



Integrating Science Literacy into Non-Formal Parenting Education to Strengthen Family Resilience

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ABSTRACT

Purpose of the study: This study examines the implementation of parenting classes at PUSPAGA Cinta Syejati, Samarinda City, as a non-formal educational setting for integrating family science literacy to strengthen family resilience.

Methodology: The study employed a descriptive qualitative approach. Data were collected through interviews with the program coordinator, psychologists, tutors, and parents, alongside observations and document analysis. Data were analyzed using the Miles and Huberman framework, comprising data reduction, data presentation, and conclusion drawing. Triangulation enhanced data credibility.

Main Findings: The findings indicate that parenting classes involve needs-based planning, participatory learning, counseling, and evaluation through observations, discussions, post-tests, and interviews. Participants reported perceived improvements in family communication, emotional management, and responses to parenting challenges. However, the existing program does not systematically assess parents' ability to evaluate scientific evidence, identify misinformation, or independently apply scientific information.

Novelty/Originality of this study: This study positions family science literacy as a potential educational dimension of non-formal parenting education, connecting scientific information, parenting competence, and family resilience. Integrating evidence-based learning materials, information-evaluation activities, and targeted assessment indicators could strengthen parents' evidence-informed decision-making and support the development of more responsive, community-based parenting education programs.

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1. INTRODUCTION

The family is the most fundamental social environment in which individuals experience their earliest processes of learning, development, and social interaction. Within the family, parents play a central role in providing care, guidance, protection, and education, while children develop knowledge, attitudes, and behaviors through everyday interactions. However, contemporary families face increasingly complex challenges related to economic conditions, health, child development, technology, social change, and the rapidly changing information environment. These challenges require parents not only to possess practical parenting skills but also to have the ability to access, understand, evaluate, and apply reliable information when making decisions

concerning their children's well-being. Consequently, parenting education has become increasingly important as a means of strengthening parents' knowledge and competencies and supporting family resilience. Family resilience refers to the capacity of families to manage available resources, respond to challenges, and maintain adaptive and supportive family relationships. In this context, strengthening parents' competencies through educational interventions is essential because the quality of parenting decisions can influence children's health, development, learning, and overall well-being [1]–[6].

Parenting decisions increasingly require parents to engage with scientific information in everyday life. Parents are expected to make informed decisions concerning children's nutrition, physical and mental health, physical activity, adolescent development, environmental health, digital technology use, reproductive health, and other issues that are closely related to scientific knowledge. At the same time, parents are exposed to an enormous amount of information through social media, digital platforms, online communities, and interpersonal networks. Not all of this information is scientifically valid, and parents may encounter misinformation, misleading health claims, pseudoscientific explanations, or conflicting recommendations. For example, decisions regarding children's nutritional intake require an understanding of basic health and nutritional information; decisions concerning physical activity require knowledge of children's developmental needs; while decisions regarding digital technology require parents to understand its potential benefits and risks for children's development and well-being. Similarly, discussions of reproductive health and environmental health increasingly require parents to distinguish evidence-based information from unsupported claims. Therefore, parenting competence in contemporary society extends beyond knowledge of caregiving techniques and behavioral strategies; it also involves the ability to engage critically with scientific information and use evidence to support decisions affecting family life.

This ability can be conceptualized through the notion of family science literacy, namely the capacity of family members, particularly parents, to access, understand, critically evaluate, communicate, and apply scientific information in everyday family decision-making. Science literacy is generally associated with the ability to use scientific knowledge to identify questions, explain phenomena, interpret evidence, and make informed decisions about issues involving science [7]–[9]. When situated within the family context, science literacy extends these competencies into everyday parenting practices. Family science literacy therefore involves not merely knowing scientific facts but also recognizing the relevance of science to family problems, evaluating the credibility of information, interpreting evidence, and applying scientific reasoning when making decisions about children's health, development, safety, environment, and use of technology. Such literacy is particularly important in an information-rich society, where parents increasingly function as mediators between scientific knowledge and children's everyday experiences. Developing family science literacy can consequently strengthen parents' capacity to respond rationally and adaptively to emerging challenges while reducing vulnerability to misinformation.

The development of family science literacy requires educational environments that are accessible to adults and connected directly to their everyday needs. In this regard, non-formal education provides an important alternative educational pathway because it can accommodate learning needs that are not necessarily addressed through formal schooling. Non-formal education is characterized by its flexibility in terms of participants, learning objectives, content, learning methods, and delivery contexts, allowing educational programs to be designed according to community needs [10]–[12]. For parents, non-formal education can provide opportunities to learn scientific concepts through authentic family problems rather than through abstract academic instruction. Such learning may involve interpreting nutrition labels, evaluating health information from social media, understanding children's physical and psychological development, identifying environmental risks, or discussing the appropriate use of digital technologies. Thus, non-formal education has the potential to function as a bridge between scientific knowledge and everyday family decision-making. Rather than positioning parents merely as recipients of parenting advice, non-formal education can empower them as active learners who critically engage with evidence and apply knowledge within their own family contexts.

One form of non-formal education that has considerable potential in this regard is the parenting class. Parenting classes are educational activities designed to improve parents' knowledge, skills, and competencies in carrying out their parenting roles. Traditionally, parenting classes have focused primarily on child growth and development, communication, caregiving practices, positive parenting, and family relationships [13]–[15]. However, the increasingly scientific and digital nature of contemporary parenting suggests that parenting classes need to move beyond the transmission of normative parenting practices toward the development of parents' capacity to understand and evaluate evidence-based information. A parenting class informed by science literacy can integrate topics such as child nutrition, health, physical activity, adolescent development, environmental health, digital technology, reproductive health, and misinformation into practical learning activities. Through discussion, problem-solving, interpretation of evidence, and reflection on real-life parenting situations, parents can develop competencies that enable them to make more informed decisions. In this sense, parenting classes can function not only as instruments for strengthening parenting skills but also as non-formal learning spaces for developing family science literacy and, ultimately, supporting family resilience.

The Family Learning Center (PUSPAGA) Cinta Syejati in Samarinda City, under the auspices of the Women's Empowerment and Child Protection Agency, provides preventive and educational services intended to improve family quality and support parents in carrying out their roles. One of its programs is the parenting class, which provides an important context for examining how non-formal education can respond to contemporary family needs. Previous studies concerning PUSPAGA have primarily discussed its institutional role, digital policies, and service provision in general [16]. However, limited attention has been given to how parenting classes are implemented as a structured non-formal educational process and, more importantly, how such programs can contribute to parents' capacity to engage with scientific information in everyday family decision-making. Existing discussions also tend to emphasize parenting competence and family resilience without explicitly positioning family science literacy as an educational outcome or analytical framework. This creates an important research gap concerning the relationship between parenting education, science literacy, and family resilience within non-formal education settings.

Therefore, this study examines the implementation model of the parenting class program at PUSPAGA Cinta Syejati, Samarinda City, with particular attention to its potential as a non-formal educational space for developing family science literacy. The study analyzes the planning, implementation, learning content, facilitation processes, and evaluation of the program through a descriptive qualitative approach using interviews, observations, and document analysis. Rather than examining parenting classes solely in terms of the delivery of parenting knowledge, this study explores how educational processes enable parents to understand, evaluate, and apply knowledge relevant to scientific issues in family life. The novelty of this study lies in positioning family science literacy as a conceptual and educational dimension of parenting education, thereby connecting three domains that have rarely been examined together: science literacy, non-formal education, and family resilience. The findings are expected to provide an empirical basis for developing parenting programs that are not only oriented toward improving parenting practices but also toward strengthening parents' capacity to make evidence-informed decisions in an increasingly complex information environment. In addition, the study may provide a transferable model for integrating science literacy into community-based parenting and family empowerment programs in other contexts.

2. RESEARCH METHOD

This study used a descriptive qualitative approach to further examine the childcare class program model implemented through non-formal educational space for developing family science literacy. This study aims to obtain a general overview of the childcare class model in strengthening family resilience competencies and science literacy. This study used data collection techniques in the form of interviews, observation, and document study. Interviews were conducted through questions and answers to obtain information from research sources. Informants in this study were the head coordinator of PUSPAGA, PUSPAGA psychologists, tutors, and family/parents. Observation techniques were carried out by observing program implementation. Document study techniques were carried out by reviewing documents available at PUSPAGA Cinta Syejati.

The results of data collection consist of raw data that must be analyzed. This study includes data analysis techniques from Miles and Huberman, namely data reduction, data presentation, and conclusion drawing. Data reduction is used by researchers to organize the data obtained from questions and answers, then adjust it to focus the research. Data presentation involves researchers describing the data from the data reduction results. Conclusions are drawn from this study by drawing conclusions from the research results.

To verify the validity of the data, researchers used triangulation and source triangulation techniques. Triangulation was conducted by comparing research findings from interviews, observations, and document studies. Source triangulation was conducted by comparing research findings or results with information from various research sources.

3. RESULTS AND DISCUSSION

3.1. Parenting Classes as a Non-Formal Educational Space for Family Science Literacy

Parenting classes at PUSPAGA Cinta Syejati are designed to help parents develop knowledge and skills for creating a safe, supportive, and conducive family environment. The program also seeks to strengthen parenting competence, improve family communication, and support children's growth and development. These objectives are closely related to family resilience, which involves the capacity of family members to respond to challenges, manage available resources, and maintain family well-being.

From a non-formal education perspective, the program provides a learning environment in which parents can identify parenting problems, discuss their experiences, and develop strategies for addressing challenges in family life. However, the findings indicate that the educational value of parenting classes extends beyond the delivery of parenting information. The program also creates opportunities for parents to reflect on

their experiences, reconsider established parenting practices, and adapt their approaches to the changing needs of their children.

These processes can be examined through the concept of family science literacy. In this study, family science literacy provides an analytical perspective for understanding how parents engage with knowledge and use it to make decisions about family life. Although the existing program findings demonstrate opportunities for knowledge acquisition, reflection, and practical application, they do not establish whether participants' abilities to evaluate scientific evidence or identify misinformation improved. Therefore, family science literacy is considered a potential educational dimension for further developing the parenting class program rather than an outcome that has already been empirically verified.

The following sections examine how the planning, implementation, and evaluation stages of parenting classes at PUSPAGA Cinta Syejati create opportunities for developing parental competencies and how these processes could be strengthened through a more explicit integration of science literacy.

3.2. Planning Stage: Identifying Parenting Needs as the Foundation of Contextual Learning

Program planning is an essential stage in non-formal education because it establishes learning objectives, determines appropriate content, and identifies the resources required to achieve the intended outcomes [17], [18]. At PUSPAGA Cinta Syejati, planning begins with identifying participants' needs and the parenting problems they experience. Coordinators, tutors, and supporting staff participate in designing the program, selecting learning materials, and establishing objectives that correspond to the conditions of participating families.

The findings indicate that the identification process involves consultation, observation, and interviews. These activities enable tutors to obtain information about family circumstances, understand parents' concerns, and identify issues requiring educational or counseling support. Consultation provides opportunities for parents to communicate their difficulties, while observation and interviews help tutors develop a more comprehensive understanding of children's behavior and family interactions [19]-[23].

Interviews with tutors revealed that some parents experienced difficulties understanding their children's behavioral patterns. According to the tutors, differences in children's personalities, family positions, and developmental needs could influence parenting practices. Parents sometimes found that approaches that had previously worked were no longer effective as their children grew older and developed different needs [24]. These findings demonstrate the importance of needs-based planning in parenting education. Rather than assuming that all parents require the same information, PUSPAGA Cinta Syejati identifies specific problems before determining the appropriate educational response. Such an approach allows learning activities to be connected to participants' everyday experiences and increases the relevance of the material to their circumstances.

From a family science literacy perspective, needs identification can also serve as the starting point for connecting scientific knowledge with parenting decisions. Parents' questions about children's behavior, development, health, and emotional responses can provide opportunities to introduce relevant evidence and encourage critical reflection. For example, concerns about adolescent behavior could be addressed through developmentally appropriate information, while questions about children's health could be connected to reliable health information.

Nevertheless, the existing findings primarily document the identification of parenting needs rather than the systematic use of scientific evidence during program planning. The integration of family science literacy would therefore require tutors to identify not only the parenting problems experienced by participants but also the types of information they use, the difficulties they encounter in assessing information credibility, and the scientific knowledge needed to make informed decisions.

The identification process also revealed concerns regarding parents' understanding of appropriate parenting practices and their ability to manage their emotions when interacting with children. These concerns became important considerations in designing activities intended to improve communication and parenting competence [25]-[27]. The findings suggest that needs identification functions as both a diagnostic and an educational process: it establishes the problems that the program seeks to address and provides a basis for determining relevant learning objectives.

Accordingly, effective planning should integrate three interconnected dimensions: the parenting problems experienced by participants, the learning competencies that parents need to develop, and the evidence-based information required to support informed family decisions. This integration could strengthen the role of parenting classes as non-formal education programs that contribute to parenting competence while creating opportunities for developing family science literacy.

3.3. Implementation Stage: Participatory Learning and the Application of Knowledge in Family Life

The implementation stage translates program plans into learning activities designed to improve participants' knowledge, skills, and understanding [28], [29]. At PUSPAGA Cinta Syejati, the parenting class

program is delivered through educational activities that include material presentation, outreach, interactive discussions, practical activities, and counseling. The findings indicate that PUSPAGA Cinta Syejati introduces parenting classes to communities through outreach activities at schools and other institutions. These activities help introduce the program to parents who may not previously have been familiar with its services. Program materials are subsequently delivered by tutors, while participants engage in activities intended to help them understand and apply the information provided [30]–[33].

The implementation process demonstrates that parenting classes are not limited to the one-way transmission of information. Tutors also encourage participants to share their experiences and discuss parenting problems. This approach is consistent with participatory learning, in which participants actively contribute to the learning process through discussion, interaction, and reflection [34]–[38]. Participatory learning is particularly relevant to adult education because parents bring existing knowledge, beliefs, and experiences into the learning environment. These experiences can become resources for learning when participants are encouraged to examine their assumptions, compare different approaches, and reflect on the consequences of their decisions.

The findings further indicate that tutors use effective communication, reflection on participants' experiences, and counseling to facilitate learning. These approaches encourage parents to express their concerns and discuss sensitive family issues in a supportive environment. Effective communication and reflective counseling can help establish trust, promote openness, and enable facilitators to respond more appropriately to participants' emotional conditions [39], [40]. From a family science literacy perspective, these learning processes provide a foundation for developing critical engagement with information. Parents can be encouraged to move beyond accepting advice based solely on personal experience or social influence by examining the reasons behind particular parenting recommendations. Facilitators could, for example, invite participants to compare parenting claims encountered on social media with information from credible scientific or professional sources, discuss the evidence supporting different recommendations, and consider whether the information is appropriate for their children's developmental stages.

Such activities would connect participatory learning with the competencies associated with science literacy: understanding relevant knowledge, evaluating evidence, interpreting information, and applying knowledge to everyday decisions. Importantly, these activities are proposed opportunities for strengthening the existing program; the current findings do not establish that systematic scientific-information evaluation was already part of its implementation. The findings also reveal that parenting challenges differ according to children's developmental stages and individual characteristics. Parents reported that approaches used when their children were younger did not always remain appropriate as the children entered adolescence or adulthood [24]. This finding highlights the importance of adaptive parenting education that recognizes developmental differences rather than promoting a single approach for every family.

The implications extend beyond the selection of parenting techniques. Parents need opportunities to understand why children's needs change and how reliable information can help them respond to these changes. Parenting classes could therefore incorporate developmentally relevant topics, including adolescent health, emotional development, physical activity, digital technology use, reproductive health, and the evaluation of health-related misinformation. The specific topics should be determined by participants' needs and the program's educational objectives.

3.4. Evaluation Stage: Assessing Learning Outcomes and Identifying Opportunities to Measure Family Science Literacy

Program evaluation is a systematic process for determining the extent to which educational objectives have been achieved and identifying areas requiring improvement [41]–[46]. At PUSPAGA Cinta Syejati, evaluation is conducted through observations of learning activities, discussions, question-and-answer sessions, and post-tests administered at the end of learning sessions.

The findings indicate that evaluation focuses on participants' responses, their understanding of the material, and the need for further educational support. Post-tests are used to assess participants' understanding of the material presented, while interviews provide additional information about perceived changes in parenting practices and family interactions [44], [47]. Interviews with participants indicated that they considered the knowledge gained from parenting classes useful. Participants also described improvements in communication, emotional management, and their ability to respond to family problems. Reported changes included greater openness when communicating with family members, improved emotional control, and more constructive approaches to addressing difficulties in the family [48]–[50]. These findings suggest that the program provides educational benefits that participants perceive as relevant to their parenting roles. The combination of post-tests, observations, and participant interviews also provides different sources of information for understanding the program's outcomes. Post-tests provide information about immediate understanding, while interviews offer insights into how participants perceive the relevance of the learning experience to their everyday lives. However, the findings need to be interpreted in relation to the scope of the evaluation methods. Post-tests administered at the end of a session primarily provide evidence of short-term understanding. Meanwhile, reported behavioral

changes and tutor observations do not, by themselves, establish sustained improvements in parenting practices or demonstrate causal effects of the program. Further evaluation would be needed to determine whether the reported changes persist over time and translate into consistent practices at home.

The findings also indicate that the current evaluation does not explicitly measure family science literacy. Although participants report improvements in understanding and applying parenting knowledge, the available results do not establish their ability to distinguish reliable scientific information from misinformation, interpret evidence, or evaluate competing claims about family health and development. This distinction is important because understanding parenting material and evaluating scientific information are related but different competencies. Parents may understand the information presented during a class without necessarily developing the skills required to independently assess the credibility of information encountered elsewhere.

To strengthen the program's contribution to family science literacy, evaluation could incorporate indicators that assess whether parents can identify credible sources, explain evidence supporting a recommendation, distinguish evidence-based claims from unsupported statements, and apply relevant information to realistic family situations. These indicators could be assessed through scenario-based questions, information-evaluation tasks, reflective activities, and follow-up interviews. A more comprehensive evaluation framework could therefore distinguish between three levels of outcomes: immediate understanding of parenting material, the ability to critically evaluate relevant information, and the application of knowledge in everyday parenting decisions. Follow-up assessments could subsequently examine whether these competencies are retained and used in family contexts.

The findings thus demonstrate the importance of evaluation not only as a mechanism for assessing program delivery but also as an opportunity to refine educational objectives. By incorporating indicators of family science literacy alongside existing measures of parenting knowledge and perceived behavioral change, PUSPAGA Cinta Syejati could develop a more comprehensive understanding of how its parenting classes support informed decision-making and family resilience.

3.5. Emerging Needs in Parenting Education: Adapting to Adolescence and Adulthood

An important finding of this study is that participants' parenting needs are not limited to the care of young children. Some parents reported difficulties adapting their parenting approaches as their children entered adolescence or adulthood. Approaches that had previously been considered effective were no longer perceived as appropriate because children's characteristics, behaviors, and needs had changed. This finding suggests that parenting education needs to accommodate a broader range of developmental stages. Although early childhood remains an important period for parenting support, families continue to encounter educational needs as children become more independent and experience changes in their social relationships, emotional development, health, and use of technology.

The significance of this finding lies in the need for parenting classes to be responsive to the developmental circumstances of participating families. Rather than relying exclusively on general parenting materials, program organizers should identify the ages and developmental stages of participants' children and adjust learning content accordingly. The finding also creates an opportunity to strengthen the program's family science literacy dimension. Parents of adolescents may need reliable information about physical and emotional development, digital media, physical activity, reproductive health, and health-related misinformation. Parents supporting older children may face different questions involving autonomy, decision-making, communication, and the transition to adulthood. Addressing these needs requires educational materials that are developmentally appropriate and supported by credible evidence.

Nevertheless, the present findings establish the existence of changing parenting needs rather than demonstrating that participants lack scientific literacy in these areas. Further assessment is required to determine what information parents currently use, how they evaluate its reliability, and which science-related competencies would be most beneficial for different groups of participants. The practical implication is that parenting classes should be organized around participants' actual concerns while maintaining clear educational objectives. A modular approach could allow the program to address early childhood, adolescence, and the transition to adulthood through different learning units. Each unit could combine parenting strategies with relevant scientific information and activities that encourage parents to evaluate and apply that information. This approach would strengthen the responsiveness of non-formal education to family needs and create a clearer connection between parenting competence, family science literacy, and family resilience.

The findings provide a basis for examining parenting classes through three interconnected dimensions: non-formal education, family science literacy, and family resilience. First, the study illustrates the role of non-formal education in responding to parenting needs through consultation, needs identification, participatory learning, counseling, and evaluation. These processes provide a flexible educational structure that can accommodate the experiences and concerns of participating parents. Second, family science literacy offers a potential framework for extending the educational objectives of parenting classes. The program's existing emphasis on understanding parenting problems, discussing experiences, and applying knowledge provides a

foundation upon which scientific-information competencies could be developed. However, the current findings do not demonstrate that these competencies have already been systematically taught or measured. Their integration therefore represents an opportunity for program development rather than a confirmed outcome of the existing intervention. Third, family resilience remains an important broader objective because parenting competence, communication, and the ability to respond to changing family needs are relevant to family well-being. Family science literacy could contribute to this objective by helping parents make informed decisions and respond more critically to information related to children's health, development, and safety. Nevertheless, the relationship between family science literacy and family resilience should be examined empirically rather than assumed to be causal.

On a practical level, the findings suggest that PUSPAGA Cinta Syejati could strengthen its program through four complementary strategies. The first is to incorporate an assessment of parents' information needs and existing information-evaluation practices into the planning stage. The second is to integrate relevant scientific information into parenting materials according to participants' needs. The third is to use participatory learning activities that encourage parents to compare sources, discuss evidence, and apply information to realistic family situations. The fourth is to develop evaluation indicators that distinguish knowledge acquisition from scientific-information evaluation and practical application. These strategies could help transform parenting classes from programs primarily focused on the delivery of parenting advice into more comprehensive learning environments that support evidence-informed family decision-making. The study's contribution lies in connecting the implementation of parenting classes with the potential development of family science literacy within a non-formal education setting. This perspective extends the analysis of parenting education beyond the acquisition of caregiving knowledge and highlights the relevance of scientific-information competencies to contemporary family life. At the same time, the proposed connection requires further empirical examination through research that directly measures family science literacy and investigates its relationship with parenting practices and family resilience.

This study has several limitations. First, changes in parental understanding and behavior were primarily identified through interviews and tutor observations. The study did not include systematic, longitudinal observations of parenting practices in participants' homes. Consequently, the sustainability of reported behavioral changes cannot be established. Second, the available findings do not provide detailed information about the number of participants, the distribution of children's ages, or the duration and intensity of program participation. These limitations restrict the extent to which the findings can be generalized to other parenting education settings. Third, the post-test evaluation primarily addressed participants' immediate understanding of the material presented. It did not explicitly assess their ability to evaluate scientific evidence, identify misinformation, or independently apply science-related information to family decision-making. Therefore, the study cannot establish the level of family science literacy among participants or demonstrate that the program improved this competency. Fourth, although participants reported perceived improvements in communication, emotional management, and problem-solving, these accounts should not be interpreted as conclusive evidence of causal effects on family resilience.

Future research should address these limitations by developing and validating instruments to assess family science literacy in parenting education contexts. Such instruments could examine parents' ability to identify credible information sources, interpret evidence, evaluate competing claims, and apply scientific knowledge to family-related problems. Follow-up assessments conducted several months after program participation could also investigate the retention and practical application of learning outcomes. Further studies could examine how family science literacy varies across children's developmental stages and determine which educational strategies are most effective for different groups of parents. A more systematic evaluation design, potentially combining pre-tests, post-tests, scenario-based assessments, interviews, and follow-up observations, would provide stronger evidence concerning changes in participants' competencies. For PUSPAGA Cinta Syejati, future program development could include age-specific parenting modules that integrate relevant scientific information with practical parenting strategies. These modules could address child health, nutrition, physical activity, adolescent development, environmental health, digital technology, reproductive health, and misinformation according to the needs identified among participants. Such developments would provide a basis for examining whether integrating family science literacy into non-formal parenting education can strengthen parents' evidence-informed decision-making and contribute to family well-being and resilience.

4. CONCLUSION

This study concludes that parenting classes at PUSPAGA Cinta Syejati, Samarinda City, provide a non-formal educational environment that supports the development of parenting competence and addresses families' changing needs. The program incorporates needs-based planning, participatory learning, counseling, and evaluation through observations, discussions, post-tests, and interviews. Participants reported perceived improvements in family communication, emotional management, and their ability to respond to parenting

challenges. These findings highlight the potential contribution of parenting education to family well-being and resilience. However, the existing program has not systematically integrated or measured family science literacy as a specific learning outcome. In particular, parents' abilities to identify credible information sources, evaluate scientific evidence, distinguish evidence-based claims from misinformation, and apply scientific knowledge to family decisions remain insufficiently assessed. Therefore, the development of family science literacy should be regarded as an opportunity for program improvement rather than an established outcome of the current intervention. To strengthen this contribution, parenting classes should integrate evidence-based scientific information into learning materials, employ participatory activities that encourage critical evaluation of information, and develop assessment indicators that measure knowledge, evidence evaluation, and practical application. Learning modules should also accommodate parents' needs across different developmental stages, including childhood, adolescence, and the transition to adulthood. Future research should develop and validate instruments for assessing family science literacy and employ follow-up assessments to examine the sustainability of learning outcomes. Further empirical investigation is also needed to determine how family science literacy relates to parenting practices and family resilience. These efforts could support more responsive non-formal parenting education and promote informed family decision-making.

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AUTHOR CONTRIBUTIONS

Conceptualization, EGTL and M.; Methodology, EGTL and H.; Investigation, EGTL and N.; Data curation, H. and N.; Writing – Original Draft, EGTL; Writing – Review & Editing, M. and N.; Supervision, M.; Project Administration, EGTL.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in this study. Prior to participation, each subject was given a detailed explanation of the study's purpose, procedures, potential risks, and benefits. All participants voluntarily agreed to participate and provided informed consent to be included in the study. All images in this article have been authorized and are the property of the authors.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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