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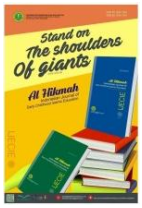

Population and Sampling Concepts in Quantitative Research and Participant/Key Informant Selection in Qualitative Research within the Context of Early Childhood Education (ECE)

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ABSTRACT

This study examines key issues related to understanding population concepts and the application of sampling techniques in quantitative research, as well as procedures for selecting participants and key informants in qualitative research within the context of early childhood education. The problem arises from the social, cultural, economic, and cognitive diversity of young children, which requires population designs and sampling strategies that are more adaptive and sensitive to contextual factors. The aim of this study is to analyze population concepts, assess the effectiveness of sampling techniques, and evaluate key informant selection practices that accurately reflect children's developmental dynamics. The method used is a literature review through systematic screening of reputable scholarly sources to identify concepts, methodological approaches, empirical findings, and critical perspectives. The main results show that populations in early childhood education cannot be defined numerically alone but must consider cultural diversity, socioeconomic conditions, and children's learning experiences. Quantitative sampling techniques remain relevant but require flexibility to address limited baseline data and variations in institutional characteristics. The core discussion highlights the importance of integrating quantitative and qualitative methods, including participatory observation and the use of educational technology, to strengthen data accuracy and the credibility of findings. The conclusion states that adaptive, ethical, and contextual methodological approaches can improve the quality of population formulation, sampling strategies, and informant selection. This study provides a significant contribution to policy development, research practices, and the enhancement of early childhood education quality through a more comprehensive methodological understanding.

INTRODUCTION

Research on population and sampling in the context of Early Childhood Education (ECE) is critically important, as the quality of collected data directly affects the accuracy of understanding children's developmental trajectories and learning processes. In ECE, children come from diverse cultural, social, and cognitive backgrounds, making the design of population frameworks both complex and methodologically demanding. Ensuring representativeness in population and sampling design is therefore crucial, as it guarantees that research findings reflect actual classroom conditions and children's learning environments (Aguayo et al., 2021; Aguilar et al., 2023). Without rigorous planning, data can be biased,

misrepresenting children's developmental needs, behaviors, and learning outcomes, which may hinder the formulation of effective educational interventions. Consequently, a robust methodological framework for population and sampling is essential for generating valid, credible, and generalizable results.

Several studies emphasize the influence of parent-child interactions in cultural socialization on identity formation and social understanding, indicating that sampling strategies in ECE research must capture cultural and familial diversity (Aguayo et al., 2021; Turner & Turner, 2025). Children from distinct cultural or linguistic backgrounds may display different behavioral patterns and developmental milestones, which should be represented in the research sample to prevent biased conclusions. Population determination and sampling techniques must therefore integrate both quantitative representativeness and qualitative contextual relevance to ensure methodological integrity.

Field research in ECE often faces challenges stemming from the heterogeneity of early childhood institutions and limited baseline data. Many preschools and early learning centers lack standardized databases, forcing researchers to use ad hoc methods for participant selection, which increases the risk of sampling bias (Håberg & Leer-Salvesen, 2020; McDermott, 2023). Such limitations can distort research conclusions, particularly when findings are intended to inform policy or practice. Without clearly defined population frameworks, the reliability and validity of ECE research remain vulnerable to methodological weaknesses.

Direct observation is a widely used method for evaluating children's behaviors, interactions, and play patterns in ECE, yet its effectiveness depends on careful sampling design (Al-Hendawi et al., 2025; Gunawan et al., 2023). Observation studies may miss crucial variations in children's behavior if sampling does not account for classroom differences, time-of-day effects, or peer composition. Structured and context-sensitive sampling is therefore essential to capture authentic developmental experiences. Aligning observational research with comprehensive sampling plans enhances both the validity and applicability of findings across diverse educational settings.

Ethical considerations form another critical component of ECE research. Researchers must adhere to rigorous ethical standards to protect the rights and well-being of child participants, particularly in vulnerable populations (Askari et al., 2024; Magnesya et al., 2025; Mayasari, 2022). Recruitment processes must respect the social and cultural contexts of families, ensuring that participation is voluntary and informed. Ethical lapses in participant selection can exacerbate inequities, undermine trust between families and educational institutions, and compromise the quality of both research and interventions.

The representativeness of samples also directly affects the generalizability of research outcomes. Studies show that children living in socioeconomically unequal neighborhoods experience disparities in developmental outcomes as early as age five (Aguilar et al., 2023). Ignoring these environmental and social inequities in population and sampling design risks producing findings that primarily reflect advantaged populations. Proper sampling strategies enable researchers to identify disparities, inform policies, and implement interventions that target inequities rather than merely documenting them.

Institutional readiness significantly influences the reliability of observational and intervention-based data collection. Variability in ECE educators' preparedness to implement instruments or interventions affects both data consistency and fidelity (Bleses et al., 2023; Butcher et al., 2023). Research designs must therefore consider both the statistical selection of participants and the capacity of institutions to support data collection. Incorporating institutional readiness into sampling ensures that findings are both methodologically sound and practically applicable.

Contextual sensitivity is equally important. Observational studies in non-traditional settings, such as museums or informal learning environments, demonstrate that situational factors, including media exposure and activity type, affect children's behavior (Shawcroft et al., 2022). Sampling that ignores these contextual variables risks collecting unrepresentative data, limiting the study's relevance to real-world educational contexts. Therefore, population and sampling strategies must be tailored to the environment in which children's development is observed.

Quantitative and qualitative sampling approaches complement each other in ECE research. While probability sampling strengthens generalizability, traditional statistical methods may not fully capture the dynamic and context-dependent nature of early childhood behaviors (Kurt, 2023; Thorpe et al., 2025). Researchers must adapt sampling techniques to account for variability in learning experiences, ensuring that both statistical rigor and contextual relevance are maintained. In qualitative research, ethnographic and participatory methods allow for a nuanced understanding of children's lived experiences and the socio-cultural factors influencing development (Köngäs & Määttä, 2023; Sun et al., 2023). Key informant selection, including parents, teachers, and administrators, must reflect the diversity of participant experiences while adhering to ethical guidelines, enhancing both credibility and validity (Lanfer et al., 2024; Montreuil et al., 2021).

Ethical sampling practices in qualitative research extend beyond procedural compliance. They require minimizing burdens on children and families, respecting participants' rights to decline involvement, and ensuring that study activities do not harm well-being (Montreuil et al., 2021; Sun et al., 2023). By integrating ethical protocols into participant selection, ECE research achieves methodological rigor while honoring social responsibility.

Despite methodological advancements, gaps remain in integrating quantitative and qualitative sampling strategies. Many studies emphasize one approach over the other, limiting the comprehensiveness of findings. Integrated frameworks that combine statistical representation, ethical rigor, and contextual awareness are necessary to generate robust, socially meaningful, and culturally responsive research outcomes (McDermott, 2023; Mohammadi et al., 2025).

This research proposes a model for population determination and key informant selection in ECE that combines statistical representativeness, institutional readiness, and ethical considerations. By integrating quantitative and qualitative approaches, the model provides a flexible, comprehensive, and actionable framework for ECE research. Such an approach ensures that findings accurately represent diverse children's experiences, guide

equitable interventions, and enhance the methodological quality of early childhood studies, ultimately contributing to improved educational outcomes and policy development.

METHODS

This study employed a literature review approach to analyze the concepts of population and sampling techniques in quantitative research, as well as the selection of participants or key informants in qualitative research within the context of Early Childhood Education (ECE). This approach was chosen because it allows researchers to thoroughly examine the development of concepts, methods, and current practices in ECE research, while also understanding the challenges, critiques, and methodological recommendations discussed in academic literature. A literature review facilitates the integration of diverse perspectives, both supportive and critical of sampling practices and informant selection, enabling the study to provide a more comprehensive and adaptive methodological framework.

Literature data were collected through systematic searches in leading academic databases such as Scopus, Google Scholar, Taylor & Francis, and SpringerLink. Keywords included terms such as "population in early childhood research," "sampling in quantitative ECE research," "key informant selection," "qualitative sampling in ECE," and other relevant methodological terms. Each article or source was read thoroughly to extract information regarding concept definitions, methodological approaches, empirical findings, critiques, and practical recommendations related to population, sampling, and key informant selection. The data obtained were then recorded in a literature matrix containing article identification, research focus, methodological contributions, and the position of the article within a critical or supportive context regarding ECE research practices.

Data analysis was conducted using content analysis techniques through three main stages: data reduction, data presentation, and conclusion drawing. In the data reduction stage, information and findings from various articles were categorized into themes such as ECE population frameworks, quantitative sampling techniques, qualitative participant selection, key informant selection, methodological biases, and critical perspectives. The data presentation stage provided a comparative narrative among different articles, highlighting similarities, differences, and supporting or critical arguments. In the conclusion drawing stage, the researcher synthesized all findings to generate a comprehensive understanding of the application of population concepts, quantitative sampling techniques, and ethical and effective procedures for participant and key informant selection in ECE research.

To ensure the validity of the literature review, this study employed source triangulation strategies, used literature from high-reputation journals, and presented a balanced perspective between articles that support and critique research practices. Logical coherence was maintained by ensuring that the conclusions drawn were fully based on verified academic evidence. This approach is expected to produce a methodological framework that is not only academically valid but also applicable for researchers, educational institutions, and policymakers seeking to improve the quality of early childhood education research and practice.

RESULT

The research on population concepts and sampling in quantitative studies, as well as participant and key informant selection in qualitative research within the context of Early Childhood Education (ECE), reveals several findings relevant to research practice and educational application. The literature review indicates that population concepts in ECE are not merely numerical but also encompass the social, cultural, and cognitive contexts of children. In field practice, population frameworks developed for ECE research must reflect the heterogeneous variation of children from diverse backgrounds, including language, ethnicity, and family practices. These findings emphasize that statistical sample representativeness must be balanced with contextual considerations that reflect the diversity of children's experiences.

Field observations show that quantitative sampling techniques, particularly probability sampling, are commonly employed to ensure the generalizability of findings. However, the dynamic nature of classrooms and rapidly changing child behavior demands flexibility in implementing these techniques. In studies monitoring children's play behavior and social interactions, structured observation systems allow for the identification of developmental patterns, but without proper sampling strategies, behavioral variation across classrooms or groups can be overlooked. This underscores the importance of sample design that considers temporal variations, peer composition, and classroom conditions to obtain valid data.

The literature review also highlights significant challenges related to the lack of baseline data in many ECE centers. Many early childhood institutions do not maintain comprehensive databases, resulting in ad hoc participant selection. Such practices increase the risk of sampling bias, which in turn affects the reliability of findings. Research shows that children from different socioeconomic environments demonstrate significant differences in cognitive and social development; thus, sampling designs that ignore these disparities may produce unrepresentative results. This emphasizes the need to integrate quantitative and qualitative strategies in constructing population frameworks that include all child subpopulations.

Institutional readiness in ECE centers is another critical factor affecting data quality. Literature analysis indicates that teachers' or educators' ability to implement observation instruments varies significantly, impacting data consistency. Some institutions lack training or resources to conduct accurate observations, leading to inconsistent or misleading data. These findings underscore the need to align sampling strategies with institutional capacity to ensure both practical and methodological validity.

Table 1. Comparison of Quantitative and Qualitative Sampling Strategies in ECE

Aspect	Quantitative Sampling	Qualitative Sampling	Description
Purpose	Generalization of findings	In-depth understanding	Quantitative emphasizes numerical representation; qualitative emphasizes

			context and experience
Techniques	Probability: random, stratified, cluster	Purposive, snowball, key informant	Quantitative emphasizes statistical distribution; qualitative emphasizes informant experience
Challenges	Situational child responses, classroom dynamics	Informant selection bias, experience representativeness	Both approaches face difficulties capturing the complexity of child behavior
Ethical Considerations	Minimal, related to data collection procedures	High, protection of children and families	Qualitative requires informed consent, reducing research burden

(researcher-processed data source)

Qualitative data analysis indicates that key informant selection in ECE research requires strategic consideration. Teachers, parents, and institution administrators serve as primary information sources, offering diverse perspectives on children's behavior, social interactions, and learning experiences. However, without systematic informant selection, studies risk producing biased or less credible data. In practice, key informant selection strategies involve defining inclusion criteria, considering ethical principles, and adapting to participants' socio-cultural contexts. Research shows that integrating statistical representativeness with ethical and institutional readiness considerations produces a more comprehensive sampling model.

The use of direct observation in various ECE institutions highlights differences in data quality due to institutional readiness. Data indicate that children respond differently to observation instruments depending on time, environment, and peer interactions. Figure 1 illustrates patterns of child interaction during free play activities observed in field studies, showing variation across different classroom groups.

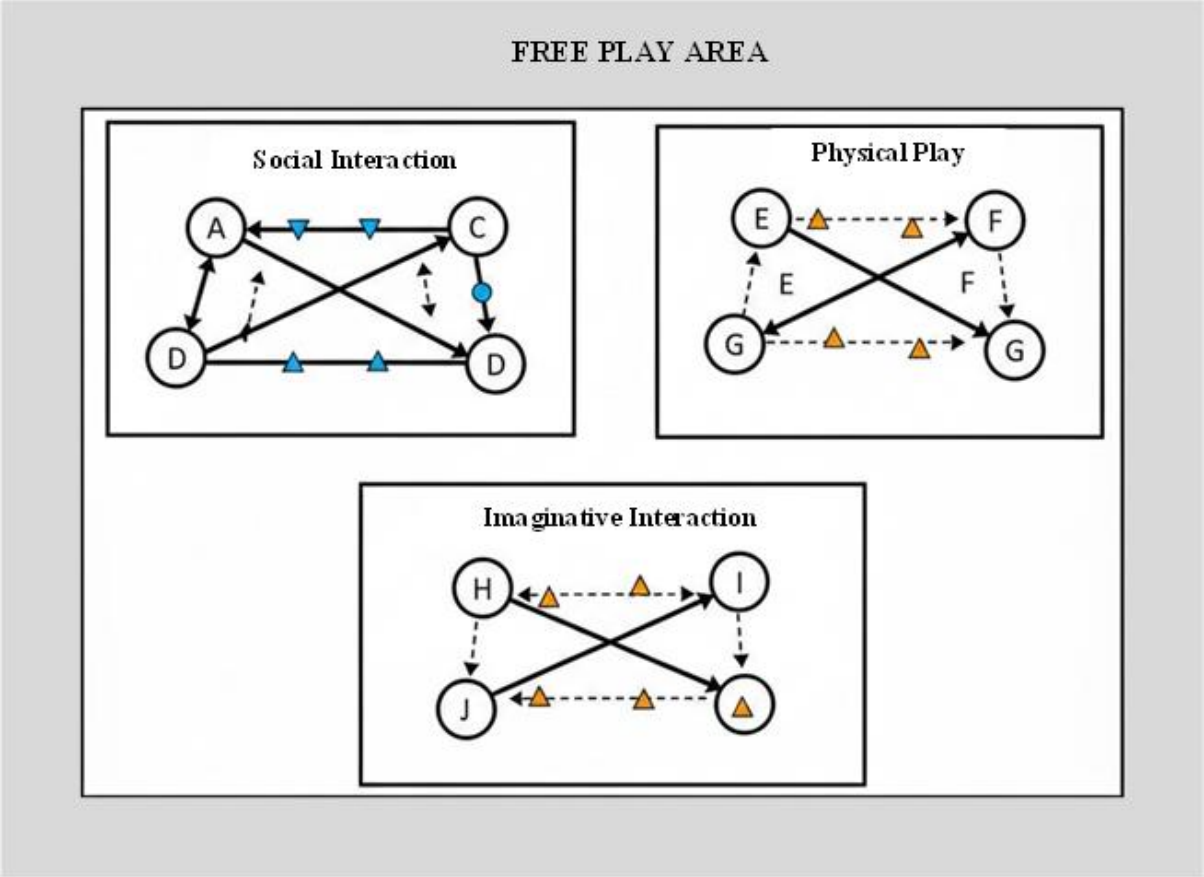

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Figure 1. Variation in Child Interaction During Free Play in ECE

The diagram shows variations in children's free-play interactions using lines and symbols to represent social, physical, and imaginative engagement. Solid lines (→) indicate active interaction, while dashed lines (⋯) show passive observation. Two-way arrows (↔ / ↔⋯) mark reciprocal exchanges. Symbols clarify interaction types: an inverted triangle (∇) signals social play, an orange triangle (△) represents physical activity, and a dotted triangle (△⋯) denotes imaginative play. Blue circles (•) highlight social cues. Together, these markers reveal how children shift roles, distribute attention, and respond to peers, helping researchers understand behavioral diversity in early childhood settings.

Analysis shows that integrating quantitative and qualitative strategies allows researchers to capture both numerical and contextual dimensions of child behavior. In quantitative research, probability techniques help ensure numerical representativeness, while qualitative studies provide in-depth understanding of socio-cultural factors influencing child development. This combination is crucial for producing valid, credible, and applicable findings in educational practice.

Furthermore, the literature review emphasizes that ethics is a non-negotiable aspect of ECE research. Recruitment processes must respect the rights of children and families, provide clear information about the study's objectives, and minimize potential burdens. Implementing ethical protocols in participant and key informant selection improves data quality and the credibility of research findings. Field studies demonstrate that strict adherence to ethical

procedures increases participant cooperation and results in more accurate and representative data.

Research also finds that socioeconomic, cultural, and environmental disparities significantly impact differences in children's developmental outcomes. Children living in less advantaged environments show different developmental achievements compared to those from more privileged backgrounds. Therefore, effective sampling strategies must consider socioeconomic, cultural, and environmental variables to prevent bias and enhance research relevance.

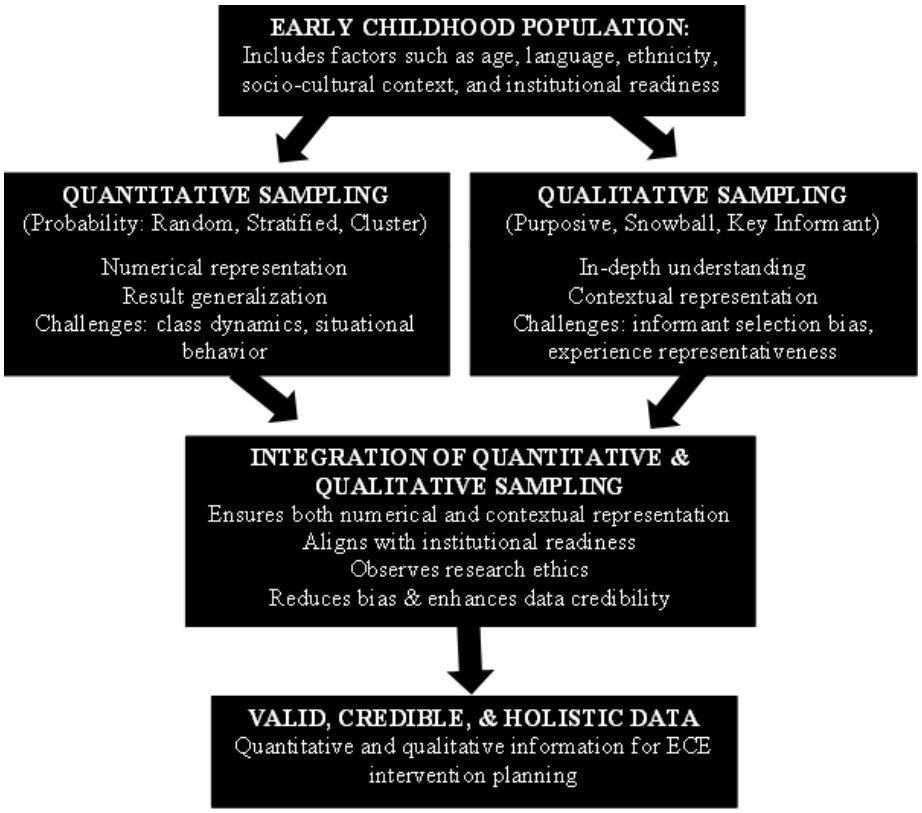
Table 2. Factors Affecting Population and Sampling Selection in ECE

Factor	Impact on Sampling	Mitigation Strategy
Child heterogeneity	Risk of bias if not representative	Stratification by age, language, and social background
Institutional readiness	Affects data consistency	Teacher training and instrument adjustment
Socioeconomic factors	Differences in developmental outcomes	Inclusion of all socioeconomic groups
Cultural context	Variation in child behavior	Purposive sampling for cultural diversity
Research ethics	Participant compliance, data quality	Ethical protocols, parental consent

(researcher-processed data source)

The findings also highlight technical challenges in integrating both sampling approaches. Field studies show that an excessive focus on numerical representation often overlooks strategic key informant selection, while emphasizing key informants may neglect the formation of initial numerical samples. This creates methodological gaps that can affect research validity and credibility. An integrated approach combining statistical representativeness, institutional readiness, socio-cultural context, and ethical principles addresses these challenges, producing an adaptive and applicable methodological framework.

The analysis further emphasizes the importance of flexibility in probability sampling within ECE environments. Children in dynamic classrooms with varied activities require context-sensitive sampling designs. Studies show that children's behaviors and responses are highly situational, and rigid sampling can fail to capture the complexity of their experiences. Adjusting sampling to reflect actual classroom conditions ensures that collected data accurately represent children's natural behaviors.



(researcher-processed data source)

Figure 2. Integration of Quantitative and Qualitative Sampling Strategies in ECE

Further analysis indicates that ethical and representative key informant selection enriches qualitative research. Teachers and parents are selected using inclusion criteria that consider professional experience, family background, and involvement in children's activities. This approach enables researchers to gain in-depth insights into learning practices, social interactions, and cultural factors affecting development. Studies show that purposive or snowball strategies for key informant selection increase data credibility when ethical procedures are maintained.

The review also shows that children from different cultural and linguistic backgrounds display varying behavioral patterns and developmental achievements. Research highlights the need for sampling strategies that reflect cultural diversity to produce findings that are relevant and equitable for all children. Balanced numerical representation alongside contextual representation ensures research integrity and reduces bias risk arising from sample homogeneity.

Field findings regarding limited baseline data in ECE institutions emphasize that population design must be adaptive to real conditions. Many ECE centers have incomplete or non-standardized child development records, necessitating a combined approach of direct observation and key informant interviews to complete data collection. This method allows researchers to capture comprehensive information on child development, social interactions, and classroom educational practices.

Moreover, the literature indicates that integrating quantitative and qualitative strategies not only enhances research validity but also provides practical guidance for planning

educational interventions. Quantitative data help assess developmental trends and generalize findings, while qualitative data enrich understanding of social, cultural, and child-centered contexts. This integrated approach facilitates the development of educational policies responsive to the needs of children from diverse backgrounds.

DISCUSSION

The research findings on the concepts of population and sampling in quantitative studies, as well as the selection of participants and key informants in qualitative research within the context of Early Childhood Education (ECE), highlight significant complexity in understanding child populations and implementing effective sampling practices. The population in ECE cannot be viewed merely as a numerical entity; it also encompasses children's social, cultural, ethnic, linguistic, and cognitive heterogeneity. This aligns with Aguayo et al. (2021), who emphasize how cultural socialization within parent–child interactions generates substantial variations in children's behavioral and cognitive development, indicating that socio-cultural context is essential for determining a valid population frame. Similarly, Aguilar et al. (2023) and Butcher et al. 2023) show that socioeconomic factors, educational access, and environmental conditions influence child development, requiring adaptive sampling strategies to ensure population representativeness.

Field findings confirm that a population frame capable of representing heterogeneous children from diverse ethnic, linguistic, family practice, and socioeconomic backgrounds is crucial for producing samples that reflect realistic variations in children's experiences. Studies by Ramdhan & Sholeh (2025) underscore the importance of multicultural awareness in early education, while Odoi et al. (2025) highlight the influence of sociocultural factors on children's compliance in various educational interventions, further reinforcing the need for adaptive population frames.

In quantitative research, probability sampling remains relevant for supporting generalization, yet its implementation often faces practical constraints. Al-Hendawi et al. (2025) emphasize the importance of direct observation for capturing children's dynamic behaviors, Kurt (2023) shows that children's understanding of informal statistics can shape interpretations of behavior. Variability in peer interaction, classroom dynamics, and temporal behavioral fluctuations necessitates methodological flexibility, making overly rigid sampling designs inadequate for addressing the complexity of children's behavior. Samuelsson (2025) stresses that integrating quantitative and qualitative approaches strengthens data validity, as it allows researchers to capture both numerical and contextual dimensions simultaneously.

Limited baseline data in many ECE institutions remains a major challenge. Many centers lack comprehensive databases, resulting in ad hoc participant selection that increases sampling bias. Butcher et al. (2023) show that socioeconomic factors can undermine the validity of findings, and McDermott (2023) highlights the need for adaptive methods in studies of small and heterogeneous populations. These issues are consistent with Banda et al. (2025) and Copeland et al. (2024), who emphasize the challenges of conducting research in socioeconomically diverse ECE environments. Mixed-methods approaches that integrate quantitative and qualitative strategies become essential for developing population frames that

are both statistically representative and contextually grounded (Mohammadi et al., 2025; Sánchez et al., 2024).

The practical implications for ECE emphasize the need for sampling strategies that account for child heterogeneity, institutional readiness, and sociocultural context. Teachers' ability to implement observation instruments directly affects data quality and consistency, as found by Bleses et al. (2023) and Gunawan et al. (2023). Thorpe et al. (2025) highlight the importance of teacher training and instrument adaptation to ensure accurate reflection of children's behavior. Strategic selection of key informants involving teachers, parents, and administrators enhances qualitative data credibility and enriches understanding of children's social interactions and learning practices, as noted by Lanfer et al. (2024), Håberg & Leer-Salvesen (2020), and Winter (2024).

This research contributes by developing a methodological framework that integrates quantitative and qualitative strategies in ECE contexts. Combining probability sampling with purposive or snowball strategies in selecting key informants enables holistic data collection that incorporates both numerical representation and sociocultural context. Montreuil et al. (2021) and Sun et al. (2023) emphasize the importance of participatory and ethical approaches in child research, while Askari et al. (2024) and Magnesya et al. (2025) highlight ethical considerations in child data collection. This integration not only improves data validity and credibility but also provides practical guidance for developing educational policies responsive to the needs of children from diverse backgrounds. Turner & Turner (2025) and Vuletich et al. (2024) add that awareness of historical and cultural bias is key to preventing inequities in research and educational practice.

The study's limitations include limited baseline data, variation in teachers' readiness to apply observation instruments, and the complexity of integrating quantitative and qualitative methods. The literature review and field observations do not fully cover all variations in children's social, cultural, and economic contexts across the national level, consistent with findings by Banda et al. (2025), Copeland et al. (2024), and Dumas et al. (2020). This opens opportunities for more comprehensive and representative future research.

Future studies should focus on developing adaptive population frames that align sampling designs with real-world conditions. Li et al. (2024) recommend the use of dynamic monitoring systems and early interventions to complement real-time child development data. Magnesya et al. (2025) and the Mayasari (2022) underscore the importance of participatory and ethical observation methods that consider institutional readiness to enhance qualitative data validity and credibility. Additionally, Samuelsson (2025) highlights the integration of educational technology to strengthen monitoring and data analysis capacity while maintaining sensitivity to sociocultural context and child research ethics. Zhang et al. (2024), Shawcroft et al. (2022), and Peltoperä et al. (2023) emphasize the need to develop observational and evaluative methods that account for developmental transitions and children's dynamic interactions.

This approach supports the advancement of holistic, adaptive, and ethical sampling strategies, making research findings more relevant for educational practice, policy interventions, and the overall improvement of early childhood education quality. Emphasizing the integration of sociocultural perspectives, research ethics, and technological

innovation positions this methodological framework as a potential model for ECE research across diverse contexts from urban to rural settings and across a wide range of socioeconomic backgrounds.

CONCLUSION

This study confirms that the concept of population and sampling techniques in early childhood education must account for children's social, cultural, and cognitive heterogeneity, as well as institutional readiness and practical field conditions. The integration of quantitative and qualitative strategies including probability sampling, purposive sampling, and snowball sampling combined with participatory observation and the use of educational technology, enables the collection of representative and credible data. This approach strengthens validity, supports evidence-based decision-making, and optimizes the roles of teachers, parents, and administrators in selecting key informants. As a solution-oriented framework, this methodological model provides an adaptive, ethical, and contextual structure that is relevant for policy development, educational practice, and interventions responsive to the diverse needs of young children, while also serving as a reference for early childhood research in both urban and rural settings.

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