

Preparing Learners for the AI Era: A Conceptual Review of 4C Competency Development in Indonesia's Equivalency Education Program

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Abstract

The rapid advancement of generative artificial intelligence (AI) has reshaped the competencies demanded in the labor market and education. The four competencies known as the 4Cs, namely critical thinking, communication, collaboration, and creativity, are regarded as relatively resistant to automation as they involve contextual reasoning and meaning-making that remain difficult for machines to replicate. This article presents a conceptual review examining the urgency of developing 4C competencies among learners in Indonesia's Equivalency Education Program (Paket A, B, C), a non-formal pathway serving communities with limited access to formal schooling. The review synthesizes national and international literature from 2020-2026 focusing on AI integration, twenty-first-century competencies, and non-formal education. Findings indicate AI can strengthen 4C development through personalized instruction and rapid feedback, but only when paired with pedagogy that keeps learner reasoning central. The Equivalency Program is positioned as a strategic space for contextual 4C development, although its implementation still faces limited tutor capacity, uneven infrastructure, and the absence of explicit 4C competencies in the curriculum. The review recommends sustained tutor capacity building, adaptive blended-learning models, and curriculum revisions that explicitly integrate the 4Cs.

Keywords: 4C competency; artificial intelligence; equivalency education; non-formal education; digital era.

1. INTRODUCTION

Generative AI has spread rapidly since the start of this decade and has reshaped how people work, learn, and solve everyday problems. International institutions consistently document this shift: the World Economic Forum's latest Future of Jobs Report ranks analytical thinking as the competency companies value most, followed by resilience, leadership, and creative thinking, and reports that AI literacy is growing fastest in importance without displacing these cognitive and interpersonal skills from the top ranks (World Economic Forum, 2025). A recent meta-analysis of AI's impact on 4C competencies by Tian and colleagues reinforces this picture: AI is not simply replacing these four competencies but is transforming how learners develop and demonstrate them (Tian et al., 2026). Generative AI use in literacy practices and academic writing brings faster, more personalized feedback, yet it also risks dulling learners' metacognitive engagement when instructional design fails to compensate (Sanz-Tejeda et al., 2026). A separate meta-analysis of 43 studies still finds that AI feedback significantly improves the writing quality of higher-education students (Zhan, 2026), confirming that AI carries both real benefits and real risks for academic literacy that instructors must manage deliberately. Human non-technical abilities therefore remain the key differentiator between workers who adapt to AI-based automation and those who fall behind. Research on labor-market needs in the Industry 5.0 era confirms that employers increasingly treat soft skills, including the four 4C dimensions, as non-negotiable requirements (Polakova et al., 2023), and both students and employers rank these competencies as an urgent shared need (Romanenko et al., 2024). Indonesian research on AI use in education concentrates on formal schools and higher education, with chatbots and automated assessment as the dominant focus, while studies on the non-formal pathway remain scarce (Sihaloho & Napitupulu, 2024). AI-based educational transformation in Indonesia can expand access through personalized learning, but it still requires governance readiness and infrastructure that remains unevenly distributed across regions (Haetami, 2025).

Indonesia's challenge in preparing learners for this competency transformation intersects directly with unequal access to education. The Equivalency Program, comprising Paket A (elementary-school equivalent), Paket B (junior-secondary equivalent), and Paket C (senior-secondary equivalent), has long served children and adults who cannot pursue or complete formal schooling because of economic constraints, dropping out, working at an early age, or living in remote areas. Core education data from the Ministry of Primary and Secondary Education record more than twelve thousand Community Learning Activity Centers and hundreds of Learning Activity Studios spread across nearly every province as of mid-2025/2026 (Ministry of Primary and Secondary Education, 2025), showing that this pathway carries a significant share of the national effort to fulfill the right to education. Tutors within this pathway rarely receive modules or explicit guidelines that direct them to deliberately cultivate learners' critical thinking, communication, collaboration, and creativity skills, so non-academic competency strengthening has not yet become a structured priority (Ministry of Education, Culture, Research, and Technology, 2023). This gap grows more urgent given that many Equivalency Program graduates will enter a workforce that explicitly demands these competencies.

Most literature linking AI, twenty-first-century competencies, and learning practice still concentrates on formal education, from elementary school through higher education. Espina-Romero and colleagues mapped Scopus-indexed soft-skill research and found that, despite rapid growth in this field, the distribution of studies remains uneven and centers on the formal-education sector and the corporate world, leaving vulnerable populations in the non-formal pathway, including Equivalency Program learners, with little academic attention (Espina-Romero et al., 2023). A bibliometric mapping of non-technical-skills research in health vocational education shows the same pattern: research productivity concentrates in a small number of institutions and specific contexts (Arunratanothai et al., 2026). Few conceptual frameworks therefore link AI development, the need for 4C competencies, and the structural characteristics of non-formal education, such as flexible learning time, diverse learner age and background, and an orientation toward real-life problem-solving, within a single model. This article addresses that gap through a conceptual-review approach.

This article's novelty lies in linking three elements that the literature has so far treated separately: (a) generative AI's development and its impact on 4C competencies, (b) the structural characteristics of Indonesia's non-formal education, and (c) the need for measurable assessment of twenty-first-century competencies, into a single integrative model proposition that prior studies have not produced. Bibliometric studies map general soft-skill research trends without targeting the non-formal context (Espina-Romero et al., 2023; Arunratanothai et al., 2026), and literature reviews of AI use in Indonesian education still focus on the formal level (Sihaloho & Napitupulu, 2024; Haetami, 2025); this article instead contributes a 4C integration model that positions the Equivalency Program as its unit of analysis and formulates the mechanism linking AI, tutors, pedagogical strategies, learning activities, and assessment in cultivating the 4Cs within that context (see Figure 1 in the Results and Discussion section). The model serves as an initial, testable framework rather than a final conclusion, so it can guide further empirical research and inform equivalency-curriculum policy.

This article pursues three objectives on this foundation. First, it analyzes the urgency of developing 4C competencies for learners who face the demands of work in the age of artificial intelligence. Second, it examines the opportunities and challenges of implementing 4C development within the specific context of Indonesia's Equivalency Program. Third, it formulates a realistic implementation strategy that accounts for the characteristics and structural limitations inherent in non-formal education. These three objectives together aim to provide an initial conceptual contribution that grounds further empirical research and informs equivalency-curriculum policy that responds more effectively to changing times.

The term 4C refers to four core competencies popularized by the Partnership for 21st Century Learning through the Battelle for Kids framework (Battelle for Kids, 2021): critical thinking, communication, collaboration, and creativity. Critical thinking involves analyzing information logically, evaluating arguments, and making evidence-based decisions; communication encompasses conveying ideas clearly through oral, written, or digital modes; collaboration involves working effectively within diverse groups; creativity emphasizes generating new, valuable ideas or solutions. These four competencies have become a widely used reference in curriculum development across many countries because they represent the skills learners need to succeed in a twenty-first-century work environment and life full of uncertainty and rapid change. Applied studies, such as Ye and Xu's case study of

interdisciplinary thematic learning (Ye & Xu, 2023) and research on project-based learning's effect on these four competencies at the elementary-school level (Amroni et al., 2024), show that the 4Cs are not merely an abstract concept but competencies that educators can cultivate measurably through appropriate instructional design. Research at the foreign-language education level likewise reports that project-based learning using information and communication technology effectively cultivates all four 4C dimensions simultaneously (Waly & Ashadi, 2024). The communication and collaboration competencies within the 4C framework also overlap considerably with emotional intelligence, which contributes to team effectiveness and leadership (Coronado-Maldonado & Benitez-Marquez, 2023; Filice & Weese, 2024), career decision-making (Wang et al., 2026), and career success when combined with resilience in facing difficulties (Zhao & Sang, 2023); strengthening the 4Cs therefore also touches learners' socio-emotional dimension. Most of this evidence, however, comes from formal education levels (elementary school, foreign-language education) or international contexts outside Indonesia, so this review treats it as conceptual evidence that the 4Cs can be cultivated measurably rather than as direct evidence from the Equivalency Program context; generalization to Indonesia's non-formal pathway remains inferential.

The presence of AI in education carries two faces that need balanced treatment. Adaptive AI systems that personalize material to each learner's needs tend to support 4C competency development: decision-making scenario simulations train critical thinking, and writing-practice spaces that provide instant feedback accelerate written-communication skills. Tian and colleagues' meta-analysis confirms that AI's effectiveness here depends heavily on how instructional design positions the technology, not on the technology's sophistication alone (Tian et al., 2026). A recent synthesis on generative AI's impact on academic literacy and writing warns that learners risk shallow learning when they rely on instant AI answers instead of thinking independently, which can erode the metacognitive engagement that critical thinking requires (Sanz-Tejeda et al., 2026). Research on ICT competency strengthening in blended learning likewise confirms that curriculum, materials, and teaching strategy determine learning outcomes far more than technology availability alone (Ashraf et al., 2022), a conclusion that findings from massive open online courses for soft-skill development in higher education also support (Fernandez Pato et al., 2025). A conceptual review of AI-based tools' affordances for twenty-first-century competencies confirms that such technology benefits learners most when it supports their reasoning rather than replaces their thinking process (Celik et al., 2024). AI therefore does not automatically increase or decrease 4C competencies; its impact depends heavily on the pedagogical structure within which educators deploy it. These findings on AI's impact on the 4Cs and academic literacy largely derive from higher-education contexts and student populations in developed countries, so their relevance to Indonesia's Equivalency Program learners remains conceptual and analogical rather than direct empirical evidence; differences in age, learning motivation, and access to technology between those populations and equivalency-program learners warrant caution before applying these findings directly.

Out-of-school education, including the Equivalency Program, carries several distinctive characteristics that set it apart from formal education: flexible learning time and place that accommodate learners who often also work or carry family responsibilities, a learning orientation grounded in learners' needs and real-life experience, and far greater diversity in age and social background than formal-school classrooms show. These characteristics align well, in theory, with learning principles considered effective for cultivating 4C competencies, such as project-based and contextual learning, because both approaches require learners to actively solve real problems relevant to their lives rather than memorize material detached from context. The diversity of age and life experience among equivalency-program learners, often regarded merely as a classroom-management challenge, can instead become social capital that enriches cross-generational collaboration when tutors facilitate it appropriately. This facilitation principle intersects with social-emotional learning practice: a systematic review of such programs across education levels finds that tutors must themselves hold adequate social-emotional competence before they can cultivate it in learners (Barnes et al., 2023). Meta-analyses of social-emotional competency-strengthening programs at the elementary-education level (Shi et al., 2022) and in post-pandemic learning contexts (Raimundo et al., 2024) confirm this approach's effectiveness, both reporting improvements in learners' behavioral aspects and social relations following consistently implemented interventions.

2. METHOD

This article was prepared using a conceptual-review or narrative-review approach, a method aimed at synthesizing, connecting, and critiquing ideas from various literature sources to build a new framework of understanding, rather than testing hypotheses through the collection of primary data. The literature search was conducted through academic databases and platforms including Scopus, Google Scholar, and open-access journal repositories such as Frontiers, Cogent, Heliyon, and MDPI, using a combination of keywords including "4C competency," "twenty-first-century competency," "artificial intelligence in education," "soft skill development," "equivalency education," and "non-formal education." Priority was given to articles published within the last five to six years, namely from 2020 to 2026, considering that the issue of AI integration in education is developing very dynamically, so that older literature risks being less relevant to the current technological context.

The inclusion criteria used in this search were: (a) articles or official documents in Indonesian or English published between 2020 and 2026; (b) substantively discussing at least one of three main themes, namely the 4C/twenty-first-century competency framework, the use of AI in education, or the characteristics of non-formal education/the Equivalency Program; (c) being an indexed journal article (Scopus, DOAJ, or Sinta), an official institutional report, or core government education data; and (d) full text being accessible. The exclusion criteria included: (a) opinion pieces or brief editorials without substantive data or argumentation; (b) sources that had not undergone a peer-review process, other than official government documents; (c) duplication of findings already covered by other cited sources; and (d) articles that, although touching on the search keywords, were not substantively relevant to any of the three themes above after being read in full.

The selection process was carried out in stages. The initial search of the aforementioned databases and repositories produced a number of candidate sources; after removing duplicates and screening at the title and abstract level, full-text reading was conducted to assess conformity with the inclusion-exclusion criteria above. Through this process, 34 literature sources were established as the final references analyzed in this review, consisting of 24 international journal articles indexed in Scopus/DOAJ, 6 Indonesian national literature sources that directly discuss the Equivalency Program and non-formal education, and 4 official documents/institutional reports (the Ministry of Education, the World Economic Forum, and the Partnership for 21st Century Learning). It should be honestly noted that of these 34 sources, not a single one directly examines the intersection of all three themes (AI, the 4Cs, and the Equivalency Program) simultaneously; it is precisely this gap that forms the basis of this review's novelty argument as well as the boundary of the generalizability of its findings.

In line with this, the 34 sources were also distinguished according to their closeness to the review's context: sources providing direct evidence from the non-formal education or Equivalency Program context in Indonesia (including Anggraini et al., 2025; Utami & Shofwan, 2024; Wardianti et al., 2026; Sihalohe & Napitupulu, 2024; Haetami, 2025; Fauziddin et al., 2025), and sources providing conceptually relevant evidence because they originate from formal education, higher education, or contexts outside Indonesia (the majority of the literature on the 4C framework and the impact of AI). This distinction is applied consistently in the Results and Discussion section: direct evidence is used to support specific claims about the Equivalency Program, while conceptually relevant evidence is used as a theoretical foundation or analogy, not as empirical evidence already tested on the equivalency-learner population.

The selected sources were then grouped into two categories. The first category is international literature, the majority indexed in Scopus and DOAJ, used as the main theoretical foundation regarding the 4C framework, the impact of AI on those competencies, and the principles of social-emotional and project-based learning. The second category is Indonesian national literature, used to complement the

picture of the local context of the Equivalency Program and learner-empowerment practices at Community Learning Activity Centers. The synthesis process was carried out thematically, by grouping findings from various sources into major themes consisting of the 4C framework, the opportunities and risks of AI for the 4Cs, and the characteristics of non-formal education, before then linking them to one another in the discussion section to produce a conceptual proposition regarding a 4C integration model for the Equivalency Program. Technically, this thematic-synthesis stage followed three steps: (1) open coding, namely tagging the findings of each source into major theme categories (the 4C framework, AI opportunities-risks, characteristics of non-formal education, and assessment); (2) axial coding, namely linking these categories to identify patterns of convergence and contradiction across sources; and (3) integrative synthesis, namely formulating conceptual propositions and a 4C integration model by linking direct evidence and conceptually relevant evidence as explained above. As part of quality control, all references were also re-verified to ensure consistency between in-text citations and the reference list, and to ensure that every entry lists the actual author names; through this process, six entries that had previously erroneously listed a journal or platform name as the author in an earlier draft were identified and corrected (see References).

3. RESULTS AND DISCUSSION

3.1 The 4C Integration Model in the Paket A, B, and C Learning Modules

Conceptually, the integration of 4C competencies into the Equivalency Program can be achieved by linking each 4C dimension to learning activities already closely tied to learners' life context. Critical-thinking competency can be cultivated through case studies drawn from real problems in learners' environments, such as household financial-management analysis or the evaluation of information circulating on social media, so that learners are trained to sort information and make evidence-based decisions within contexts they recognize. Communication competency can be honed through digital or oral communication practice across contexts, such as job-interview simulations, writing official messages, or presenting group-project results before a learning community. Collaboration competency can be facilitated through group work that deliberately brings together learners of different ages and backgrounds, so that the collaboration process simultaneously trains empathy and the ability to negotiate across different perspectives. Creativity, meanwhile, can be cultivated through small entrepreneurship projects, social campaigns within the surrounding community, or creative products based on local skills, which also give learners real experience in generating economic or social value from their ideas. This kind of integration model is consistent with practices already reported in the context of empowering youth participants of the equivalency program through practical-skills training such as event hosting (MC) and video editing (Anggraini et al., 2025), which shows that project-based approaches and applied skills are quite well received and relevant for non-formal-pathway learners in Indonesia. A cooperative learning approach based on family-community education, reported to be effective as a restorative strategy in the context of juvenile diversion in Indonesia, further strengthens the argument that cross-generational and cross-background cooperation can serve as a vehicle for developing collaboration as well as strengthening character within the non-formal education pathway (Wardianti et al., 2026). At a technical level, a CSE-UCLA model evaluation of blended learning in the Equivalency Program confirms that the success of integrating technology into equivalency learning depends heavily on the alignment between program planning, implementation, and continuous follow-up improvement (Utami & Shofwan, 2024), a lesson relevant to efforts to link 4C activities with the use of AI in the Paket A, B, and C modules.

So that the relationships between the elements above are not understood only in narrative form, Figure 1 presents a conceptual model linking AI and the tutor as two enablers that underpin pedagogical strategy; that strategy drives contextual learning activities; those activities cultivate the four 4C

dimensions; and the resulting 4C development is then measured through assessment, the results of which become feedback for the tutor to refine the next pedagogical strategy.

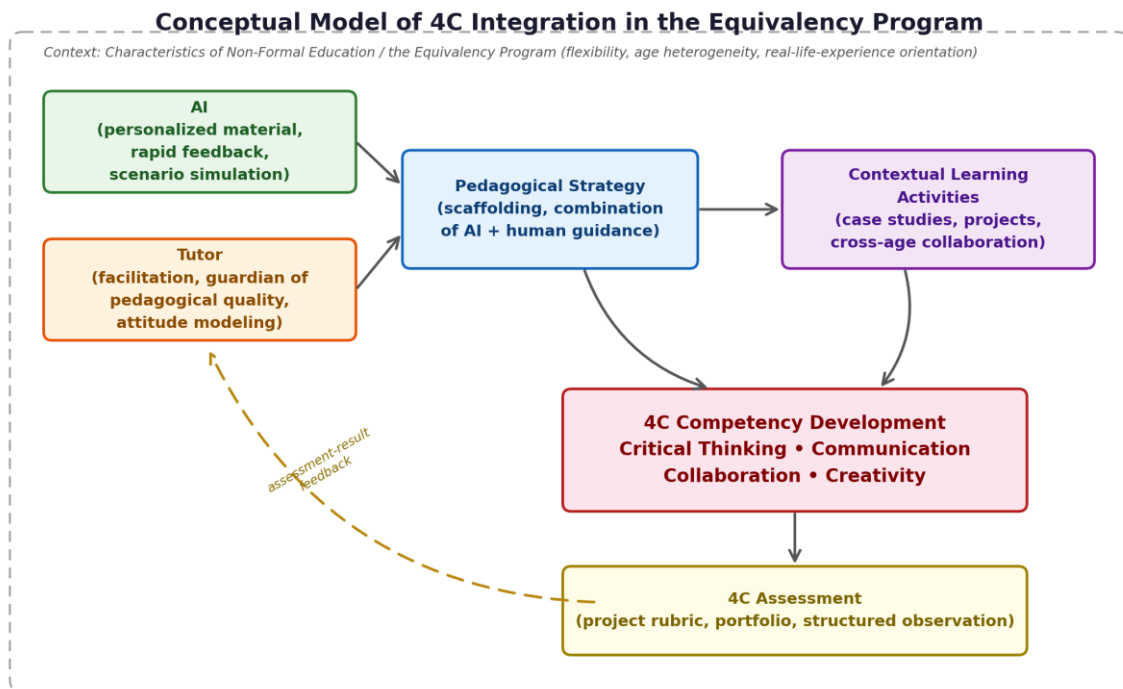


Figure 1. *Conceptual Model of the Integration of AI, Tutors, Pedagogical Strategy, and Learning Activities in 4C Development within the Equivalency Program (dashed lines indicate assessment-result feedback).*

3.2 The Role of AI as a Support Tool, Not a Replacement for the Tutor's Role

Within this integration framework, AI is most appropriately positioned as an enabler or support tool that expands the tutor's capacity, not as a replacement for the tutor's role itself. As an enabler, AI can be used to personalize learning material according to each learner's pace and learning style, generate rapid feedback on writing assignments or practice exercises, and help tutors develop contextual teaching materials more efficiently. Nevertheless, the aspects of character building, strengthening social relations, and modeling empathetic and ethical attitudes remain domains that fundamentally depend on human-to-human interaction, and therefore cannot be fully delegated to an AI system. The tutor in this context functions as the guardian of pedagogical quality, ensuring that the convenience offered by AI does not turn learners passive, but instead continues to encourage them to think, argue, and create independently. In other words, the success of AI integration in 4C development within the Equivalency Program depends heavily on the extent to which tutors are able to position AI as a complement to, rather than the center of, the learning process.

In more detail, the mechanism by which AI supports each 4C dimension needs to be explained so that the tutor's role as guardian of learners' thinking process does not remain a mere slogan. For critical thinking, AI is best used in a Socratic dialogic mode, namely providing guiding questions or scenarios that require learners to weigh several options, rather than directly offering a final answer; the tutor then asks learners to explain the reasoning behind their choice before the AI's answer is confirmed. For communication, AI functions as a provider of feedback on the structure, clarity, and spelling of learners' writing, while ownership of the ideas and the draft remains in learners' hands, and the tutor validates whether the revisions made genuinely reflect learners' understanding or merely copy the AI's suggestions. For collaboration, AI can serve as a tool for technical group coordination, such as drafting an agenda or summarizing discussion points, but decisions regarding role division, conflict resolution,

and group agreements remain entirely within the realm of interaction among learners, facilitated by the tutor. For creativity, AI can spark initial ideas or display a variety of examples as prompts, but learners are encouraged to elaborate, modify, or even reject those ideas with their own original ideas, so that the final product remains the result of learners' own thinking. Across all four mechanisms, the tutor holds the same role, namely ensuring that AI stops at the stage of sparking ideas and providing feedback, and does not go on to become the provider of final answers that replace learners' reasoning process.

3.3 Implementation Challenges

There are at least three structural challenges that need to be taken into account in efforts to integrate 4C competencies into the Equivalency Program. First, tutors' limited competence in digital literacy and the pedagogical use of AI, given that most equivalency tutors have not yet received specific training on how to use AI technology to support, rather than replace, learners' thinking processes. Second, the digital-infrastructure gap that remains quite wide between regions, especially in underdeveloped, frontier, and outermost areas, so that a uniform technology-integration approach risks actually widening the learning gap instead of narrowing it, as similarly illustrated by a study on digital-literacy gaps in higher education in Sub-Saharan Africa showing a comparable pattern (Ndibalema, 2025). Third, the current Equivalency Program curriculum has not yet explicitly and measurably incorporated 4C competencies as learning outcomes, so that the development of these competencies, if it occurs, depends largely on individual tutors' own initiative rather than being part of a structured, widely replicable curriculum design. These three challenges are also reflected in a study on the impact of AI on the future of education in Indonesia, which highlights that infrastructure gaps and educator readiness remain the main obstacles to the equitable distribution of AI's benefits across education levels, including the non-formal education pathway (Fauziddin et al., 2025).

3.4 Strategies for Addressing the Challenges

To address these three challenges, this review proposes three complementary strategic directions. First, organizing sustained, community-of-practice-based tutor training, so that capacity building does not stop at a one-time training session but continues as a collective learning process among tutors who share field experience with one another. Second, developing a blended-learning model that combines printed modules with simple technology, such as text messages or chat applications that do not require large data quotas, as a middle path for regions with limited infrastructure, so that the benefits of AI can still be felt without requiring adequate devices and internet connectivity across all regions. Support for this strategic direction is also evident from a cross-country meta-analysis of blended learning, which reports that such models consistently have a positive impact on learning outcomes and learner engagement as long as the face-to-face and online components are designed to complement each other, rather than merely being combined without planning (Cao, 2023). Third, revising the equivalency curriculum to explicitly and measurably incorporate 4C competencies into learning outcomes, for example through project-assessment rubrics that specifically measure all four dimensions, so that 4C development no longer depends solely on individual tutors' creativity but becomes an integral part of the national equivalency-education system.

3.5 4C Competency Assessment Mechanisms

So that the recommendation to make the 4Cs an explicit and measurable learning outcome does not remain merely normative, this review proposes three assessment mechanisms that are realistic to implement within the context of the Equivalency Program. First, an analytic, project-based rubric that breaks down each 4C dimension into observable behavioral indicators, for example for critical thinking: accuracy in identifying the problem, the quality of evidence used, and the validity of conclusions; for

communication: clarity of delivery and appropriateness for the audience; for collaboration: contribution and responsiveness toward group members; and for creativity: originality and the usefulness of ideas. Second, a learning portfolio that documents learners' progress over time, including initial drafts and revisions resulting from interaction with AI, so that tutors can assess the thinking process, not just the final product. Third, structured observation by the tutor using a simple checklist during group activities or presentations, as a complement suited to the Equivalency Program context, which does not necessarily have adequate access to standardized testing instruments or complex digital platforms. All three mechanisms are designed so that they can still be implemented without depending on sophisticated digital infrastructure, in line with the resource limitations characteristic of most equivalency-education units, and their results can serve as a basis for curriculum revision as recommended in the Conclusion section.

Table 1. Summary of Selected Literature Referenced in This Review

Author (Year)	Source	Focus of Study	Key Relevant Findings
Tian et al. (2026)	Assessing Writing	Impact of AI on 4C skills	Generative AI has varied effects on the 4Cs; its effectiveness depends on pedagogical design and the level of learning personalization.
Sanz-Tejeda et al. (2026)	Frontiers in Education	Synthesis of the impact of generative AI on academic literacy	Using AI without scaffolding risks reducing learners' metacognitive engagement and the depth of their critical thinking.
Zhan (2026)	Cogent Education	Meta-analysis of AI feedback on writing skills	AI-based feedback improves writing quality, but its benefits are optimal when combined with human guidance.
Ndibalema (2025)	Cogent Education	Digital literacy gaps in higher education in Sub-Saharan Africa	Infrastructure and digital-literacy gaps hinder the equitable development of twenty-first-century skills, relevant as an analogy for Indonesia's underdeveloped, frontier, and outermost (3T) context.
Wu (2024)	Behavioral Sciences	Emotional intelligence and workplace spirituality	Emotional intelligence contributes to career success, reinforcing the argument for the importance of non-cognitive soft skills.
Ye & Xu (2023)	Frontiers in Psychology	Interdisciplinary thematic curriculum for the 4Cs	Cross-subject thematic learning effectively cultivates all four 4C dimensions in an integrated, rather than partial, manner.
Amroni et al. (2024)	Edunesia	Project-based learning and the 4Cs of elementary-school students	The project-based learning model was shown to improve all four 4C components at the elementary-education level in the Indonesian context.
Espina-Romero et al. (2023)	Heliyon	Bibliometric mapping of soft-skill research	Soft-skill research is growing rapidly but remains concentrated in formal education and the industrial sector, with minimal attention to non-formal education.
Oliveira et al. (2021)	Frontiers in Psychology	SEL intervention for teachers	Strengthening educators' social-emotional competence correlates with the effectiveness of SEL interventions for learners.

Source: compiled from various literature used in this review (2026).

3.6 Cross-Study Synthesis

When the ten sources in Table 1 are read across studies rather than one by one, at least three interrelated patterns emerge. First, convergence. Tian et al. (2026), Celik et al. (2024), and Ashraf et al. (2022), although examining different levels and contexts, consistently arrive at the same conclusion, namely that the effect of AI on the 4Cs is not a function of technological sophistication, but rather a function of the instructional design within which the technology is embedded. This convergence strengthens this review's argument that the tutor's role as guardian of pedagogical quality (discussed in the previous section) is not merely a normative position, but is supported by a recurring pattern of findings across diverse contexts. Second, tension or differing emphasis. Zhan (2026) reports that AI feedback generally improves writing quality, whereas Sanz-Tejeda et al. (2026) emphasizes the risk of declining metacognitive engagement resulting from the same use of AI. These two findings do not cancel each other out; rather, they show that the results obtained depend heavily on moderators not always explicitly reported by each study, such as the level of scaffolding accompanying AI use and the extent to which learners are asked to reflect on the AI's output. It is this very tension that forms the basis of this review's argument that AI mechanisms need to be specified per 4C dimension (see the section on the Role of AI above), rather than generalized as a single effect. Third, a recurring contextual gap. Espina-Romero et al. (2023) and Arunratanothai et al. (2026), despite studying different fields (soft skills in general and dental education), both find that research productivity is concentrated in a small number of institutions and specific sectors, while Ndibalema (2025) shows a similar pattern in digital-literacy gaps in higher education in Sub-Saharan Africa. This recurring pattern across three different fields reinforces the presumption that the research gap in non-formal education populations, including the Equivalency Program in Indonesia, is not coincidental but rather a structural pattern in the distribution of academic attention—one of the fundamental reasons why a conceptual review such as this article is needed as an initial step before empirical research can be conducted.

4. CONCLUSION

As a conceptual study, this article has certain limitations that should be acknowledged: being a narrative rather than a systematic review, the literature selection did not follow a rigorous protocol such as PRISMA and may carry source selection bias; much of the theoretical literature on 4C competencies and AI's impact originates from formal education contexts or other countries, making its generalization to Indonesia's Equivalency Education Program inferential and in need of further empirical verification; and the study has not yet incorporated primary field data such as surveys or interviews with tutors and learners, so the proposed 4C integration model remains conceptual and requires empirical validation. This study concludes that 4C competencies, namely critical thinking, communication, collaboration, and creativity, are increasingly crucial for learners in the Equivalency Education Program in facing the demands of an ever-changing workforce driven by artificial intelligence, and that the Program, with its flexible, contextual, and real-life-experience-oriented characteristics, theoretically holds strong potential as a relevant space for developing 4C competencies, provided that three structural challenges, namely tutor capacity, infrastructure gaps, and an as-yet-unexplicit curriculum, can be addressed systemically and sustainably, with AI best positioned as a supporting tool that expands personalized learning rather than as a replacement for the tutor's essential role in building learners' social relationships and character. Based on these conclusions, this study recommends revising the Equivalency curriculum to explicitly and measurably incorporate 4C competencies into learning outcomes and assessment rubrics, continuously strengthening tutor capacity through digital literacy training and pedagogically oriented use of AI, and conducting further empirical research to test and refine the proposed 4C integration model so that it can be more widely replicated within Indonesia's equivalency education system.

AI USAGE STATEMENT

During the preparation of this work, the author(s) used Claude (Anthropic) for language editing, translation, and proofreading assistance. The author(s) reviewed and edited the content as needed and take full responsibility for the content of this publication.

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