learned and practised across multiple domains, rather than those specific to any particular domain (e.g. creative writing; Barton et al., 2023).

Our research questions were as follows:

1. How much importance do Australian teachers ascribe to teaching CCT?
2. What professional learning have they undertaken in this aspect of teaching?
3. How confident do they feel regarding their teaching of CCT?
4. What aspects of Australia's CCT general capability do they teach, and how?
5. What professional learning in CCT teaching do they desire?

## Method

### Overall methodology

A pragmatic mixed-methods, exploratory survey was conducted. Currently practising Australian primary and secondary teachers were invited to contribute to the online survey, which was open from the beginning of the Australian school summer holiday period in December 2022 until February 2023. An online survey was selected as it was best able to gather the views and practices of a large number of teachers and uncover tendencies and patterns in how they teach CCT in relation to Australia's CCT general capability curriculum. An online survey was considered suitable as a way to connect with practising teachers, given many teachers use social media for professional networking. The La Trobe University Ethics Project Number is HEC22350.

### Questionnaire design

The questionnaire included seven sections, each described below. All but the first section offered respondents the opportunity to provide elaborative or qualifying comments in open text responses. The questionnaire was piloted with three teachers to ensure the questions were clear and to ascertain the time requirement (approximately 10 min).

The first survey section sought demographic information, including respondents' gender (male, female, non-binary); age (five categories from 'less than 25 years' to 'over 55 years'); years of teaching (undergraduate with permission to teach, postgraduate, less than 2 years, between 2 and 5 years inclusive, more than 5 and up to 10 years, more than 10 years); education sector (Catholic, Government, Independent) and setting (special, education, primary, secondary, alternative); residing state or territory; predominant teaching grade level; and any learning area specialisation(s) if applicable (English, Humanities and Social Sciences, Health and Physical Education, Languages, Mathematics, Science, Technologies, and/or The Arts).

For the subsequent sections, the following definitions of critical thinking and creative thinking were provided to respondents for reference, drawing on the introductory text of the CCT general capability of Versions 8.4 and 9 (ACARA, n.d.a; n.d.b).[1] Respondents were informed that, for the purposes of the survey, critical thinking meant 'analysing, evaluating, and using information, ideas, evidence, and logic to draw conclusions and solve problems in reasoned ways' and creative thinking meant 'seeing situations in new ways, considering alternative explanations and possibilities, and identifying links between, generating, and applying ideas'.

The second section focused on any preservice or in-service education the respondents had undertaken in how to teach CCT. The categorical options for each question, respectively, were as follows: No, I did not learn about how to teach CCT; I cannot recall whether I learned about CCT teaching; Unsure if it can be classified CCT teaching; and Yes, I did learn about how to teach CCT.

The third section collected general views and practices regarding teaching CCT. Respondents were asked how much they agreed with these statements:

- I believe it is important to develop Critical Thinking in my students,
- I believe it is important to develop Creative Thinking in my students,
- I am confident in my ability to teach Critical Thinking, and
- I am confident in my ability to teach Creative Thinking.

For each statement, a 5-point Likert scale applied: 1—strongly disagree, 2—disagree, 3—neutral, 4—agree, and 5—strongly agree.

Respondents were also asked how often they provide opportunities for their students to practise critical thinking and creative thinking, respectively. The options were as follows:

- I am unsure that I ever do,
- About once a year,
- About once a term,
- About monthly,
- About weekly,
- Most lessons, and
- Usually every lesson.

[1] Version 8.4: 'Critical thinking … involves students learning to recognise or develop an argument, use evidence in support of that argument, draw reasoned conclusions, and use information to solve problems'. 'Creative thinking involves students learning to generate and apply new ideas in specific contexts, seeing existing situations in a new way, identifying alternative explanations, and seeing or making new links that generate a positive outcome'. Version 9: 'Critical thinking involves students analysing and assessing possibilities against criteria for judgement. They construct and evaluate arguments, and use information, evidence and logic to draw reasoned conclusions and to solve problems'. 'Creative thinking involves students learning to generate and apply new ideas and see existing situations in new ways. They identify alternative explanations and possibilities and create new links to generate successful outcomes'.

The fourth section focused on respondents' confidence in their *understanding* of the sub-elements in Australia's CCT general capability, and the fifth section focused on their confidence to *explicitly teach* these sub-elements. Refer to Table 2 for the sub-elements and descriptors presented in the survey. In both sections, for each sub-element, the scale ranged from '1—not confident at all' to '5—extremely confident'. For these sections, the descriptors in the *latest* version of the Australian Curriculum CCT general capability (i.e. Version 9, not Version 8.4) were used as the basis for seeking the respondents' self-ratings. We decided to use Version 9 sub-element descriptors for two reasons. First, the differences in wording between the previous Version 8.4 (released in 2018) and Version 9 (released in 2022) are minor, but the text is clearer in Version 9 (ISSR, 2021). Second, we believed that our findings and any recommendations based on these findings would have greater utility by focusing on the latest version compared with using the superseded version.

In the sixth section, in relation to teaching critical thinking and creative thinking, respectively, the respondents were asked to provide 'up to three examples of what you say' and 'up to three examples of what you do' that 'best reflect your typical approach'. The intention was to invite a range of teaching practices that teachers use to teach CCT.

Section 7 asked the respondents if they would 'like (more) education or guidance regarding effective ways to teach CCT': No—I am not interested in learning more about teaching this area of curriculum; Yes—I would like more understanding and guidance regarding this area of curriculum. A description of the kind of professional learning they desired was invited in the associated textbox.

### Recruitment

The survey link was promoted via our university social media platforms and respective professional and collegial teacher networks via LinkedIn, Facebook, Twitter, and email. Our teacher networks (connected by LinkedIn, Facebook, and Twitter) included teachers in the Government, Catholic, and Independent sectors and in metropolitan and regional areas, mostly in Victoria. Several Facebook groups such as Victorian Teachers Online and QLD Primary Teachers were also asked to promote the link via their pages. In the blurb above the survey link, onward sharing to other potentially interested teachers across Australia (snowballing) was encouraged.

The participant information and consent statement were presented on the first page of the survey. Clicking 'start' at the end of this information, to proceed to the survey questions, was considered 'conduct implying consent' (National Health and Medical Research Council, Australian Research Council, & Universities Australia, 2023, p. 16). Respondents had the option to skip any question or exit the survey at any point.

### Participants

A total of 259 teachers responded to the survey, 86 of whom responded to the open-ended questions seeking CCT teaching examples. Most (80%) of the respondents were female; most were aged 36–45 (32%) or 46–55 (31%) years, followed by over 55 (18%) or 26–35 (17%); most had been teaching for over 10 years (64%), followed

by 5–10 years (21%); and most were teaching in Government schools (71%), with the remaining in Independent (16%) and Catholic (13%) schools. The majority taught in primary (68%) or secondary (28%) settings, and in Victoria (58%), NSW (17%), Queensland (8%), or WA (7%), but all school settings and Australian states and territories were represented. There was an even spread of teachers across all year levels (18–20% in Years 1–2, 3–4, 5–6, and 9–10, respectively) with fewer teaching Foundation and Year 7–8 (12%, respectively). Although 4% selected 'none of the areas listed', all Learning Area specialisations were represented, most frequently English (26%), Mathematics (18%), Science (14%), and Humanities (16%). Technologies, HPE, Arts, and Languages were less frequently selected (9%, 5%, 5%, and 2%, respectively).

### Data analyses

Descriptive and inferential quantitative analyses were conducted with Microsoft Excel (Version 2302) and IBM SPSS (Version 29). The qualitative coding of respondents' free-text responses involved a basic non-hermeneutic form of qualitative analysis known as 'directed content analysis' (Hsieh & Shannon, 2005), assisted by Microsoft Excel (Version 2302) and NVivo (Version 1.7.1).

Each respondent's CCT teaching examples (typically multiple examples per respondent) were analysed by two members of the research team, achieving consensus through discussion where initial codings differed. For each respondent, their examples were copied to one row in Excel. The remainder of the row was divided into the sub-elements of the Australian Curriculum CCT general capability (Version 9; see Table 2). The examples text for each respondent was analysed for full or partial connection with one or more sub-elements. For example, if a concept or skill from a sub-element (even if not the whole sub-element) was addressed in an example, this was reflected by placing an x in the cell representing that sub-element. In addition, we analysed how each identified sub-element was taught. Five ways of teaching were identified: (1) providing opportunity for students to engage in the skill (e.g., by prompting an action or asking a question); (2) modelling the skill; (3) providing scaffolded guidance (e.g., providing steps to follow or a thinking tool); (4) labelling the CCT concept or skill and explaining its meaning or value; and/or (5) providing constructive feedback or positive reinforcement. A single teaching example could be categorised as constituting more than one of these pedagogical practices.

## Results

### How much importance do Australian teachers ascribe to teaching CCT?

A large majority of respondents believed it was important to develop their students' critical thinking (65% strongly agreed and 27% agreed) and creative thinking (61% strongly agreed and 30% agreed), respectively. The mean agreement rating

for critical thinking was $m = 4.51$ (SD = .85) and for creative thinking was $m = 4.45$ (SD = .85). No grouping variable was statistically significantly associated with the level of importance that respondents ascribed to teaching CCT.

Congruent with the high levels of perceived importance, most of the teachers also self-reported that they provided regular opportunities for their students to practise CCT. Opportunities for critical thinking were reportedly provided weekly by 34% of the teachers, most lessons by 34%, and usually every lesson by 8%. Similarly, opportunities for creative thinking were provided weekly by 32%, most lessons by 31%, and usually every lesson by 9%. The remaining believed they facilitated CCT less than weekly, with 7 and 8% feeling 'unsure' that they 'ever do' provide opportunities for critical and creative thinking, respectively.

### What professional learning have teachers undertaken in CCT teaching?

A total of 34% of the respondents could recall receiving preservice (9.5%) and/or in-service (29.4%) professional learning in CCT teaching. Recalling participating in any professional learning in CCT was associated with increased confidence levels (see the next section) and was also statistically significantly associated with greater self-reported frequency of providing opportunities for critical thinking ($m = 5.23$, SD = 1.50 versus $m = 4.86$, SD = 1.47, $p = .05$).

Our content analysis of the respondents' descriptions of the CCT professional learning that they could recall engaging in revealed some common ideas. In their descriptions of their *preservice* learning, many teachers reported learning that CCT is important and the end goal of teaching. They also reported that their learning tended to be based on philosophical or theoretical discussions, rather than focused on specific strategies for teaching CCT. Some recalled discussions about teaching CCT through problem-based learning or inquiry. A few respondents reported learning explicit pedagogies in their arts and media disciplines.

The teachers' descriptions of their *in-service* learning about CCT sometimes identified the provider of the professional learning and not its content. When details were reported about the content of their learning, mostly respondents recalled learning general strategies or philosophies underpinning CCT teaching, including ways to engage students in thinking, the importance of open-ended tasks or inquiry learning, '21st-century skills', and 'buzzwords'. Overall, the teachers tended to report that the in-service training they had received was broad or vague; only a few teachers reported learning specific methods or practices for teaching CCT.

### How confident do teachers feel regarding their teaching of CCT?

In response to the general statement 'I am confident in my ability to teach critical thinking', a modest majority (62.7%) of the teachers agreed: 51.3% agreed and 11.5% strongly agreed. In response to the general statement 'I am confident in my ability to teach creative thinking', fewer (57.1%) agreed: 46.1% agreed and 11.0% strongly agreed. Overall, the mean confidence ratings were therefore moderate. For teaching critical thinking, the mean was $m = 3.60$ (SD = .89) and for teaching

**Table 3** Teachers' Self-rated understanding of, and confidence to teach, the Australian curriculum CCT sub-elements (5-point scale)

| Element | Sub-element | Confidence in understanding, *m* (SD) | Confidence to teach, *m* (SD) | Mean paired difference |
|---|---|---|---|---|
| Inquiring | Develop questions | 3.32 (1.04)[abc] | 3.43 (1.07) | 0.12* |
| | Identify sources, process, and evaluate information | 3.51 (1.07)[be] | 3.47 (1.09)[ab] | − 0.04 |
| Generating | Create possibilities | 3.41 (.99) | 3.28 (1.07)[b] | − 0.13** |
| | Consider alternatives | 3.48 (.99) | 3.34 (1.07) | − 0.14** |
| | Put ideas into action | 3.40 (1.00) | 3.25 (1.06)[a] | − 0.15** |
| Analysing | Interpret concepts and problems | 3.37 (1.09)[def] | 3.35 (1.11) | − 0.02 |
| | Draw conclusions and provide reasons | 3.51 (1.03)[ad] | 3.43 (1.13) | − 0.08 |
| | Evaluate actions and outcomes | 3.36 (1.03)[gh] | 3.38 (1.08) | 0.02 |
| Reflecting | Think about thinking (metacognition) | 3.38 (1.06) | 3.36 (1.10) | − 0.03 |
| | Transfer knowledge | 3.51 (.99)[cfgh] | 3.42 (1.03) | − 0.09 |

The superscript letters indicate pairs where the within-column differences were significant ($p < .05$)
*$p < .05$. **$p < .01$

creative thinking, the mean was $m = 3.50$ (SD = .94). Recalling any professional learning in CCT was associated with higher confidence regarding teaching both critical thinking ($m = 3.98$, SD = .83 versus $m = 3.42$, SD = .86, $p < .001$) and creative thinking ($m = 3.84$, SD = .89 versus $m = 3.33$, SD = .91, $p < .001$). Reporting a STEM specialisation (i.e. science, mathematics , or technology) was associated with greater confidence in teaching creative thinking ($m = 3.62$, SD = .87 versus $m = 3.31$, SD = 1.00, $p = .01$).

In relation to the specific Australian Curriculum CCT general capability sub-elements, confidence levels tended also to be moderate. As can be seen in Table 3, the teachers' self-rated *understanding* of the sub-element descriptions varied significantly between sub-elements (several statistically significant differences were observed) whereas their levels of confidence in their ability to *explicitly teach* the sub-elements, while only moderate, were relatively stable across sub-elements.

As shown in Table 3, the teachers' confidence in their ability to explicitly *teach* the sub-elements tended to be lower than their self-rated *understanding* of the sub-element descriptions, particularly for the Generating sub-elements. The Inquiring sub-element 'Develop questions' was an exception to this pattern: The teachers felt more confident in their ability to teach question-development than in their understanding of the sub-element description. They were most confident in their ability to teach the Inquiring sub-elements and one Analyse sub-element: 'Draw conclusions and provide reasons'. The teachers reported least confidence in their ability to teach the Generating sub-elements. In the textboxes, some teachers commented on perceived challenges in addressing the CCT general capability 'in practice'.

**Table 4** Percentages of respondents (N = 86) who provided an example of teaching CCT that related to an Australian curriculum (version 9) CCT general capability sub-element

| Pedagogical practices | Elements and sub-elements | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inquiring 1. Question 2. Process | | Generating 1. Create 2. Alternatives 3. Action | | | Analysing 1. Interpret 2. Conclude 3. Evaluate | | | Reflecting 1. Metacog 2. Transfer | |
| | 1. | 2. | 1. | 2. | 3. | 1. | 2. | 3. | 1. | 2. |
| Any teaching | 13 | 31 | 26 | 40 | 6 | 14 | 29 | 13 | 19 | 10 |
| Opportunity | 6 | 24 | 23 | 36 | 4 | 8 | 24 | 11 | 14 | 5 |
| Model | 4 | 7 | 4 | 6 | 1 | 2 | 2 | 1 | 6 | 4 |
| Scaffold | 4 | 6 | 8 | 6 | 2 | 5 | 10 | 2 | 1 | 2 |
| Explain | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 |
| Feedback | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Percentages are rounded. Percentages could total more or less than 100% because more than one (sub)element or pedagogical practice, or none, could be represented in each respondent's example(s)

## What aspects of Australia's CCT general capability do teachers teach, and how?

Across all the 'say' and 'do' examples of typical CCT teaching shared by the 86 teachers who responded to this part of the survey, every Australian Curriculum CCT sub-element was represented at least partially. The examples shared by the teachers indicated that they incorporate CCT into their teaching of other learning area content, as intended by the Australian Curriculum. As shown in Table 4, the examples most frequently related to 'Consider alternatives', 'Identify, process, and evaluate information', and 'Draw conclusions and provide reasons'. The examples were mostly of the teachers providing opportunities for students to engage in CCT skills (e.g., asking questions or prompting), rather than explicitly labelling, explaining, modelling, scaffolding, or reinforcing CCT skills.

It was rare for a CCT sub-element to be represented fully in the teachers' examples of their 'typical approach' to teaching CCT; instead, the examples tended to focus on very specific CCT skills, that is, components of sub-elements. For example, many teachers shared examples of asking their students to consider an alternative approach (e.g. 'What is another way you can do that?'), which we coded as 'Consider alternatives' even though most of that sub-element description was not addressed in the example. Some teachers asked their students to consider how or where they could seek information, which we coded as 'Identify, process, and evaluate information', even though that full sub-element was not addressed, or they asked their students to provide a reason for an answer or view, which we coded as 'Draw conclusions and provide reasons', even though that full sub-element was not addressed.

We found that the coding was most difficult for the Generating sub-elements. Most of our inter-coder conferencing was focused on this element because there is some conceptual overlap between the sub-elements within the Generating element (between 'create possibilities' and 'consider alternatives'), and between the

**Table 5** Percentages of teachers reporting any kind of teaching of the CCT sub-elements: differences by setting and specialisation

| | Elements and sub-elements | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Inquiring<br>1. Question<br>2. Process | | Generating<br>1. Create<br>2. Alternatives<br>3. Action | | | Analysing<br>1. Interpret<br>2. Conclude<br>3. Evaluate | | | Reflecting<br>1. Metacog<br>2. Transfer | |
| | 1. | 2. | 1. | 2. | 3. | 1. | 2. | 3. | 1. | 2. |
| Whole sample ($n=86$) | 13 | 31 | 26 | 40 | 6 | 14 | 29 | 13 | 19 | 10 |
| **Setting** | | | | | | | | | | |
| Primary ($n=59$) | 18* | 25 | 16 | 42 | 4 | 7 | 28 | 12 | 23 | 4 |
| Secondary ($n=27$) | 4 | 40 | 52* | 36 | 12* | 28* | 28 | 16 | 12 | 24* |
| **Specialisation** | | | | | | | | | | |
| STEM ($n=50$) | 10 | 22 | 27 | 43 | 8* | 10 | 22 | 12 | 22 | 10 |
| Non-STEM ($n=36$) | 17 | 43 | 26 | 37 | 3 | 20* | 37 | 14 | 14 | 9 |

*In these cases, the percentage is more than double the corresponding percentage

Generating sub-elements and other elements (e.g., between 'put ideas into action' and 'evaluate actions and outcomes').

Table 5 shows some differences in the foci of the shared teaching examples based on setting (primary versus secondary) and specialisation (STEM versus non-STEM). As can be seen in Table 5, primary teachers were more than twice as likely to provide examples of teaching the skills involved in 'Developing questions' whereas secondary teachers were more than twice as likely to do so for skills involved in 'Create possibilities', 'Put ideas into action', 'Interpret concepts and problems', and 'Transfer knowledge'. STEM teachers were more than twice as likely to address 'Put ideas into action', whereas non-STEM teachers were twice as likely to address 'Interpret concepts and problems'.

## What kind(s) of professional learning in CCT teaching do teachers desire?

Most of the respondents (82%) endorsed the statement that they would 'like (more) education or guidance regarding effective ways to teach CCT'. The textbox elaborations revealed that most respondents would value professional learning focused on implementation of CCT teaching in real-world classrooms while considering the need for curriculum integration and time efficiency. They would value practical examples of explicit CCT teaching, including observations of expert teachers, and high-quality CCT teaching materials they could adapt for use in their classroom. There were also a few responses requesting professional learning on teaching CCT to students with diverse learning needs, including

behavioural challenges and low literacy, as well as on the assessment of CCT and on the link between CCT and background knowledge.

## Discussion

This study explored practising Australian teachers' adoption of CCT as curriculum via a national online survey. Despite Australia's CCT general capability being in place for over a decade, the findings suggest that 'typical' teacher practice in this area does not align strongly with this curriculum. The teachers generally viewed teaching CCT as important, and most reported providing regular opportunities for their students to engage in CCT. However, we found a skewed emphasis on some elements of the CCT general capability curriculum, while other elements were relatively neglected. This may reflect jurisdictional or school-based implementation issues and/or an inappropriate curriculum structure. Further, while teachers reported providing opportunities for their students to exercise CCT skills, there was minimal evidence of CCT being *explicitly* taught as intended by ACARA. The modest alignment between the intended curriculum and enacted teacher practice is consistent with the participants (a) reporting limited professional learning in this area and (b) rating their understanding and confidence re the CCT general capability as only moderate.

The Australian Curriculum presents the CCT general capability as comprised of four elements and includes learning continua that suggest each element should be addressed at all levels. However, based on the 'typical' CCT teaching examples shared in this study, teachers do not appear to be emphasising each element equally. Instead, different patterns in the teachers' examples were observed based on their setting and nominated specialisation. For example, primary teachers were more likely than secondary teachers to share examples of teaching 'developing questions' and 'metacognition' but less likely to share examples of most other sub-elements. Similarly, there were differences in the examples provided by STEM specialised teachers compared to other teachers. STEM specialised teachers were more likely to share examples of 'considering alternatives', 'putting ideas into action' and 'metacognition', but less likely to share examples of teaching other skills. The shared examples reflect the practices of only some teachers and should not be considered exhaustive. It is likely that many practices occur that were not captured in the shared examples. However, it is also possible that certain CCT skills may be viewed in certain teaching contexts to be more/less relevant or useful. Future qualitative research with teachers is warranted because, if teachers do hold such views, such insights should not be ignored. It is also possible that teachers in certain contexts may require more guidance in how to pedagogically integrate certain CCT skills. Further research with teachers may inform improved curricular frameworks and/or professional learning offerings.

Our findings suggest that *explicit* teaching of CCT skills (explaining, modelling, providing guided practice and feedback) is not common. The relative lack of examples of explicit teaching of CCT skills suggests the intentions of the Australian Curriculum CCT general capability are not being realised. According to the Victorian

Curriculum and Assessment Authority (VCAA, n.d.), 'explicit attention to' and 'explicit support to develop' students' CCT skills is necessary to build students' capacity to manage their thinking productively and purposefully. The relative lack of explicit teaching in the teachers' examples warrants attention because explaining and modelling skills and providing scaffolded practice and feedback are effective ways to teach skills (AERO, 2023a; Archer & Hughes, 2011; Berger & Foster, 2020; Fisher & Frey, 2021), and these methods may currently be underutilised in relation to developing students' CCT skills.

Merely providing *opportunities* to engage in CCT skills may develop or consolidate these skills for students who already have the required dispositions and confidence, but it may not address the needs of other students. CCT scaffolding can be provided in several ways and offers a 'safety net' for students (Vigors, 2022, p. 45). In the words of Vigors, 'modelling our thinking and naming what we are doing through think alouds allows our students to see and hear what effective thinkers do… to demystify the type(s) of thinking being asked of the students' (2022, p. 45). The power of explicit positive feedback can also be harnessed to strengthen CCT (Scott & Landrum, 2020). Professional learning in the explicit teaching of CCT skills was specifically requested by many of the teachers.

While examples of explicit teaching were rare, there were nonetheless many examples shared by the teachers that showcased their significant practical expertise in harnessing opportunities to encourage CCT. This is unsurprising, given most respondents to our survey had at least 10 years of teaching experience and an interest in CCT. There were also *some* examples of explicit teaching of CCT skills. This means it should not be assumed that Australian teachers do not know what CCT skills are or that they teach CCT skills just by giving students 'problems they can't solve' (Duggan, 2022; Sweller, 2022). Some teachers may require more support to teach CCT more effectively; however, our findings indicate that many teachers are employing sound CCT teaching practices. Many teaching examples were provided of using questions to prompt CCT in relation to the topic being taught. Strategic questioning is a well-established pedagogy for engagement, consolidation, and extension (Galatis, 2019; Hopkins & Craig, 2015; Ritchhart & Church, 2020; Rosenshine, 2012, pp. 14–15).

A potential explanation for the poor alignment between the CCT general capability sub-elements and the teachers' shared examples could be the lack of effective preparation participants reported receiving. Only a minority could recall preservice or in-service professional learning in this area. Professional learning unable to be recalled might be considered ineffective. The professional learning that was recalled tended to be reported to be philosophical rather than pedagogical in focus and was rarely specific to the Australian Curriculum CCT general capability. Unsurprisingly, the teachers' confidence in their understanding of, and their ability to explicitly teach, the CCT general capability sub-elements tended to be only moderate. Improved professional learning may be needed, either as part of teachers' initial teacher education or as part of their in-service professional learning. Recalling any CCT professional learning was associated with greater confidence to teach CCT and with providing more frequent opportunities for critical thinking, and many of our respondents called for more guidance in this aspect of their teaching. If teachers are

to play a strong role in promoting CCT and the associated benefits to individuals and society, there needs to be investment in equipping them with the conceptual and pedagogical expertise to do so. However, improved professional learning may not be the only area of potential improvement.

It is possible that the current design of Australia's CCT general capability curriculum may not be practicable. Presently, this curriculum is complicated and is, itself, part of a complex broader curriculum. The CCT general capability is comprised of four elements and ten sub-elements and, at each of the six levels, each sub-element has multiple links to other same-level content descriptions and elaborations in the eight learning areas (e.g. English, Mathematics, Science, etc.). Significant issues with this 'matrix approach' to curriculum design have been highlighted by Gilbert (2019). Moreover, CCT reporting, if mandated at all, is mandated only at the general capability level, not by element or sub-element (e.g. VCAA, 2023) and this reporting is not required to be linked to any specific learning area(s). Responsibility for teaching CCT in any one learning area—or at all—is therefore dissipated. Such issues may explain why the general capabilities in the Australian Curriculum, in general, are rarely taught (Carter & Buchanan, 2022) and why confidence with the CCT general capability, in the current study, was not high.

The current CCT general capability is likely to be difficult to integrate, in its entirety, into one's teaching of the wider curriculum simply because it is so complex. It is possible that a simplified CCT general capability, consisting of essential, explicitly teachable CCT concepts and skills, all general enough to be applicable or adaptable across learning areas and accessible to learners of all ages and diverse abilities, might be more readily taught. Simplifying the current CCT general capability structure, by identifying teachable skills that contribute to critical thinking and creative thinking, respectively, such as those shown in Table 1, might facilitate greater teacher confidence and improved learning and consolidation of those skills for students. CCT concepts and skills self-evidently related to critical thinking and creative thinking, respectively, might be more easily integrated into teachers' own CCT schemas (Cottingham, 2022) and, therefore, into their daily pedagogical practice. Such a curricular re-organisation might also address previously identified weaknesses in the structure and clarity of the current CCT general capability (ISSR, 2021).

## Limitations

The findings of this study should be interpreted with caution in three respects. First, our sample was not nationally representative. In addition to most of the teachers practising in Victoria, the sample snowballing that was encouraged may have resulted in the recruitment of clusters of teachers with similar views and approaches, further narrowing the representativeness of our sample and reducing the generalisability of our findings. Due to self-selection, our sample almost certainly over-represents teachers with an interest in teaching CCT.

Second, care should be taken when drawing inferences about the teacher-provided examples of 'typical teaching' in this study. While it is reasonable to assume that the

examples shared by the teachers reflect their front-of-mind, typical CCT teaching practices, the examples do not represent a complete catalogue of every CCT teaching practice they engage in. There may be additional CCT skills, and more explicit teaching of these skills (i.e., explaining, modelling, scaffolding, and reinforcing), beyond what was conveyed in the teachers' contributed examples.

Finally, this study employed an exploratory survey methodology. While exploratory survey research enables the identification of patterns, including sub-group analyses, future in-depth qualitative research would afford opportunities for clarification and deeper understanding that are not possible in survey research.

Notwithstanding these limitations, the patterns revealed in this study indicate that more research is needed with respect to jurisdiction/school-based implementation and/or improvement of the Australian Curriculum CCT general capability. Our findings also highlight the need for nuanced, evidence-based scholarly discourse about the teaching of CCT in schools. Beyond focusing on whether CCT can/should be taught (e.g. Sweller, 2022), our research shows there is a need to focus on the curricular frameworks and resources and professional learning that teachers need to maximise students' CCT capabilities, including through explicit teaching of CCT concepts and skills.

## Conclusion

Many Australian teachers are committed to teaching thinking skills that help their students to critically and creatively utilise and enrich their learning, but many of these teachers do not feel well prepared to implement Australia's CCT general capability curriculum. The teachers' CCT teaching examples do not reflect holistic adoption of this curriculum. Based on our findings, we argue that one area deserving of increased attention is CCT-focused teacher education. We believe teacher education has an important role to play in ensuring all teachers are skilled and confident in teaching CCT as part of their regular teaching. Our findings equally raise questions, however, regarding the extent to which the nature of the current CCT general capability is fit for purpose. The complexity of this general capability may be suboptimal because it does not efficiently facilitate explicit, integrated CCT teaching. Despite this, hearteningly, our research has found that many teachers are incorporating CCT teaching as part of their teaching practice.

**Funding** Open Access funding enabled and organized by CAUL and its Member Institutions. No funding was received for this research. Ethical approval was obtained for this research.

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