



Research Article

Transforming Early Childhood Education through Artificial Intelligence: Addressing Teacher Shortages, Inequality, and Quality Gaps in Early Learning Systems

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**Abstract**

This study examines the potential of artificial intelligence (AI) to support early childhood education (ECE) in addressing workforce pressures, inequality, and quality-related challenges, while identifying the organisational, pedagogical, and ethical conditions required for responsible AI use. An interpretivist qualitative design was used with 22 participants (8 head teachers and 14 early childhood teachers) from ECE institutions in Sydney, Australia, who took part in semi-structured face-to-face interviews. Six interconnected themes emerged from inductive thematic analysis: workforce and operational challenges; AI awareness and readiness; AI as teacher support, not replacement; AI and equity; AI and learning quality; and responsible AI adoption. Participants considered how AI could support planning, documentation, translation, administration, and personalised learning, freeing up time for meaningful teacher–child interaction. They stressed, however, that AI cannot address structural workforce shortages and cannot take the place of teachers’ relational, professional, and safeguarding roles. The study’s contribution lies in bringing together workforce, equity, learning quality, and responsible AI adoption within a single ECE-focused empirical framework, and in highlighting the necessity of human-centred implementation. Longitudinal and mixed-methods studies in various settings are needed to investigate the impact of AI on teacher workload, child outcomes, equity, and policy implementation.

Keywords

Artificial Intelligence, Early Childhood Education, Teacher Shortages, Educational Inequality, Learning Quality.

1. Introduction

Early childhood education (ECE) systems are now expected to be inclusive, stable, and of high quality, and to serve as a mechanism for increasing access. However, research indicates that these goals are not easy to achieve at the same time. In Australia, [Tang et al. \(2024\)](#) conducted a study with 77,113 children and found that socio-economically disadvantaged groups and families in regional and remote communities were less likely to access high-quality ECE services, while recent immigrant families were more likely to access lower-quality services. In a global study of 303,344 children from 30 low- and middle-income countries, [Yang et al. \(2024a\)](#) concluded that while ECE policy expansion tends to decrease inequality, increased enrolment does not necessarily mean that access to ECE is more equitable. The results thus suggest that affordability, location, disadvantage, and quality should also be considered in expansion. A further challenge is workforce instability. [Ng et al. \(2023\)](#) analysed 39 studies and identified low wages, lack of organisational support, weak career advancement, insufficient professional development, and low-quality relationships as factors linked to educator burnout. Staff burnout may lead to staff turnover and affect children’s learning. Teacher shortage

are therefore not just about recruitment but also about workload, working conditions, professional support, and teacher retention.

Artificial intelligence may help to address some of these pressures. According to [Su and Yang \(2022\)](#), AI applications in ECE could contribute to creativity, literacy, collaborative inquiry, computational thinking, and AI-related knowledge. [Lee et al. \(2025a\)](#) also proposed that humanoid AI robots can encourage engagement when used with developmentally appropriate and child-centred pedagogies. [Sun et al. \(2025\)](#), after analysing 12 studies, concluded that AI-powered language learning, especially through social robots and focused applications, frequently achieved results similar or superior to those of traditional methods, albeit with a limited number of studies. The success of implementation, however, depends heavily on teachers' readiness. [Kolemen and Yildirim \(2025\)](#) revealed that while teachers acknowledged the educational potential of AI, they felt their own competence with AI was inadequate. Privacy, data security, incorrect output, poor infrastructure, and lack of training were all concerns.

The question, then, is how AI can augment, rather than supplant, educators. [Lee et al. \(2025b\)](#) reported that teachers appreciated the use of AI in learning support and classroom management, while prioritising human interaction, play, relationships, and professional judgement. However, these dimensions have largely been examined separately, and limited empirical research has investigated how AI may simultaneously relate to workforce pressures, equity and accessibility, and learning quality within early childhood education settings. Hence, context-specific evidence is needed that takes into account all these interconnected challenges, as well as the organisational, pedagogical, and ethical conditions for implementing responsible AI in early childhood settings. The role of AI in simultaneously addressing teacher shortages, unequal access, and quality gaps in early learning systems has received less attention. The aim of this study is to explore how artificial intelligence can support early childhood education by addressing teacher shortages, reducing workload pressures, improving equity and accessibility, and enhancing learning quality, while identifying the pedagogical, organisational, and ethical conditions necessary for responsible, human-centred AI adoption in early childhood education settings in Sydney, Australia. Accordingly, the study addresses the following research questions:

RQ1. How do early childhood teachers and head teachers perceive current workforce and operational challenges in ECE settings?

RQ2. How do teachers and head teachers perceive the potential role of AI in supporting workforce capacity, equity and accessibility, and the quality of early learning?

RQ3. What organisational, pedagogical, and ethical conditions are considered necessary for responsible AI adoption in ECE?

2. Literature Review

Research on artificial intelligence (AI) in early childhood education (ECE) has grown rapidly, yet it varies in geographical scope, methodological sophistication, and theory building. In a review of 39 studies published between 2020 and 2024, [Ljungcrantz \(2026\)](#) found significant development in the field but also geographical bias, insufficient representation of age groups, and no longitudinal studies. Likewise, [Zhang et al. \(2026\)](#) found that empirical studies on generative AI in ECE were highly clustered in the United States and China. These trends indicate that understanding of AI in ECE has grown faster than evidence on whether that knowledge transfers between educational and cultural settings.

A key theme concerns AI-supported learning and the maintenance of developmentally appropriate pedagogy. [Heeg and Avraamidou \(2025\)](#) revealed that young children's understandings of AI are developed through their daily sociocultural experiences, and [Yang et al. \(2024b\)](#) reported that embodied activities with intelligent agents could promote AI literacy among 5-year-old children. [Mifsud et al. \(2025\)](#) also showed that social robots can play intermediary roles in literacy activities. However, there is also clear evidence of the limits of technological interaction. [Neumann et al. \(2023\)](#) noted greater positive engagement with a human teacher than with a social robot; however, [Neumann and Barry \(2025\)](#) indicated that preschool children were able to engage successfully in literacy and language activities using the NAO robot. [Kyaw et al. \(2025\)](#) also found potential for AI-powered robots to act as teaching assistants and social partners, along with technical and ethical issues. Taken together, these results indicate that AI can be used as a pedagogical tool but not as a replacement for human interaction.

Another line of research concerns developmentally appropriate AI literacy and learning design. [Aslan et al. \(2024\)](#) found that a multimodal AI environment was immersive and supported learning, physical activity, and social interaction, suggesting that AI-supported learning can be active and not necessarily screen-based. [Qian \(2026\)](#) also stressed the importance of pedagogical frameworks that combine AI with developmentally appropriate activities. [Su \(2024\)](#) showed that AI literacy can be assessed in kindergarten children, and [Williams et al. \(2019\)](#) found that pre-K and kindergarten learners could comprehend basic AI concepts using the PopBots curriculum. [Su et al. \(2023\)](#), however,

pointed out that teachers still lack knowledge, curricular design, and pedagogical guidance. These findings indicate that AI in ECE can be beneficial but requires more than technological capacity; it needs to be integrated into age-appropriate learning experiences.

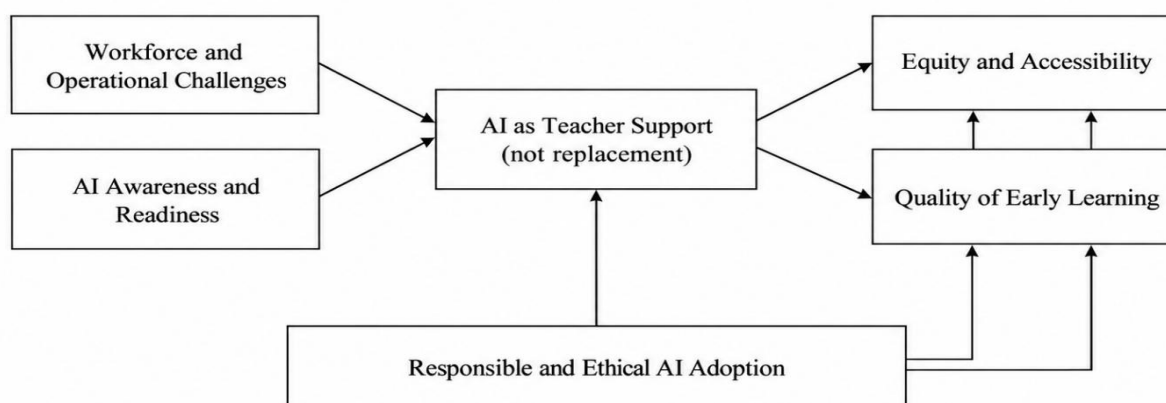
Teacher readiness and organisational conditions form another theme. [Undheim et al. \(2024\)](#) demonstrated that teachers' interpretations of digital tools and their use in early childhood education and care (ECEC) practice are influenced by their beliefs. [Saimon et al. \(2024\)](#) emphasised the need for structured pedagogical design to equip student teachers to incorporate AI applications, and [Lee \(2024\)](#) reported that, despite the challenges, pre-service ECE teachers' interaction with ChatGPT may aid pedagogical practice and critical awareness. Collectively, these studies indicate that effective AI adoption requires not only access to technology but also professional knowledge, confidence, pedagogical judgement, and institutional support.

Parental expectations, implementation legitimacy, and equity are also key issues. [Camparo et al. \(2026\)](#) found that educators, parents, and the public hold varying perspectives on classroom AI, with parents being especially concerned about children's privacy. [Mbithi and Maina \(2026\)](#) also found that affordability and parental control strongly affected preferences for AI-powered ECE tools. These results suggest that institutional capacity, affordability, family trust, and local expectations are important factors, in addition to technology, when considering equitable and responsible adoption.

The literature points to an ecological and sociocultural view, in which the outcomes of AI are shaped by the interaction between children, educators, families, technologies, pedagogy, and institutional conditions. [Wong \(2026\)](#) highlights the interconnected responsibilities of educators, designers, parents, and regulators, whereas [Cai et al. \(2025\)](#) argue that ECE-AI research has tended to adopt cognitive and situated perspectives rather than critical theoretical perspectives. Although there is a wealth of evidence, these dimensions have largely been studied separately. There is still a lack of empirical studies that explore the interplay of workforce pressures, teacher readiness, equity, learning quality, and responsible AI adoption in real-world ECE settings. This study addresses this gap by exploring these interrelated dimensions in a single empirical study using the perspectives of early childhood teachers and head teachers in Sydney, Australia. The conceptual framework guiding the study is presented in Figure 1.

Figure 1: Conceptual Framework of AI Integration in Early Childhood Education

Conceptual Framework of AI Integration in Early Childhood Education



Based on the study themes: workforce pressures, readiness, teacher support, equity, quality, and responsible implementation.

3. Methodology

This study adopted a qualitative exploratory design with an interpretivist approach to explore how teachers and head teachers in early childhood education perceive the potential of artificial intelligence to respond to workforce pressures, inequities, and quality challenges in ECE. This design was suitable because empirical knowledge about AI implementation in early childhood education is at an early stage and needs to take into account participants' backgrounds, experiences, and interpretations. The study was carried out in selected ECE institutions in Sydney, Australia. Participants were recruited through purposive sampling. The final sample comprised 22 participants: 14 early childhood teachers and 8 head teachers. The unit of analysis was the individual teacher or head teacher. Given the sample size, its gender imbalance, and its location in one metropolitan area, the results are offered as contextual qualitative insights rather than as a basis for statistical or global generalisation.

Face-to-face semi-structured interviews (approximately 30–45 minutes) were used to gather primary data. A semi-structured interview guide was followed to ensure consistency across interviews, while allowing interviewees to explain their experiences, perceptions, and concerns in detail. Interview questions covered workforce and operational issues, awareness of and readiness for AI, potential uses of AI in professional practice, equity and accessibility, the quality of teaching and learning, and the conditions necessary for responsible AI use. Table 1 displays the key interview questions and probes.

Table 1: Semi-Structured Interview Questions and Follow-up Probes

No.	Main Interview Question	Follow-up Probes
1	What are the main challenges you currently experience in delivering high-quality early childhood education?	• How significant are teacher shortages or staff workload in your setting? • Are there challenges related to resources, class size, or staff capabilities? • How do these challenges affect children's learning and development?
2	What is your current understanding or experience of using AI in early childhood education?	• Have you used any AI-based tools in your teaching or management work? • What kinds of tasks do you think AI could support? • How comfortable do you feel using AI technologies?
3	How could AI help institutions manage teacher shortages and workload pressures?	• Could AI assist with lesson planning, assessment, documentation, or administration? • Which teacher responsibilities should not be supported or replaced by AI? • Do you think AI could allow teachers to spend more time interacting directly with children?
4	How could AI influence equality and access to quality early childhood education?	• Could AI support children from disadvantaged, culturally diverse, or multilingual backgrounds? • Could differences in access to technology create new inequalities? • What resources would institutions need to ensure equitable AI use?
5	How might AI affect the quality of teaching and learning?	• Could AI support personalised learning or help identify individual learning needs? • How might AI influence teacher–child interaction? • What aspects of early childhood learning require human involvement rather than technology?

No.	Main Interview Question	Follow-up Probes
6	What factors should be considered before wider AI adoption?	• What concerns do you have about privacy, child safety, bias, or excessive technology use? • What training or support would teachers and head teachers need? • What role should schools, government, parents, and policymakers play? • What would responsible use of AI in early childhood education look like to you?

Source: Author's interview guide.

A cross-sectional time horizon was used for the study. Inductive thematic analysis was used to analyse the interview data. The researcher first became familiar with the interview material by reading it repeatedly, and segments of data were then coded for meaning. Comparison of related codes resulted in sub-themes, which were then developed into themes describing commonalities among participants. The emerging themes were constantly reviewed against the interview material, and differences in perspective, especially in participants' level of AI awareness, experience, and readiness, were retained.

The researcher performed coding through an iterative interpretive process. No statistical inter-rater reliability test was performed, and coding was not done independently. Rather, analytic consistency was achieved by re-checking the codes, sub-themes, and final themes against the interview data. Reflexivity was maintained during analysis by acknowledging the researcher's interpretive position and by comparing interpretations with the original participants' accounts (including contrary patterns).

Data adequacy was addressed by considering the repetition and depth of relevant perspectives in the interviews. Subsequent interviews confirmed the emerging themes and added diversity to them. A numerical threshold for saturation was not set prior to the analysis; instead, the sample was deemed adequate to provide meaningful thematic depth for the exploratory purposes of the study. Formal member checking did not take place. Instead, credibility was achieved by working repeatedly with the interview data, systematically checking interpretations against participants' descriptions, and incorporating direct participant quotations in the findings.

The criteria of credibility, dependability, confirmability, and transferability were used to address trustworthiness. Credibility was enhanced by extensive engagement with the interview data and the use of participants' quotes; dependability by a systematic and transparent coding process; confirmability by reflexive checks of interpretations against the original data; and transferability by detailed reporting of the participants and the study context. To preserve anonymity, participants were identified as P1–P22.

Ethical issues addressed included informed consent, voluntary participation, confidentiality, anonymity, and the right to withdraw. Institutional names and other identifying details are not reported.

4. Results

This section presents findings from semi-structured interviews with 22 early childhood teachers and head teachers in Sydney, Australia. It first outlines participants' demographic characteristics and then presents the six themes generated through inductive thematic analysis. These themes capture participants' views on workforce challenges, AI readiness, teacher support, equity and accessibility, learning quality, and responsible AI adoption.

Table 2: Demographic Profile of the Study Participants

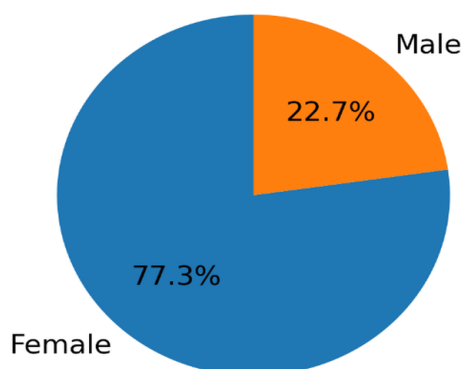
No.	Professional Role	Gender	Age Group	Educational Qualification	ECEC Experience	Previous AI Experience
P1	Head Teacher	Female	40–49 years	Master's Degree	11–15 years	Moderate
P2	Head Teacher	Female	30–39 years	Bachelor's Degree	5–10 years	Limited
P3	Head Teacher	Male	40–49 years	Master's Degree	11–15 years	Regular AI user
P4	Head Teacher	Female	50 years and above	Master's Degree	More than 15 years	No previous experience
P5	Head Teacher	Female	40–49 years	Bachelor's Degree	11–15 years	Moderate

No.	Professional Role	Gender	Age Group	Educational Qual- ification	ECEC Experi- ence	Previous AI Ex- perience
P6	Head Teacher	Male	50 years and above	Master's Degree	More than 15 years	Limited
P7	Head Teacher	Female	40–49 years	Master's Degree	More than 15 years	Regular AI user
P8	Head Teacher	Female	50 years and above	Bachelor's Degree	More than 15 years	Limited
P9	Early Childhood Teacher	Female	20–29 years	Diplo- ma/Certificate in ECE	Less than 5 years	Limited
P10	Early Childhood Teacher	Female	30–39 years	Bachelor's Degree	5–10 years	Moderate
P11	Early Childhood Teacher	Male	20–29 years	Diplo- ma/Certificate in ECE	Less than 5 years	No previous expe- rience
P12	Early Childhood Teacher	Female	30–39 years	Bachelor's Degree	5–10 years	Moderate
P13	Early Childhood Teacher	Female	30–39 years	Bachelor's Degree	5–10 years	Regular AI user
P14	Early Childhood Teacher	Female	40–49 years	Master's Degree	11–15 years	Limited
P15	Early Childhood Teacher	Female	30–39 years	Bachelor's Degree	5–10 years	No previous expe- rience
P16	Early Childhood Teacher	Male	40–49 years	Master's Degree	11–15 years	Moderate
P17	Early Childhood Teacher	Female	20–29 years	Diplo- ma/Certificate in ECE	Less than 5 years	No previous expe- rience
P18	Early Childhood Teacher	Female	30–39 years	Bachelor's Degree	5–10 years	Regular AI user
P19	Early Childhood Teacher	Male	30–39 years	Bachelor's Degree	5–10 years	Limited
P20	Early Childhood Teacher	Female	20–29 years	Diplo- ma/Certificate in ECE	Less than 5 years	Moderate
P21	Early Childhood Teacher	Female	20–29 years	Bachelor's Degree	Less than 5 years	Limited
P22	Early Childhood Teacher	Female	30–39 years	Bachelor's Degree	5–10 years	Regular AI user

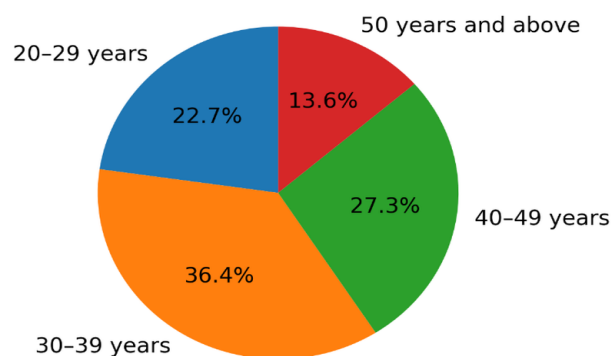
Source: Author's compilation from interview data.

Table 2 and Figure 2 present the demographic characteristics of the 22 participants. The sample was predominantly female (77.3%), while males represented 22.7%. Most participants were aged 30–39 years (36.4%), followed by 40–49 years (27.3%), 20–29 years (22.7%), and 50 years and above (13.6%). In terms of professional role, 63.6% were early childhood teachers and 36.4% were head teachers. Regarding education, half of the participants held a bachelor's degree (50.0%), followed by a master's degree (31.8%) and diploma/certificate qualifications (18.2%). Work experience was also diverse, with the largest group having 5–10 years of ECEC experience (36.4%). Overall, the sample represents participants with varied ages, qualifications, professional roles, and experience levels, providing a broad range of perspectives on AI adoption in early childhood education.

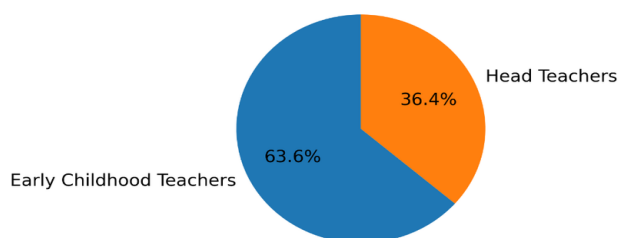
Distribution of Participants by Gender



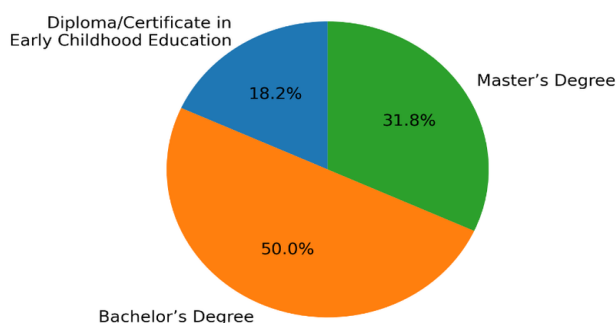
Distribution of Participants by Age Group



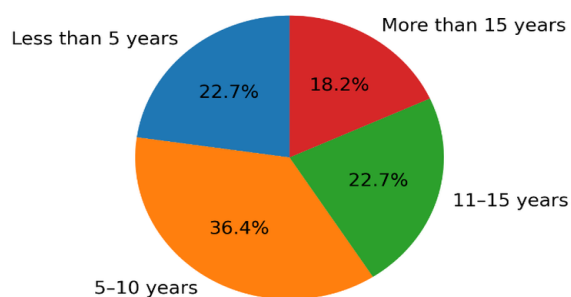
Distribution of Participants by Professional Role



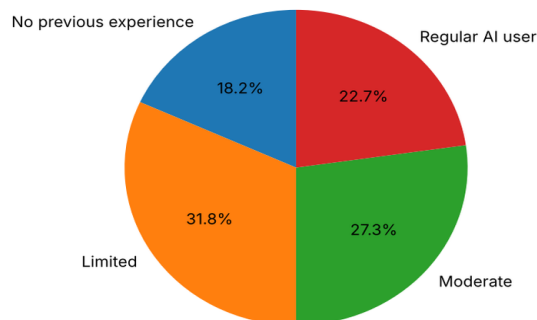
Distribution of Participants by Educational Qualification



Distribution of Participants by ECEC Work Experience



Distribution of Participants by Previous AI Experience

**Figure 2:** Frequency Distribution of the Study Participants

This section summarises the six major themes identified through thematic analysis of the interview data. The results reveal that participants faced ongoing pressures on the workforce and on operational processes, and that awareness and use of AI varied widely. Generally, AI was seen as a tool to assist with planning, documentation, administration, and personalised learning, rather than as a replacement for teachers. Participants also noted its potential to enhance equity, accessibility, and quality of education, including through translation, inclusion, and differentiated learning. Yet participants also raised concerns about the digital divide, privacy, child safety, bias, and overuse of technology (Table 3).

Table 3: Summary of Themes and Key Sub-themes Emerging from the Interviews

Theme	Key Sub-themes/Codes
1. Workforce and Operational Challenges	Staff shortages, workload, retention, documentation, inclusion, limited resources
2. AI Awareness and Readiness	AI familiarity, limited experience, planning, writing, translation, confidence
3. AI as Teacher Support, Not Replacement	Planning, documentation, administration, workload reduction, human judgement
4. AI, Equity and Accessibility	Translation, inclusion, disability support, digital divide, affordability
5. AI and Quality of Early Learning	Personalisation, differentiated learning, responsive planning, human interaction
6. Responsible and Ethical AI Adoption	Privacy, child safety, bias, training, accountability, parental involvement

Source: Author's thematic analysis of interview data.

4.1 Theme 1: Workforce and Operational Challenges

The first theme concerns the pressures participants experienced in providing good-quality early childhood education in Sydney. Major sub-themes included workload, staff shortages, retention, documentation, inclusion, and limited resources. Staffing problems were not just about staffing levels but also about continuity, planning, supervision, relationships, and individualised support. P1 noted that “when someone leaves, it can take time to find an appropriate replacement, and the immediate challenge is not only to fill staffing needs but to maintain continuity of the children.” P2 also highlighted workload, saying that “workload is probably more important than the number of staff because of programming, observations, documentation, communicating with families and compliance.”

Administrative duties were also significant. P10 noted that “documentation takes a large amount of my time, and sometimes I feel caught between documenting a learning experience and actually participating in it.” Inclusion added further pressure, as P15 explained: “Sometimes we need another skilled person or specialist guidance more than another set of classroom resources.” P16 also noted staff fatigue, stating that “if another educator isn’t there, you feel the difference right away; it’s hard to be as patient and as energetic at the end of a tiring day.” In general, instability and administrative burden limit teachers’ ability to maintain consistent interactions with children and to provide responsive, individualised support.

4.2 Theme 2: AI Awareness and Readiness

The second theme highlights significant differences in participants’ awareness of, experience with, confidence in, and preparedness for professional use of AI. Exposure to AI ranged from basic familiarity among some participants to others using tools such as ChatGPT for planning, writing, summarising, translation, and activity development. P2 was hesitant when discussing their experience with AI, saying that “my experience of AI is still quite limited; I know broadly what it can do, and I would need proper training to use it properly in my professional practice.” In contrast, P3 said they used AI more regularly and explained that they would always check its output, as it was not always accurate or appropriate, but that they had used it for “ideas for staff training, cutting down on information and structuring planning documents.”

Variation was also evident among teachers. P11 commented, “I have not made much use of AI in my teaching, and my confidence with AI is currently low.” P17 also said, “If it really made my job easier, I’d be interested, but I would like to be taught by someone rather than having to figure it out on my own.” On the other hand, P18 indicated frequent use, saying that “I use AI on a regular basis to come up with initial concepts, and I have a good degree of trust in it but still confirm information it provides.” The range of views suggests that readiness for AI was not consistent among participants. While some were novices and lacked confidence, others were using AI extensively for planning, writing, summarising, and idea generation. Notably, even frequent users mentioned that they still had to check AI-generated content, indicating that experience did not remove doubts about accuracy or appropriateness. This variation indicates that professional development may need to be differentiated according to educators’ experience and confidence. The data reveal that AI readiness is far from uniform and is related more to experience, confidence, training, and critical evaluation abilities than to access.

4.3 Theme 3: AI as Teacher Support, Not Replacement

The third theme focuses on the use of AI as a complement to teachers, not a replacement. The roles participants considered most likely were planning, documentation, administration, communication, and repetitive tasks. P1 made a clear distinction between support and substitution: "I don't think AI is going to solve the teacher shortage because the kids still need qualified teachers in person with them, but it can ease some of the strain on the teachers that are already there." The same participant also noted that AI can aid planning, documentation, and routine communication, provided teachers check and customise the output.

Documentation, as an essential component of assessment, was highlighted as particularly suitable for AI support, but it was also noted that "assessment is complex and should be considered a professional responsibility and not an automated response – development in early childhood is complex." P7 also saw benefit in automating management tasks to allow leaders to spend more time supporting teachers directly. This distinction was echoed by teachers. P18 said she believes AI will take over repetitive tasks and open up opportunities for her to "sit on the floor, talk to the children and be involved in their play." P19 was more specific about boundaries, saying, "A digital system will not soothe a distressed child, will not be able to pick up on nuanced shifts in behaviour or will not be able to resolve a disagreement the way an educator can." Overall, participants saw the value of AI as a means of shifting peripheral workload without taking away human responsibility for care, supervision, judgement, and relationships.

4.4 Theme 4: AI, Equity and Accessibility

The fourth theme concerns AI's potential both to enhance access and to exacerbate inequality. Multilingualism, disability inclusion, availability of adapted resources, financial accessibility, digital accessibility, and institutional capacity building were considered key aspects. P2 noted, "While AI has potential to create multilingual information and make learning materials more accessible, families with more devices and advanced digital skills might reap the benefits sooner." This concern relates to the potential for differential benefit from technology. P4 particularly appreciated the provision of translation services, stating that "if routine information could be translated in a family's preferred language quickly, that might make parents feel more connected to the centre." However, the same participant warned that "translation is not just a matter of converting words from one language to another, but also culture."

Moreover, P7 outlined possibilities for AI support for children with additional needs, such as speech, visual communication, or adaptive resources, highlighting the need for staff training and specialist guidance. Participants also expressed concern about unequal institutional resources. P5 stated that "a strong funded centre may have good systems, internet connections, devices and staff training, whereas another service may have basic or free devices and internet, and the staff may not be trained." P11 also highlighted that some households may not have reliable internet or may share devices. Overall, AI was perceived as potentially inclusive, provided it is backed by equitable infrastructure, affordability, staff capability, and culturally responsive implementation. Participants thus described AI as a double-edged sword: it could increase access through translation, adaptive resources, and disability support, but it could also exacerbate or reinforce inequalities if families and institutions do not have equal connectivity, devices, affordability, or staff capability.

4.5 Theme 5: AI and the Quality of Early Learning

The fifth theme examines the possible impact of AI on the quality, individualisation, responsiveness, and inclusiveness of early learning. Participants identified opportunities for differentiated planning, adaptation of activities, organisation of observations, and extension of children's interests. P1 said that "AI could benefit quality by assisting teachers to respond more promptly to the individual differences between children through, for example, providing additional activities at different levels or extending a child's interest." The participant, however, pointed out that "technology can't replace a teacher knowing if a child is anxious, excited or ready to try something new." P3 also proposed that AI could assist with organising observations and spotting patterns but said, "I wouldn't want AI to diagnose developmental needs; children develop in different ways, and professional judgement, family knowledge and specialist input are still required."

One concern, highlighted by P6, was that "personalised technology could be great for one thing, but children also need to have shared experiences, and it's not personalised learning to the extent that every child is using the device separately." The importance of human interaction was reinforced by teachers. P11 warned that technology might erode some of the "conversation and social interaction" that "children need to understand and learn from." P14 said that "kids learn because they know you and feel comfortable doing something new." Participants generally saw AI as having potential for differentiated and responsive planning, but only when it is used in a way that enhances rather than replaces play, relationships, social interaction, and professional judgement.

4.6 Theme 6: Responsible and Ethical AI Adoption

The sixth theme focused on the conditions that participants felt were prerequisites for responsible and ethical AI use. Prominent sub-themes were privacy, child safety, bias, professional training, parental involvement, accountability, and progressive implementation. P1 prioritised privacy, stating that “we would need to know exactly what data an AI system collects, where it is stored and who can access it.” The participant added that staff must also have clear guidance on “what information should not be put into public AI tools.” Training was another major condition. P2 said that “staff require hands-on training not just on using AI tools but also on identifying incorrect information, bias and inappropriate content.” P3 also emphasised the importance of cultural fairness, stating that AI systems “may not be fair to all children, especially in a culturally diverse community like Sydney.”

Moreover, P4 expressed a commitment to transparency with families, saying it should be “made clear to parents why the tool is being used, what information is being included and whether they have a choice.” Teachers also had concerns about children’s direct exposure. P11 said that “young children are unable to assess whether information is reliable and appropriate, and most of the time I would prefer that it would not be accessible to them but would be available to teachers.” P17 argued for “protected professional learning time,” and P22 stated that “responsible use of AI must be keeping AI in a supporting role, with teachers still building relationships, making decisions, observing children and communicating personally with families.” Participants were generally positive about the responsible use of AI, with varying degrees of comfort regarding children’s direct exposure to it. Some expressed interest in using AI for carefully managed applications, while others preferred to keep AI mainly as a teacher support tool. In general, respondents favoured cautious, transparent, and people-led adoption rather than technology-driven adoption.

5. Discussion

The results indicate that the implementation of AI in ECE is not just a matter of technological availability but also requires teachers’ ability to incorporate AI meaningfully within current ECE practices. This is in line with previous studies, such as [Yim and Wegerif \(2024\)](#), which found that kindergarten teachers generally acknowledged the potential of AI yet lacked awareness of, or experience with, using it in the classroom. In the same vein, [Anggraini \(2025\)](#) revealed that 53.3% of 103 ECE teachers lacked knowledge of AI or did not use it. [Ozenoglu et al. \(2026\)](#) also showed that structured AI training increased preschool teachers’ AI literacy, and [Lim \(2023\)](#) indicated that generative AI teaching experiences contributed to pre-service ECE teachers’ increased sense of teaching efficacy and decreased instructional anxiety. These findings all point to the idea that readiness for AI is not a fixed attribute but a professional capability that can be developed through experience and training. Additionally, the range of responses in this study suggests that professional development could be tailored to different levels of prior knowledge, confidence, and critical evaluation skills in the use of AI.

Participants’ preference for AI as a support for teachers, not a replacement, is also in line with recent evidence. [Chen et al. \(2024\)](#) reported positive teacher attitudes and self-efficacy in using ChatGPT for instructional design, suggesting that ChatGPT can be useful for instructional planning. [Wulansari et al. \(2025\)](#) found that ECE teachers’ readiness for AI training is influenced by digital competence, openness to technology, and infrastructure and institutional support. [Balikci \(2026\)](#) reported that AI-supported self-coaching was associated with increased implementation fidelity among preschool teachers in inclusive classrooms and positive learning outcomes for children with autism. In a similar vein, [Zhang \(2026\)](#) reported that 433 preschool educators’ continued use of AI-generated content correlated with perceived usefulness and positive experiences, and [Duan et al. \(2026\)](#) determined that AI self-efficacy was a key factor in the behavioural intention of 270 preschool teachers. In aggregate, these studies are consistent with the current finding that successful AI adoption requires educators to see its pedagogical value, to feel confident in their ability to use it, and to receive organisational support. This also reinforces the conceptual stance of the study: AI is best positioned as a facilitator of professional teacher judgement, not as a substitute for it.

Results on equity indicate a comparable balance of opportunities and risks. Participants identified potential benefits of AI for translation, accessibility, differentiated resources, and support for children with additional needs, but expressed concern that unequal access to technology and professional capacity could lead to new forms of disadvantage. [Zhou et al. \(2026\)](#) studied kindergarten teachers in 15 bilingual settings and found that teachers saw potential in AI for language learning but lacked pedagogical understanding and still experienced technical difficulties. [Mukhtar et al. \(2025\)](#) also found that AI tools such as screen readers and voice interfaces could benefit visually impaired learners, but were limited by educators’ resources and expertise. Cultural appropriateness is also a concern. [Yu and Hou \(2025\)](#) found that local AI platforms performed better in culturally specific ECE tasks, whereas global platforms performed better in multilingual tasks. AI-driven personalisation and multilingualism should thus not be seen as automatically creating equity, but rather as benefits that depend on access, localisation, staff skills, affordability, and institutional capacity.

Participants also focused on privacy, child protection, human interaction, and controlled implementation. In their review of 42 studies, [Berson et al. \(2025\)](#) identified issues of child data protection, algorithmic bias, developmental impacts, and regulatory constraints. [Nikolopoulou \(2025\)](#) also posits that while generative AI can aid personalisation, multimodal learning, and teacher workload, potential drawbacks include increased screen time and reduced play and relational interaction, with possible developmental consequences. The current results underscore the need to retain a human-centred approach, in which the teacher remains responsible for relationships, assessment, safeguarding, contextual interpretation, and professional judgement, while AI acts as a limited, supportive tool. The varying levels of comfort with children's direct exposure to AI also indicate that there is no single model of responsible AI use; implementation will need to take into account age, purpose, supervision, and educational context.

These findings have implications for professional learning, institutional leadership, and quality assurance in the Australian ECE context. AI can be used to inform planning, documentation, translation, educator professional learning, and differentiated resource development, but its use must be consistent with expectations of child-centred practice, educator responsibility, safety, inclusion, and continuous quality improvement. Professional development should therefore enhance AI literacy, verification skills, cultural awareness, privacy competence, and the ability to make pedagogically appropriate decisions about AI use. Institutional and policy-level implementation of AI should be consistent with National Quality Framework (NQF) expectations relating to educational practice, children's health and safety, relationships, governance, and professional responsibility. National-level evidence, for example from the Australian Early Development Census (AEDC), may also provide a broader context for considering whether technology-supported initiatives help achieve equity in developmental and educational outcomes. Finally, any efficiency gained through AI should be used to enhance teacher-child interaction and inclusion, not to reduce professional staffing. Responsible adoption should involve human oversight, transparency with parents, safeguarding of children's data, and continuous assessment of educational value.

6. Limitations

This study has several limitations. First, as participants were drawn from selected ECE institutions in Sydney, Australia, a high-income, urban, and culturally diverse setting, the outcomes should not be generalised as representative of ECE systems nationally or internationally. Second, the sample was skewed towards females, reflecting the composition of the participating group, and may not represent the full spectrum of professional views. Third, the study used a cross-sectional qualitative design and therefore relied on participants' perceptions rather than observing AI implementation or its impact over a longer period. Formal member checking and independent coding were not conducted, although trustworthiness was supported by iterative comparison of codes and themes with the original interview data, participant quotes, and reflexive analysis. These constraints suggest that the results should be viewed as localised pointers that can serve as a starting point to guide AI use in other ECE contexts.

7. Conclusion and Future Recommendations

This study suggests that AI can complement, rather than substitute for, early childhood education and should be used to strengthen it. In the Sydney ECE context explored, participants felt that AI could be helpful for administrative tasks, planning, accessibility, and differentiated learning. However, AI cannot replace teachers' relational, emotional, safeguarding, and professional roles. Its effective use depends on teacher readiness, institutional support, equitable access, and ethical governance. Responsible implementation therefore requires human oversight, privacy protection, cultural sensitivity, professional training, and ongoing evaluation to ensure that AI supports rather than compromises child-centred education.

The results need to be interpreted in light of the geographically localised, predominantly female, cross-sectional qualitative sample. Although these limitations restrict generalisation, the study offers context-specific insights into how teachers and head teachers perceive the opportunities and conditions of using AI in ECE. The study is also interpretivist, acknowledging the researcher's role in analysing and interpreting participants' accounts.

Future studies should move beyond perception-based, cross-sectional designs and adopt longitudinal, mixed-methods, or experimental approaches to better understand the impact of AI on teacher workload, teacher retention, child outcomes, and teacher-child interactions. Comparative studies in urban and regional, low-income, and culturally diverse contexts are also required to examine equity effects across contexts. Further research is needed on specific AI tools, cost-effectiveness, data-governance models, culturally responsive implementation, and developmentally appropriate uses. The parent voice, children's experiences, and policy frameworks for the responsible use of AI in early childhood learning should also be given greater consideration.

Declarations

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Conflict of Interest

The author declares no conflict of interest.

AI Use Statement

Author to disclose any AI/LLM tools used (name, version, purpose), or state that none were used.

Data Availability Statement

The data supporting the findings of this study are available from the author upon reasonable request.

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