

Teacher Beliefs about Constructivist and Instrumentalist Approaches to Mathematics Teaching: An Exploratory Case Study

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Within a global trend of the narrowing of curricula, the teaching of mathematics through a constructivist approach, where students actively build meaning through inquiry, reasoning and conceptual understandings, is at risk. This exploratory case study, conducted in a medium-sized regional school in Queensland, Australia, sought to understand teacher's beliefs about mathematics and how these beliefs impact their practice. Findings showed that teachers held mixed beliefs about teaching and learning mathematics and often struggled to use the *Australian Curriculum* in ways that supported high-quality constructivist approaches to pedagogy, finding it too restrictive. This study highlights the need for targeted professional development to support teachers with pedagogical strategies that align with the intent of the *Australian Curriculum* and constructivist approaches, ensuring that future 21st-century learners become confident, creative users and communicators of mathematics.

Keywords • teacher beliefs • mathematics teaching • primary teaching • professional development • Australian Curriculum

Australian teachers work within the context of a current global trend towards the narrowing of curricula, characterised by a reduction of content taught and a continued push to teacher-centered instruction (Olivant, 2015). This narrowing of curricula is particularly noteworthy in mathematics, where international assessments have documented declines in student performance over time, alongside persistent differences in achievement across geographic locations in Australia (Organisation for Economic Cooperation and Development [OECD], 2026). As education systems seek to demonstrate success in increasingly test-driven environments, a stronger focus on measurable outcomes can contribute to the commodification of education (Hardy, 2015). An example of this movement towards greater standardisation and accountability is the progressive introduction of the national *Australian Curriculum* since 2009, including a specific mathematics curriculum (Assessment and Reporting Authority [ACARA], 2009). The *Australian Curriculum* mathematics includes learning outcomes that are required to be taught across each of the six strands of Mathematics—Number, Algebra, Measurement, Space, Statistics, and Probability—at each year level. Content is presented linearly with year-level boundaries along with proficiencies that teachers are expected to address. The intention of the proficiencies is that they are separate from the content, thereby affording teachers the professional respect to develop innovative and dynamic teaching methods (ACARA, 2023).

The timing and manner in which teachers implement content descriptors and proficiencies in their mathematics classroom are shaped by teacher beliefs (Polly et al., 2014). Positive teacher beliefs are essential as they influence educational practice and the way in which teachers interpret and enact curriculum expectations (Kasa et al., 2024; Farfan et al., 2025). Similar findings from the Office of the



Chief Scientist (Smith et al., 2018), identified that teachers profoundly influenced the teaching and learning of mathematics in the primary school classroom, which may in turn impact students' perceptions about mathematics.

Many internal and external factors influence the how and why of teaching. These factors include, but are not exclusive to policy, curriculum and accountability measures, student, school and community pressures, and internal features such as beliefs, self-efficacy, and knowledge (Bahr & Mellor, 2016). These factors can shape mathematics teaching and, in turn, influence student learning opportunities (Lomas, 2017). Although some teachers concentrate primarily on delivering the activity itself, teaching involves more than the delivery of prescribed activities (Bahr & Mellor, 2016). Mu et al. (2022) similarly argued that high-quality teachers go further by aligning their instruction so that students not only complete the activity but also achieve their full potential and develop a deep, transferable understanding of the content. In the context of narrowing curricula, increasing pressures towards teacher-centred, and declining mathematical outcomes, approaches that strengthen and extend students' conceptual understanding are required. This emphasis is consistent with the goals of the *Australian Curriculum*, in which learners are equipped not only to meet prescribed outcomes but to thrive as capable and flexible mathematical thinkers (ACARA, 2023).

These considerations highlight the importance of understanding how teachers' beliefs about mathematics shape their teaching, particularly within the constraints and affordances of their local contexts. This case study of a regional Queensland school, sought to understand teachers' beliefs about mathematics and how these might be reflected in practice in their classrooms.

Background Literature

Teacher Personal Beliefs

Beliefs and knowledge

To define teacher beliefs, we draw on Kasa et al.'s (2024) definition, which characterises the way teachers' perceive mathematics, is impacted by their "conscious or unconscious thoughts, ideas, meanings, regulations, mental images, and preferences regarding the subject" (p. 3). The extent to which teacher beliefs are stable or subject to change has been contested in the literature. Buehl and Beck (2015) viewed teacher beliefs as stable and highly resistant to change, whereas Beswick (2007) found that teachers who implemented new instructional practices that proved successful might revise their beliefs. Cross Francis et al. (2015) further reported changing teacher beliefs relied on many factors, such as participants volunteering for research and their prior experiences of schooling.

Buehl and Beck (2015) stated that beliefs are held within an individual and are separate from knowledge. When considering mathematical knowledge, Ernest (1989) described two contrasting epistemological perspectives: an *instrumentalist view*, in which mathematical knowledge is seen as certain, fixed and comprised of prescribed facts that children must learn, and the *constructivist view*, in which mathematical knowledge is acquired through meaning-making and active involvement by students (Geiger et al., 2020). Ernest (1989) further suggested that teachers who experienced this view of mathematics in their schooling were likely to adopt similar epistemological beliefs in their own practice. Meschede et al. (2017), however, challenged the assumption that instrumentalist and constructivist views were at opposite ends of a single continuum, asserting instead that teachers could draw on both perspectives simultaneously.

Teacher beliefs and knowledge about teaching mathematics are shaped by a range of personal and professional influences. Rubie-Davies (2015) contended that teaching experience, philosophy, values and backgrounds contribute to the formation of their beliefs, which in turn, inform the instructional strategies teachers adopt. In this sense, beliefs operate as filters through which teachers interpret pedagogical knowledge, leading to variations in how instruction is delivered (Fives & Buehl, 2012). Despite many teachers professing support for student-centred approaches (e.g., collaborative learning,

conceptual connections, and inclusive practices) empirical evidence suggests a persistent misalignment between endorsement and enactment. For example, Garegae (2016) identified inconsistencies in the relationship between some teachers' stated beliefs and their instructional behaviours, further highlighting the complexity of translating epistemological and pedagogical beliefs into practice.

Impact of teachers' beliefs in the classroom

Teachers' beliefs can play a significant role in turn on student's academic achievement and their own beliefs as learners (Carlana, 2019). Three terms coined by researchers about self-fulfilling prophecies are the "Pygmalion effect", the "Matthew effect", and the "Golem effect" (Sabarwal et al., 2022). Research found that the "Golem effect", a lowering of expectations, profoundly affected students from disadvantaged backgrounds. Teachers had lower expectations and interacted differently with these students, resulting in lower student outcomes (Bertrand & Duflo, 2016). Teachers who held these biased views failed to encourage students to reach their potential, even in the face of information that promoted these ideas as erroneous (Carlana, 2019). In contrast, the "Pygmalion and Matthew effects" emphasised that teachers with high expectations of children interacted differently, so children's beliefs about themselves and their academic outcomes were increased. This theory was supported by Wang et al. (2018), who found that teachers often held lower expectations for low socioeconomic students and students with learning difficulties and disabilities.

Research has also been undertaken to study teacher gender beliefs. Lavy and Sand (2015) found that teachers favoured boys in mathematics, positively affecting their achievements. Conversely girls were significantly, and negatively affected, by teachers holding lower expectations for them resulting in lower math scores and being discouraged from taking mathematics in later years (Carlana, 2019; Wang et al., 2018). Researchers espoused that although teachers did not explicitly endorse these beliefs, gender stereotypes were so deeply embedded in their experiences that they affected student interactions (Carlana, 2019). Alan et al. (2018) found that the personal views of elementary school teachers can play a critical role in lessening or extending the gender achievement gap. Lazarides and Watt (2015), who undertook research in Australia, agreed with gender bias results for girls leading to "lower mathematical success expectancies, task values, and subsequent lower mathematics-related career plans" (p. 58).

Teachers' own efficacy of mathematics was also identified in the literature (Rubie-Davies, 2015; Trusz, 2017) as contributing to enactment of classroom pedagogy. A variety of studies showed teachers thoughts about their own competency impacted the utilisation of student agency, including use of collaborative mathematical activities for developing twenty-first-century skills (Nieminen et al., 2022), developing mathematical understandings (Hansen, 2022) and noticing students' ideas (Stockero et al., 2017). Rubie-Davies (2015) research that showed teachers with high self-efficacy regarded the need for deep learning and mastery and encouraged children to interact and support each other. These teachers identified errors were learning opportunities and were able to provide constructive feedback focused on acquiring skills and understanding (Rubie-Davies, 2015). In contrast, Täschner et al.'s (2025) systematic literature review of 115 studies evidenced that teachers with low self-efficacy expected students to listen and learn, behave well, and follow directions, avoiding cognitively demanding teaching and used less engaging practices.

Teacher confidence or anxiety of teaching mathematics are crucial in the primary years. Ganley et al. (2019) found that higher teacher maths anxiety is associated with lower mathematical knowledge for teaching and more traditional beliefs about mathematics instruction, including less time spent on mathematics instruction and fewer opportunities for student participation, were less disposed to try new and novel strategies (Perera & John, 2020). This view encourages teachers to see mathematics knowledge as facts and figures in textbooks (Boote & Boote, 2018). Teachers' lack of confidence presents a challenge to adopt student-centred teaching and assessment approaches. This is consistent with research by Täschner et al. (2025), which shows lower teacher self-efficacy correlates with less engaging practices. Teachers' choice of curriculum topics, goals, tasks, pedagogical choices, and classroom



climate are important, as they were demonstrated to affect students' learning opportunities (Lomas, 2017).

Current pedagogical approaches to teaching and assessing mathematics

Mathematics mastery for teachers and students involves conceptual understanding and procedural fluency (Keazer & Phaiah, 2022). Conceptual learning is shown by students when they can identify and apply principles, integrate related concepts, and use a variety of representations to show this understanding. Procedural fluency is the ability to use processes and procedures accurately and efficiently in multiple contexts and to be able to decide the most appropriate strategy (Powell et al., 2022). Keazer and Phaiah (2022) viewed conceptual and procedural knowledge not as two distinct categories of mathematics but as "indissolubly linked" (Grootenboer et al., 2023, p. 622).

Teachers also hold various beliefs about assessment, which impacts the procedures they use in classrooms (Barnes et al., 2015). These researchers suggest that there is a continuum of beliefs about assessment, from covering necessary material, facilitating or individualising learning and making schools accountable, especially considering high-stake assessments. The *Australian Curriculum: Mathematics* has a focus on formative assessment. Formative assessment and classroom discourse are aspects of the curriculum (Schoenfeld, 2020). Moss et al. (2019) stated that assessment is the Achilles heel of an integrated curriculum and Van der Kleij et al. (2018) similarly concurred with the lack of support in the *Australian Curriculum* in that it provides little advice to teachers on how to use formative assessment in subject-specific learning areas. Instead, the absence of support in the national curriculum forces teachers to focus on content. Traditional ways of teaching the subject with little planning using evidence-based practices become a teacher's fallback position (Goos et al., 2012). As Bahr and Mellor (2016) discussed, to ensure quality teachers and teaching, there needs to be a shift away from achievement standards for learners and instead focus on the development of the whole learner and a closer partnership between schools and universities to provide authentic contexts for pre-service teachers.

Australian Curriculum and Teacher Beliefs

Goals for learning

One of the principal goals of the *Australian Curriculum* was for "all young Australians to become successful learners, confident and creative individuals, and active and informed citizens" (Ministerial Council on Education, Employment, Training and Youth Affairs [MCEETYA], 2008 p. 8). ACARA has set out the *Australian Curriculum: Mathematics* documents in year levels from Foundation to Year 10 in Number and Algebra, Measurement and Geometry and Statistics and Probability (ACARA, 2026a). Proficiency Strands of mathematical understanding and fluency, reasoning, and problem-solving skills supplement the content strands. According to Atweh and Goos (2011), a "national curriculum is as much about the identity of a nation as it is a vision for what are worthwhile capacities for its young people to meet and shape their personal and communal future (p. 215). In Australia, all schools are expected to follow the national curriculum developed by ACARA (2026a).

Two of the most common goals attributed to mathematics education are that the subject is essential to develop competent citizens of the future and that mathematics is a requirement for entry into an occupation (Stillman et al., 2020; Education Council, 2019). As the *Australian Curriculum: Mathematics* (ACARA, 2026c) states, "The curriculum aims to ensure that students: are confident, creative users and communicators of mathematics, able to investigate, represent and interpret situations in their personal and work lives and as active citizens." Mathematics is seen as a science of patterns. Therefore, educators argue that children must be able to problem-solve by using the knowledge and skills they have been exposed to in their education (Boote & Boote, 2018).

Research by Lamb et al. (2020) reported that classroom teachers do not value the *Australian Curriculum*. Hurst and Hurrell (2014) posited that looking instead at the cross-strand, "Big Ideas" in mathematics would improve teachers' understanding of how concepts are built across year levels and

alleviate concerns with the curriculum. In everyday classrooms, though, many teachers may lack insight into the curriculum's aims, rationale and content (Dyment et al., 2014). As Sullivan et al. (2013) discussed, when teachers have a superficial knowledge of the topic they are teaching and are less able to articulate the crucial ideas and concepts that underlie these topics. Ingram et al. (2020) found that teachers did not plan activities that allowed students to develop the proficiencies. Therefore, the curriculum must discuss the connections among these "Big Ideas" and real-world contexts so teachers and children can see these connections (McCluskey et al., 2016). Thornton (2017) suggested that this would produce a classroom culture that embraces "higher-order thinking, collaborative inquiry and dispositions that support productive struggle and confidence to take intellectual risks" (p. 324).

When looking at the goals to create successful students, Reid (2019) criticised the lack of an overarching rationale in the *Australian Curriculum*, which may clarify how the curriculum can build student capacities to meet future challenges. Atweh and Goos (2011) and Lingard (2018) agreed that the structure of the curriculum around content fails to provide future orientation. The absence of focus on the intent of the mathematics curriculum (Atweh et al., 2012) means that the goal of active and informed citizens is far from being realised. Grootenboer et al. (2023) added that teaching can also be constrained by a curriculum that has a "dispensary view" (p. 609).

Challenges in implementing the curriculum in the classroom

Lomas (2017) discussed that an innovative curriculum, like the *Australian Curriculum*, is demanding of teachers as they must make connections between students' informal knowledge and the formal knowledge of mathematics; this can lead to anxiety in both students and teachers. Moreover, teacher beliefs were also observed to influence teachers' acceptance of curriculum reform. As Van der Kleij et al. (2018) concluded, "While policy expectations are high, and support ... exists in principle in the Australian Curriculum, ... practice remains at a rhetorical level" (p. 631).

Callingham et al. (2021) applauded the inclusion of the proficiencies in the curriculum but decried that these were seen as peripheral to the content. As discussed earlier, the curriculum assumes teachers have the knowledge and understanding to link the content and proficiencies. Unfortunately, this is not always the case (Ingram et al., 2020). These authors found that teachers often used textbooks as the starting point for their planning and that teachers see these books as constituting the curriculum. These researchers believed that the proficiencies should be the centre of the curriculum and that there must be direct ties into the content via the concept of "Big Ideas." Hurst (2015) suggested that dynamic and effective teaching would result if the "Big Ideas" were the curriculum's focus. Teachers could see the connections and explicitly teach them to the students. By developing a different mindset, "a richer and more connected world of understanding is likely to open for them" (teachers and students) (p. 20). Although the *Australian Curriculum* is based on evidence-based practices, these are not immediately apparent to teachers.

Callingham et al. (2021) contended that including learning progressions would provide teachers with how and when to use the content and pedagogy to support curriculum development and provide the support that the curriculum lacks. Callingham et al. (2021) also believed that focusing on content within year levels offers little flexibility for students to consolidate their knowledge or develop connections that the proficiencies hope to provide. Moss et al. (2019) stated that although the *Australian Curriculum's* integrated nature is explicit, teachers have little guidance about appropriate pedagogies. The authors continued with their criticism discussing that although the *Australian Curriculum* is detailed, the delivery in schools has become narrowed by the emphasis on high-stakes testing and teacher accountability (Moss et al., 2019). This idea conflicts with the *Australian Curriculum* and the Mparntwe goals (DESE, 2019). Teachers have inadequate mathematical and pedagogical knowledge, lack understanding about engaging student experiences, and have problems fitting everything into a crowded curriculum (Hurst, 2015).

According to the *Australian Curriculum*, critical thinking is the process by which students can develop an argument, use evidence and draw conclusions, and use information to solve problems (ACARA, 2026b). Critical thinking is a vital development skill for children (Ab Kadir, 2018). An

integrated approach to teaching this skill is implicit in the curriculum, but the curriculum is less specific in how teachers would undertake this. Research suggests that teachers would infuse critical thinking in all areas but must also be taught explicitly with clear aims in each lesson to help students understand the importance of critical thinking (Ab Kadir, 2018). This strategy would need teachers to have the prerequisite knowledge and the pedagogical beliefs to teach critical thinking.

Ab Kadir (2018) considered teachers at the heart of educational change. For this reform to occur under the current Australian Curriculum, teachers may require more profound pedagogical knowledge and an increased understanding of children's mathematical skills. As Powell et al. (2022) stated, replacing traditional practices with evidence-based practices creates a greater likelihood of success, meaning more children will succeed. Australian children will then "become confident and creative individuals, successful lifelong learners and active and informed members of the community" (DESE, 2019, p. 6).

This review of literature suggests that teacher personal beliefs impact design of mathematics activities and pedagogical approaches within the classroom. These practices depend on teachers' epistemological approaches and prior experiences. With the goal of supporting ongoing improvement in education, this study was guided by the research questions:

1. *What are the beliefs of teachers about teaching mathematics?*
2. *Do these beliefs align with the requirements of the Australian Curriculum?*

Methods

A mixed-methods exploratory case study was undertaken, according to a critical-realist framework. According to Tikly (2015) critical realism recognises that learning is shaped by underlying structures and mechanisms operating across different contexts. This ontology and a constructivist epistemology view knowledge construction as an involved process. This exploratory study aimed to discover these teachers' beliefs about teaching mathematics in the bounded context of a regional Australian school. The Teacher Beliefs Survey developed by Beswick (2005) was used, with the addition of seven additional open-ended questions based on quality teaching research (Hinz et al., 2019; Powell et al., 2022).

Participants

The research cohort comprised of teachers working in an Australian medium-sized Catholic primary school with 35 teaching staff and approximately 700 students. The school uses the *Australian Curriculum*. No scope and sequence, yearly overviews or unit plans were provided to staff. In the previous three years, the school was engaged in reviewing literacy practices, and an overhaul of teaching practices was undertaken to align current practices with evidence-based strategies. Teachers were also reviewing the use of the mathematics curriculum. Convenience sampling was used in this case study to investigate teachers' beliefs in this one school (O'Dwyer & Bernauer, 2014). As per ethical approval, the administrative assistant in the school emailed all 35-teaching staff to invite them to complete an anonymous survey. A total of 18 teachers (51%) responded, and 12 teachers (34%) answered and returned the quantitative survey. Open-ended questions were answered by nine of participants (75%). Data were collected on year level taught, educational qualifications and years of experience from the 12 quantitative survey respondents (see Table 1). Respondents were assigned ID codes for reporting purposes to maintain anonymity and confidentiality.

Table 1
Respondent Demographics

Respondent	Year Level Taught	Educational Qualifications	Years of experience
5	P-2	Bachelor	10+
6	P-2	Bachelor	10+
8	Other	Postgraduate	5-10
9	3-6	Postgraduate	10+
10	Specialist	Postgraduate	1 -5
11	P-2	Bachelor	10+
12	P-2	Bachelor	10+
13	P-2	Bachelor	10+
14	3-6	Postgraduate	5-10
16	P-2	Postgraduate	10+
17	Specialist	Bachelor	10+
18	P-2	Diploma	5 -10

P-2, Lower primary years; 3-6, School years 3-6; Other/Specialist

Most participants ($n = 7$, 58%) worked in the P-2 area of the school. One teacher had a diploma; 50% ($n = 6$) had a bachelor's degree and 41% ($n = 5$) had a postgraduate degree. The time each teacher worked in the field was also mixed, with one respondent working between 1–5 years, three respondents (25%) between 5–10 years and eight respondents (66%) working over ten years.

Data Collection

This research study used a voluntary, anonymous survey to collect data about teachers' beliefs about mathematics in schools. An online survey, created through the University Lime Survey tool, consisted of 26 questions on a Likert-type scale based on "Beliefs about Mathematics: Its Teaching and its Learning" developed by Beswick (2005), which is comprised of three key areas:

Beliefs about mathematics—for example, whether mathematics is viewed as a collection of rules and procedures or as a dynamic, problem-solving discipline.

Beliefs about teaching mathematics—beliefs concerning how mathematics should be taught, including teacher-directed versus more student-centred approaches.

Beliefs about learning mathematics—beliefs about how students learn mathematics, including the roles of understanding, problem solving, and active engagement.

The tool Beswick (2005) devised was selected for data collection as it was validated in a similar context with practising teachers and tested for validity and reliability (Ferretti et al., 2020; Madsen et al., 2018).

The quantitative questions were accompanied by seven additional open-ended questions written by the research team to provide qualitative data to elicit a deeper understanding of teaching practices and beliefs:

1. What skills, knowledge or strategies are important for children to learn mathematics?
2. What is the best way to teach mathematics? Why?
3. How do you assess children's mathematical knowledge?
4. Why do some children struggle with mathematics?
5. Has the *Australian Curriculum* inspired you to try out new activities in your mathematics teaching? Please explain and provide some examples.
6. Please relate a successful teaching experience in mathematics in your classroom.
7. What further support do you need to teach mathematics effectively in your classroom?

Data Analysis

Data were analysed in two steps. Firstly, descriptive statistics were used to summarise the responses to the 26 quantitative questions and compared with the data collected by Beswick (2005) to understand the trends (Punch & Oancea, 2014; O'Dwyer & Bernauer, 2014). Standard deviations were scored to see the variability of the respondent's answers. Scores were calculated to discover if teachers' beliefs had instrumentalist or constructivist approaches.

Next, qualitative data from the seven open-ended questions were analysed through deductive theming and coding. NVivo coding was employed to develop basic codes from the data. These codes included: concrete materials, inquiry, reasoning and observation within the constructivist perspectives, and foundational skills and explicit teaching within the instrumentalist perspectives. The researchers also coded the *Australian Curriculum* and *Professional Development* as these topics appeared frequently in data respondents (See Figure 1). All data were coded by the first author, and another author independently reviewed the coding to increase reliability.

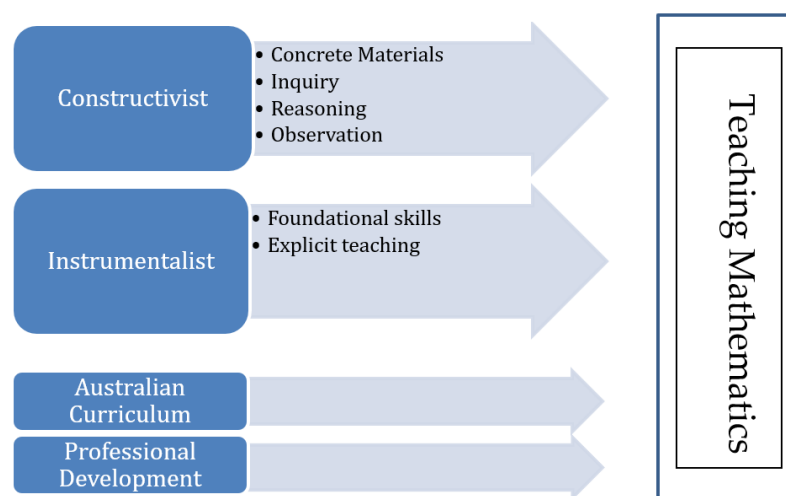


Figure 1: Codes and themes from qualitative data.

Findings

Quantitative Data

Responses from 12 primary school teachers on the 26-item Teacher Beliefs Survey (Beswick, 2005) produced total scores ranging from 85–102 (possible range 26–130). Overall, teachers endorsed several constructivist approaches. All respondents agreed that students need opportunities to reflect on and evaluate their thinking (Q3) and that teachers must understand how mathematics skills and concepts are interrelated (Q4). Across the eight constructivist-aligned items, 85% of responses ($n = 96$) were agree/strongly agree.

Teachers also expressed support for inquiry-related practices such as discussion and students justification (Q9–15), although less consistently (73% agree/strongly agree $n = 61$). Items relating to persistent questioning (Q12) and developing an attitude of inquiry (Q15) had the lowest endorsement (40%, $n = 5$). Reversed items (Q22–26) implemented to cross-check data, showed that most teachers rejected instrumentalist items inconsistent with student agency. For instance, all respondents disagreed that children's explanation of when a mathematical solution does not make sense to the teacher, it is best to ignore it (Q26). Teachers, however, were divided on other instrumentalist-learning items. Some

endorsed established sequences of content (Q17–18), indicating that not all teachers believed student-centred learning was important for mathematics.

Variability in Beliefs

Standard deviations (*SD*) were calculated to examine variation in responses (see Appendix 1). The lowest *SD* of 0.39 was associated with strong consensus on core constructivist items; including the importance of teachers' mathematical knowledge (Q4), student reflection (Q3), and responding to children's errors (Q26). In contrast, the highest *SD* (1.86) occurred for Q22 novel student responses (see Appendix 2). Teachers were also divided on how errors should be corrected Q23, (*SD* 1.51) and on the usefulness of textbooks (Q25; *SD* 1.08). These patterns suggest inconsistency and tension between valuing constructivist approaches and maintaining structured, teacher-led approaches.

Teacher Belief Profiles

Scores were plotted (Figure 2) to visualise teachers' position from instrumentalist and constructivist approaches while recognising that these that these approaches are neither fixed on one, nor the other (Churchill et al., 2022). Although some respondents (e.g. respondent 17) leaned strongly towards constructivist views and others (e.g. Respondents 6 & 18) towards instrumentalist views, most teachers demonstrated mixed belief approaches (see Appendix 2). Neutral responses contributed to lower overall constructivist scores for some participants (e.g. Respondent 5). Overall, teachers tended to endorse constructivist items about learning processes, while simultaneously supporting Instrumentalist ideas about content sequencing and teacher responsibility. Across the group, educational qualification, teaching area and teaching experience did not significantly impact the respondents' beliefs.

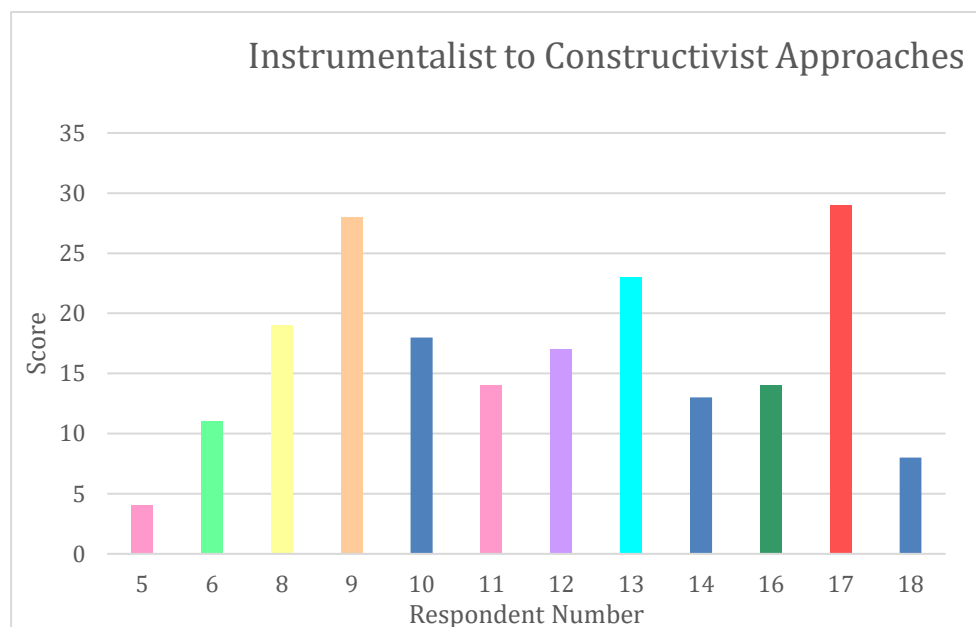


Figure 2. Instrumentalist to constructivist approaches scores.

Qualitative Data

Nine teachers provided responses to seven open-ended questions. Deductive coding identified three themes; Constructivist Perspective, Instrumentalist Perspective, and the Curriculum.

Constructivist perspective

Teachers frequently described using concrete materials (55%, $n = 5$) and encouraging students to explain their answers (66%, $n = 6$). As Respondent 17 commented, “the most critical strategy to teach children was explaining their thinking and computations.” Two respondents discussed the importance of children having a deep understanding of mathematical concepts and being able to see the relationships between these concepts. Respondent 13 encompassed these ideas with the comment that “student-centred learning was successful” in their classroom. While in Q4—*Why do some children struggle with mathematics?*—only one teacher answered that “poor teaching” was why children found mathematics a challenge, reflecting a predominantly learner-centred framing of teaching and learning.

Instrumentalist perspective

Instrumentalist perspectives were evident in teachers' emphasis on foundational skills and explicit teaching. Three respondents (33%) stressed the importance of foundational skills before working on investigations. For example, Respondent 8 commented “I believe a strong understanding of number sense is an important foundation for Mathematics.” Two respondents highlighted “explicit teaching” as a successful strategy in their classroom. Teachers identified children's barriers to learning, such as embarrassment (Respondent 6), fear of failure and anxiety (Respondent 17), disability and learning difficulties (Respondent 16) and the abstractness of concepts (Respondent 9) that impacted learning. Five respondents (55%) attributed difficulty in mathematics to a lack of foundational number concepts. These explanations align with the instrumentalist perspective, which supports the notion that children have a problem learning mathematics, not that the problem could be with the teacher.

The curriculum

References to the *Australian Curriculum* were mixed. When asked whether the curriculum had inspired new activities 44.4% of respondents disagreed. Respondent 5 remarked, “It's boring!” Respondent 13 discussed how current teaching models limit creative thinking and lean toward teaching in “units” rather than inquiry-based learning projects. An alternative view was expressed by Respondent 8, who was looking forward to implementing the revised curriculum with a broader knowledge base.

Assessment approaches also reflected mixed beliefs. Three teachers (33%) reported using constructivist aligned approaches. For example, Respondent 6 discussed, “Watching and listening to students during small group activities.” Respondent 9 discussed using investigations as an assessment tool, and Respondent 6 used *pass-out tickets* to evaluate children's understandings. Two respondents also indicated using assessment approaches categorised within Beswick's framework as evidence collection. Alternatively, three respondents indicated they used summative assessment or computational testing, which supports a more instrumentalist belief. Respondents 16 and 17 blended constructivist and instrumentalist-aligned assessments in their classrooms.

Professional development

A strong theme across responses was the need for professional development (77.7%) to improve skills in using concrete materials and differentiating activities. Respondent 9 commented that they were “Always willing to learn new ways to teach Mathematics.” While Respondent 13 wanted to know about “development in the inquiry model—how it looks, whole class.” This theme cut across teachers' diverse belief perspectives. As Respondent 16 explained, “This area [mathematics] strongly impacts real-world application, yet current models limit student growth and stunt critical thinking. Data for Math is much lower than English—teachers need upskilling.”

Summary of Findings

Across qualitative and quantitative data, teachers at the school demonstrated both instrumentalist to constructivist approaches, often holding them simultaneously. They valued student agency, reasoning and explanation, yet also expressed commitment to structured content coverage, development of

foundational skills, and explicit teaching. Responses suggested tensions between inquiry-oriented pedagogy and curriculum-driven pressures. Teachers were also broadly pessimistic about the *Australian Curriculum's* ability to support innovative mathematics teaching, while unanimously identifying improved pedagogical knowledge as crucial.

Discussion

Several findings in this study diverged from Beswick's (2005) results. Differences may be explained by changes in educational practices (Hinz et al., 2019), differences between primary and secondary teachers' understanding and teaching of mathematics (Dignath & Büttner, 2018), as well as shifts in thinking about the impact of growth mindset on mathematics learning (Rincón Castillo & Falk de Losada, 2020). The introduction of the *Australian Curriculum: Mathematics* (ACARA, 2026a) has also influenced what must be taught in classrooms since Beswick's study in 2005.

Instrumentalist: Constructivist Continuum

Consistent with Beswick's (2005) research, teachers in this study had mixed beliefs about mathematics teaching and learning, with several respondents (e.g., Respondents 16 and 17) expressing both instrumentalist and constructivist beliefs. Quantitative and qualitative data revealed a recurring pattern: teachers valued deep conceptual learning but also felt compelled to retain structured, skill-based approaches. This tension is noteworthy, as classrooms that balance mastery with explicit support may optimise student engagement and reduce anxiety (Smith et al., 2018).

Many elements of constructivist approaches to learning were provided by participants, such as the use of concrete materials (Attard, 2013; Bryant, 2014), problem-solving (Pocalana et al., 2023), justification of thinking (Hinz et al., 2019) and reflection on mathematical workings. Such approaches have been shown to improve student outcomes (Liggett, 2017; Wright, 2017), promote active participation and reduce anxiety (Boaler, 2013). Yet, many teachers also showed instrumentalist views, including structured sequencing of content (Li et al., 2022) and foundational skill development, likely influenced by recent emphasis on explicit teaching in literacy (Moats, 2020). As noted by Hinz et al. (2019), mathematics benefits from both explicit instruction and guided inquiry, an interplay teachers found challenging, as reflected in the high neutral responses in Q12 and Q21 and the mixed assessment practices described in Q3 (see Tables 2 & 3).

Curriculum Alignment and Tensions

Tensions were also visible in teachers' engagement with the *Australian Curriculum*. Several teachers criticised its perceived lack of creativity (Respondent 5) and unit-based structuring (Respondent 13), despite the curriculum's state focus on proficiencies and flexible pedagogical choices (ACARA, 2026c). Such misalignment echoes findings that many teachers struggle to interpret curriculum expectations (Moss et al., 2019; Willis & Adie, 2013; Zhang & Stephens, 2013). Respondents wishing to "marry the curriculum with enquiry learning" (Respondent 17) illustrate the gap between curriculum intent and teachers' pedagogical knowledge.

Ramirez et al. (2018) concluded that how teachers feel and act in their classrooms, whether through explicit or implicit messages, may significantly influence student learning. The differences between beliefs and teaching were found in this study, just as in research by Althaus (2015), who found that teachers had misunderstandings about the most efficient pedagogical strategies to support student learning. Professional development could address this discrepancy (Polly et al., 2014; Gess-Newsome et al., 2019).

Professional Development

One interesting point raised by teachers in this study was their need for professional development, particularly in pedagogical content knowledge and inquiry-based approaches. This idea aligns with the Jorgensen et al. (2010) study, where participants acknowledged that their practices were limited by their lack of pedagogical knowledge of evidence-based research strategies. As Hinz et al. (2019) discovered, high-quality mathematics teaching requires both mathematical content knowledge and pedagogical expertise. Teachers in this study felt unprepared in both areas, consistent with research showing that targeted professional learning can address misunderstandings about effective pedagogy (Althaus, 2015; Polly et al., 2014).

Limitations and Future Directions

As a small exploratory case study, bounded in the context of a small number of teachers in one school is a constraint of this study in terms of generalisability. Any discoveries from this research need to be considered contextually and interpreted cautiously, rather than generalised to other situations. Most respondents were early-years teachers, and broad descriptive data limited further demographic analysis. Future research could incorporate interviews and observations to deepen understanding of how beliefs influence practice. Nevertheless, these findings highlight the potential of professional development to support belief alignment and improve learning experiences in mathematical classrooms.

Conclusions

This study examined teacher beliefs in one school context, using qualitative and quantitative data, in an exploratory case study approach to investigate teacher's beliefs about mathematics teaching and learning. Findings showed that teachers had mixed beliefs, often simultaneously expressing both Instrumentalist and Constructivist beliefs. These blended and sometimes conflicting beliefs were reflected in their pedagogical and assessment choices, some of which aligned with aspects of the *Australian Curriculum*.

A misalignment was revealed between pedagogies encouraged by the *Australian Curriculum* and how teachers interpreted and enacted the curriculum in their classroom practice. Participants identified the current presentation of the *Australian Curriculum* made it difficult for teachers to identify connections between learning area content, the proficiencies and cross-curriculum priorities.

Findings from this exploratory study highlight the importance of professional development that support teachers to interpret and apply the curriculum more effectively and develop confidence in constructivist teaching approaches. Strengthening teachers' curriculum knowledge and pedagogical practices may assist in aligning beliefs with curriculum intent and improving the quality of mathematics teaching and learning.

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Competing interests

The authors declare there are no competing interests.

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Appendix 1: Variance in Teacher Beliefs

Item	Question	SD	Likert Scale	%	Respondents No.	Likert Scale	%	ID No.	Likert Scale	%	ID No.
4	It is important for teachers to understand the structured way in which mathematics concepts and skills relate to each other	0.39	0- Disagree and Strongly Disagree			0 - Neither			12 – Agree and Strongly Agree	100	5, 11, 12, 14, 16, 6, 8, 9, 10, 13, 17, 18
3	It is important for children to be given opportunities to reflect on and evaluate their own mathematical understanding	0.51	0 - Disagree and Strongly Disagree			0 - Neither			12 - Agree and Strongly Agree	100	5, 11, 12, 14, 16, 6, 8, 9, 10, 13, 17, 18
12	Persistent questioning has a significant effect on children's mathematical learning	0.51	0 – Disagree or Strongly Disagree			7 - Neither	58.3	5, 6, 8, 12, 14, 16, 18	6 - Agree and Strongly Agree	50	4, 9 10, 11, 13, 17
17	There is an established amount of mathematical content that should be covered at each grade level	0.51	0 - Disagree and Strongly Disagree			1 - Neither	8.3	10	11 - Agree and Strongly Agree	91.6	5, 8, 9, 11, 12, 13, 14, 16, 17, 6, 18
18	It is important that mathematics content be presented to children in the correct sequence	0.51	0 - Disagree and Strongly Disagree		5, 11, 14, 16	1 - Neither	8.3	14	11 - Agree and Strongly Agree	91.6	5, 6, 8, 10, 11, 12, 13, 16, 17, 9, 18
26	If a child's explanation of a mathematical solution doesn't make sense to the teacher, it is best to ignore it	0.51	12 - Disagree and Strongly Disagree	100	5,10,1 2,13, 17, 6, 8, 9, 11, 12, 14, 16, 18	0 - Neither			0 - Agree and Strongly Agree		

Appendix 2: Highest Standard Deviations

Item	Question	SD	Likert Scale	%	Respondents No.	Likert Scale	%	ID No.	Likert Scale	%	ID No.
22	I would feel uncomfortable if a child suggested a solution to a mathematical problem that I hadn't thought of previously	1.86	7 – Disagree and Strongly Disagree	58.3	5, 13, 9, 12, 14, 17, 18	0 – Neither			5 – Agree and Strongly Agree	41.6	16, 6, 8, 10, 11
23	It is not necessary for teachers to understand the source of children's errors; follow-up instruction will correct their difficulties	1.51	6 – Disagree and Strongly Disagree	50	10, 12, 9, 14, 16, 17	3 – Neither	25	5, 6, 13	6 – Agree and Strongly Agree	50	11, 8, 18
2	Ignoring the mathematical ideas that children generate themselves can seriously limit their learning	1.42	2 – Strongly Disagree	16.6	9, 18	1 – Neither	8.3	14	9 – Agree and Strongly Agree	75	5, 6, 8, 12, 16, 10, 11, 13, 17
1	A vital task for the teacher is motivating children to solve their own mathematical problems	1.21	2 – Disagree and Strongly Disagree	16.6	5, 6	2 – Neither	16.6	8, 9	8 – Agree and Strongly Agree	66.6	10, 11, 12, 13, 14, 16, 17, 18
14	As a result of my experience in mathematics classes, I have developed an attitude of inquiry	1.14	4 – Disagree	33.3	5, 11, 14, 16	3 – Neither	25	8, 12, 18	5 – Agree and Strongly Agree	41.6	10, 13, 17, 6, 9
25	It is important to cover all the topics in the mathematics curriculum in the textbook sequence	1.08	7 – Disagree and Strongly Disagree	58.3	10, 13, 8, 9, 12, 16, 17	4 – Neither	33.3	5, 6, 14, 18	1 – Agree	8.3	11