

Evaluation of an Easy-to-read Pamphlet on Infant Crying and Sleep for Parents with Intellectual Disabilities

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Abstract

This study evaluated an easy-to-read educational pamphlet, based on Lättläst (LL) manga principles, to enhance knowledge of infant crying and sleep among parents with intellectual disabilities (ID). Parents with ID often face challenges in understanding complex information about infant behavior and care. The study employed a quasi-experimental pre-test to post-test design with 14 parents with ID to assess knowledge acquisition, complemented by a cross-sectional survey of 41 healthcare professionals evaluating the pamphlet's potential clinical use. The pamphlet utilized simplified narratives and visual aids tailored to facilitate understanding. Results showed knowledge improvement among participants with ID, with differences observed by prior childcare experience and level of ID. Participants with prior childcare experience and those with mild ID showed greater improvement patterns. Both participant groups positively assessed the visual aids and narrative structure, though some areas for improvement (e.g., text size, illustration clarity) were identified. Healthcare professionals indicated a strong intention to use the pamphlet in clinical settings. This study suggests that educational materials based on LL manga principles appeared to facilitate the understanding of complex information for parents with ID. The findings underscore the importance of tailored, visually supported resources in empowering this population and potentially supporting improved childcare practices. Future research should include longitudinal follow-up studies to assess long-term effects and observational studies on real-world application.

1. Introduction

According to the American Association on Intellectual and Developmental Disabilities (AAIDD)¹⁾, intellectual disability (ID) is defined as a disability characterized by significant limitations both in intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills. It originates during the developmental period, typically before age 22. AAIDD emphasizes that ID is not solely determined by an individual's intelligence quotient (IQ) score, but rather by a combination of factors including adaptive skills, environmental factors, and the support systems available to the individual.

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Consequently, these characteristics can present unique challenges in various aspects of daily life, including parenting and responding to infant cues.

Understanding infant cries and responding appropriately is crucial for parents to provide adequate care, yet this can be particularly challenging for parents with ID. Specifically, infant cries are characterized by acoustic properties, such as abrupt changes in volume (roughness), that can be perceived as aversive and have been shown to stimulate the amygdala, a brain region associated with the perception of fear²⁾. This suggests that for parents with ID, interpreting these complex auditory cues and managing the associated stress can be particularly challenging, potentially leading to inappropriate responses. Inadequate responses stemming from these difficulties can sometimes escalate into harmful situations. Abusive head trauma, often triggered by frustration or inadequate coping mechanisms in response to persistent infant crying, causes intracranial bleeding and can have lethal consequences for the infants³⁾. These risks are compounded by the inherent challenges faced by individuals with ID in areas critical for effective parenting.

ID is characterized by limitations in adaptive behavior, which encompasses deficits in social skills, such as interpersonal relationships and social judgment, as well as practical skills, including self-management and safety awareness^{1,4-9)}. While research findings on the direct link between parental intellectual disability (ID) and child maltreatment are inconclusive, data consistently show that a high proportion of children with parents with ID enter protective care. This underscores the urgent need for effective educational interventions to support these parents. However, international studies on the association between parental ID and child maltreatment have yielded mixed results, with some indicating a positive correlation and others finding no significant link. This discrepancy may be attributed to variations in study design, definitions of maltreatment, or the level of support available to parents with ID in different regions. Among studies reporting a positive association, research from Canada has highlighted neglect as the most prevalent form of maltreatment¹⁰⁾, while a study from the United States found a higher incidence of emotional and psychological abuse compared to parents without intellectual disabilities¹¹⁾. Furthermore, some studies have suggested that parental intellectual disability may negatively impact parent-child attachment due to reduced parental sensitivity¹²⁾. Conversely, studies have also reported that children of parents with intellectual disabilities do not exhibit increased health problems¹³⁾, and that with appropriate support and training, parents with intellectual disabilities can acquire and maintain effective parenting skills, benefiting their children¹⁴⁾. Despite this, many parents with intellectual disabilities are denied the opportunity to raise their children, with research from several countries indicating that 30-50% of their children are permanently placed in protective care¹⁵⁻¹⁹⁾. This highlights a critical issue and suggests that current support systems may be insufficient in enabling many parents with ID to successfully raise their children. Therefore, addressing this critical issue through targeted support and education is paramount.

Consequently, tailored educational interventions are required, to effectively teach individuals with ID appropriate responses to infant crying. Building upon this recognition, our research group has focused on developing accessible educational materials for individuals with ID. Our previous work has focused on developing easy-to-read educational materials for individuals with ID and their support providers, including pamphlets on contraception²⁰⁾, and breastfeeding, and a handbook for assisting pregnant and postpartum individuals with ID^{†1)}. These resources were developed with the aim of promoting practical use in healthcare settings^{†1)}.

Given the importance of addressing this gap, we developed an easy-to-read pamphlet on infant crying and sleep specifically tailored for parents with ID. We then evaluated its comprehensibility and readability, and identified areas for improvement by surveying both individuals with ID and healthcare professionals.

2. Objectives

This study aimed to evaluate the perceived utility and potential impact of an easy-to-read educational pamphlet on infant crying and sleep, developed for parents with ID, from the perspectives of both individuals with ID and healthcare professionals.

2.1 Research questions

This study aimed to address the following inquiries: (i) to measure the change in knowledge regarding infant crying and sleep among participants with ID after exposure to the educational pamphlet, (ii) to explore the patterns in pre- and post-pamphlet questionnaire results in relation to participants' demographic variables (severity of ID and childcare experience), (iii) to evaluate the perceived readability of the educational pamphlet among participants with ID, (iv) to assess healthcare professionals' perceptions of the pamphlet's comprehensibility and readability, and their intentions for its use, (v) to identify recommended modifications for improving the pamphlet.

3. Methods

3.1 Development of the pamphlet on infant crying and sleep based on *Lättläst Manga Principles*

Manga, a globally recognized form of visual literature, is widely popular. In Japan, the publication of educational manga catering to diverse age groups, including adults, is prevalent. These publications often employ distinctive stylistic techniques, such as the use of manga symbols (*manpu*), which are visual cues used to convey characters' emotions or states, metaphorical expressions, and layered visual narratives. However, Yoshimura²¹⁾ noted that the inherent complexity of manga can pose comprehension challenges for certain readers. This observation led to the conceptualization of "manga literacy" and the subsequent development of simplified manga, aimed at enhancing accessibility for a broader audience, including individuals with ID^{21,22)}. Building on this approach, the present study used principles derived from *Lättläst* (LL) manga (where "*Lättläst*" is Swedish for "Easy-to-read"), a simplified reading format, to create an accessible, illustrated pamphlet on infant crying and sleep. LL manga, as conceptualized by Yoshimura and colleagues, emphasizes clear visual communication and simplified narrative structures to facilitate comprehension. This approach was deemed appropriate for the target population of individuals with ID, who may benefit from visual aids and simplified text.

For this study, a 25-page pamphlet on infant crying and sleep was developed and structured into three distinct sections. The pamphlet employed a narrative LL-manga format, centering on a couple's experience with their one-month-old son's nocturnal crying. The initial ten-page section elucidates the reasons behind infant crying and corresponding coping strategies. The subsequent four-page section expounds upon the five senses of infants and their modes of communication. The third eleven-page section provides an analysis of infant sleep patterns and the requirements for facilitating infant sleep. The pamphlet included three LL story manga titles: "Why is my baby crying? I don't understand." in the first section, "Can my baby see and hear?" in the second section, and "My baby won't sleep." in the third section.

The pamphlet's textual content, illustrations, margins, and layout were designed in accordance with the "Guidelines for Providing Easy-to-read Information to People with Intellectual Disabilities"²³⁾ and utilized LL manga principles as outlined in the "Guidelines for Creating LL Manga"²⁴⁾. Specifically, the illustrations were created by an experienced LL manga artist. The front and back covers comprised the remaining two pages.

3.2 Questionnaire

3.2.1 Questionnaire for participants with ID

The questionnaire for participants with ID was structured into five distinct sections. The initial section focused on collecting socio-demographic data, including age, classification of ID certification (B1: moderate, B2: mild)^{†2)}, gender, parental status, prior childcare experience, and obstetric history for female participants. The second section aimed to evaluate participants' baseline knowledge regarding infant crying and coping strategies, as well as infant senses and communication, prior to the intervention. This section included 31 items, all requiring participants to indicate their knowledge by selecting "true," "false," or "unknown." The third section, comprising 26 items, followed a similar format for most items but also included two multiple-choice questions (each with three options and an "I don't know" option) and assessed participants' baseline knowledge regarding infant sleep patterns and requirements. The fourth section, administered post-intervention, replicated the third section's items to assess knowledge changes regarding infant sleep

after exposure to the pamphlet. The fifth section investigated participants' perceptions of the pamphlet's readability and comprehensibility. Responses were collected using a three-point Likert scale (good, average, bad). Participants also provided open-ended explanations for their ratings, offering qualitative insights.

3.2.2 *Questionnaire for healthcare professionals*

The questionnaire administered to healthcare professionals was structured into two distinct sections. The initial section collected data on their professional background, including age, profession, and the duration of their experience (in months) supporting parents with ID. The subsequent section aimed to assess healthcare professionals' perceptions of the informational pamphlet's readability and comprehensibility. Participants were asked to rate their perceptions using a five-point Likert scale, with response options ranging from "good" to "bad," including "good," "fairly good," "neutral," "fairly bad," and "bad." In addition, intention to use the educational material was assessed using a five-point scale with anchors ranging from "likely" to "unlikely," including "likely," "somewhat likely," "neutral," "somewhat unlikely," and "unlikely." Furthermore, open-ended questions were incorporated to obtain in-depth explanations for their respective evaluations.

3.3. *Research design, participants, and procedure*

The researchers developed two pamphlets for parents with ID and conducted a simultaneous evaluation: one on infant crying and sleep, and the other on breastfeeding. The present paper focuses on the former. This study employed a mixed-methods approach, combining a quasi-experimental, single-group pre- and post-test design, with a cross-sectional survey.

3.3.1 *Quasi-experimental component (individuals with ID)*

To evaluate the observed impact of an easy-to-read pamphlet on infant crying and sleep, quasi-experimental, single-group pre-test to post-test design was utilized among adults with ID. Participants were recruited from two social welfare facilities, which served as collaborating sites in the researchers' previous study, and met the inclusion criteria of being adults with ID verified by a disability certificate. Agency administrators provided organizational consent, and care staff obtained individual informed consent after explaining the study. Data collection was conducted from November 2023 to January 2024. Participants independently completed a consent checklist and a pre-test questionnaire, reviewed the pamphlet, and then completed the post-test questionnaire. This process was conducted continuously, with a short break of a few minutes interspersed if requested by the participant. Assistance was provided by care staff, including support with reading and comprehension. For participants who explicitly requested further support, staff also acted as scribes to complete the questionnaires based on their verbal responses.

3.3.2 *Cross-sectional survey (healthcare professionals)*

A cross-sectional survey was implemented to assess the perceived utility and usability of the infant crying and sleep pamphlet among healthcare professionals. Participants were enlisted from three metropolitan municipalities and a single obstetrics clinic. Institutional approval was obtained by administrators, who subsequently disseminated an anonymized, self-report questionnaire to eligible healthcare professionals. Respondents returned completed questionnaires via postal mail in sealed individual envelopes, with submission considered indicative of consent, further substantiated by a designated checkbox. Administrators distributed survey materials between October and December 2023, and participants returned completed questionnaires. This questionnaire included a simultaneous evaluation of two pamphlets: the infant crying and sleep pamphlet and breastfeeding pamphlet.

3.4 *Data analysis*

To delineate the demographic characteristics of the participants and to summarize the frequency, means, and standard deviations of the variables under investigation, descriptive statistical methods were utilized. The primary analysis focused on the changes in responses from pre- to post-test assessments. These changes were categorized into nine distinct pre- and post-test response combinations. Improvement patterns were operationalized as shifts from "incorrect" to "correct" and "unknown" to "correct". Furthermore, verbatim transcriptions of open-ended comments, which pertained to the reasoning behind response selections and recommendations for enhancement, were compiled and displayed in a tabular format. Given

the limited sample size of 14 participants with ID, inferential statistical testing was deemed inappropriate.

4. Results

Results showed knowledge improvement among participants with ID, with differences observed by prior childcare experience and level of ID. Participants with prior childcare experience and those with mild ID showed greater improvement patterns. The following sections present detailed analyses of these findings.

4.1 Demographic characteristics of participants

Demographic characteristics of participants are indicated in Table 1.

4.1.1 Demographic characteristics of participating individuals with ID

There were nine female participants (64.3%) and five male participants (35.7%). The ages of the participants ranged from 28 to 62 years (females: 28-62 years, males: 36-59 years), with a mean age of 42.3 years (SD = 10.1). The mean age was 39.5 years (SD = 10.1) for females and 48.0 years (SD = 8.2) for males. The majority of female participants were in their 30s, and the majority of male participants were in their 40s. Regarding the level of ID, 57.1% of the participants had a mild level, and 42.9% had a moderate level. Six participants had a child, and eight participants had childcare experiences.

4.1.2 Demographic characteristics of participating healthcare professionals

The mean age of the participants was 44.6 years (SD = 10.4), ranging from 23 to 58 years. Participants included 23 public health nurses (56.1%), 16 nurse-midwives (39.0%), one registered nurse, and one obstetrician. The mean length of experience in caring for people with ID was 130.5 ± 134.8 months (median: 91.0 months, range: 0-390 months) for all healthcare professionals, 164.4 ± 141.1 months (median: 117.0 months, range: 0-390 months) for public health nurses, and 45.0 ± 54.2 months (median: 27.0 months, range: 0-126 months) for the combined group of nurse-midwives, nurses, and obstetricians.

4.2 Change between pre-test and post-test answers

4.2.1 Answer frequency

Table 2 illustrates the frequencies of the nine possible pre- and post-test answer patterns for each question. In the pre-test, two items (3-2, 3-3) achieved a 100% correct response rate, while in the post-test, five items (1-1, 3-2, 3-3, 3-6, 9-2) reached this level of accuracy. It is worth noting that two of these items (3-2, 3-3) exhibited correct-correct patterns. To assess the observed knowledge change of the pamphlet, therefore, the frequency of "improved" patterns, excluding the "correct-correct" patterns, is of particular interest. The three items that demonstrated 100% improvement patterns were 1-1, 3-6, and 9-2.

4.2.2 Detailed analysis of response patterns

Table 3 presents a comprehensive breakdown of the nine possible response patterns for each question item. The patterns included: Correct-Correct (CC), where participants answered correctly in both tests; improvement patterns such as Unknown-Correct (UC) and Incorrect-Correct (IC); no change patterns like Unknown-Unknown (UU) and Incorrect-Incorrect (II); uncertain patterns including Incorrect-Unknown (IU) and Unknown-Incorrect (UI); and decline patterns consisting of Correct-Unknown (CU) and Correct-Incorrect (CI). Analysis of these patterns revealed that the highest frequency was observed in the Correct-Correct pattern, with a mean of 8.6 (61.7%) responses across all items, indicating that many participants possessed correct knowledge before intervention. In contrast, improvement patterns (IC and UC) showed a mean of 2.4 (41.4%) responses. These findings suggest that the pamphlet was effective in correcting misconceptions and providing new information to participants who previously lacked knowledge on certain topics.

4. 2. 3 Comparison of pre-post answer patterns and childcare experiences (Table 4)

Among participants with prior childcare experience, the pre-test revealed that nine items (1-1, 1-3, 2-1, 3-2, 3-3, 3-4, 9-1, 13-4, 14-3) achieved a 100% correct response rate. In the post-test, this increased to fourteen items, with the addition of six items (3-6, 3-7, 3-8, 4-3, 9-2, 16-1) reaching 100% accuracy. In contrast, among participants without prior childcare experience, the pre-test revealed that three items (3-2, 3-3, 9-1) achieved a 100% correct response rate. In the post-test, five additional items (1-1, 2-1, 3-6, 9-2, 13-5) reached 100%

Table 1 Demographic characteristics of participants

		n (%)
Participants with ID (N=14)		
Gender		
Female		9 (64.3)
Male		5 (35.7)
Age (years), Mean $\pm$ SD (range)		42.3 $\pm$ 10.1 (28-62)
Age of females (years), Mean $\pm$ SD (range)		39.5 $\pm$ 10.1 (28-62)
20s		1 (11.1)
30s		5 (55.6)
40s		2 (22.2)
60s		1 (11.1)
Age of males (years)		48.0 $\pm$ 8.2 (36-59)
30s		1 (20.0)
40s		3 (60.0)
50s		1 (20.0)
Classification of ID certificate [†]		
B1 (Moderate) total	6 (42.9)	
Female	5	
Male	1	
B2 (Mild) total	8 (57.1)	
Female	4	
Male	4	
Number of children		
0 total	8 (57.1)	
Female	5	
Male	3	
1 total	6 (42.9)	
Female	4	
Male	2	
Prior childcare experience		
Yes	8 (57.1)	
Female	4	
Male	4	
No	6 (42.9)	
Female	5	
Male	1	
Experience of pregnancy (females only)		
Yes	3 (33.3)	
No	6 (66.7)	
Healthcare professionals (N=41)		
Profession		
Public health nurse	23 (56.1)	
Nurse-midwife	16 (39.0)	
Nurse	1 (2.4)	
Obstetrician	1 (2.4)	
Age (years), Mean $\pm$ SD (range)		44.6 $\pm$ 10.4 (23-58)
20s	4 (9.8)	
30s	8 (19.5)	
40s	11 (26.8)	
50s	18 (43.9)	
Experience with ID (months), Mean $\pm$ SD (range)		
Overall	130.5 $\pm$ 134.8 (0-390)	
Public health nurse	164.4 $\pm$ 141.1 (0-390)	
Nurse-midwife, Nurse, Obstetrician	45.0 $\pm$ 54.2 (0-126)	

ID: intellectual disabilities; SD: standard deviation

The percentage was calculated based on the total number of participants in each group.

[†] Classification according to the Japanese 'Ryōiku Techo' certification system

Table 2 Knowledge assessment: Pre-test and post-test correct response rates

Question category and items	n (%) (N=14)		
	Improvement patterns		
	Pre-test correct	Post-test correct	Improvement rate [†]
1 What are the reasons why babies cry?			
1-1 Their diaper is dirty. (True/False type)	12 (85.7)	14 (100.0)	100.0
1-2 They are hot. (True/False type)	9 (64.3)	11 (78.6)	60.0
1-3 They are hungry. (True/False type)	13 (92.9)	13 (92.9)	50.0
1-4 The baby can't burp and their stomach feels uncomfortable. (True/False type)	10 (71.4)	9 (64.3)	16.7
1-5 They are tired. (True/False type)	4 (28.6)	11 (78.6)	70.0
1-6 They are in pain. (True/False type)	10 (71.4)	10 (71.4)	16.7
1-7 They are itchy. (True/False type)	4 (28.6)	10 (71.4)	60.0
1-8 They are sleepy. (True/False type)	12 (85.7)	12 (85.7)	50.0
1-9 They feel lonely. (True/False type)	11 (78.6)	12 (85.7)	60.0
2 What are the reasons why babies around 6 months old cry?			
2-1 They have separation anxiety. (True/False type)	12 (85.7)	13 (92.9)	66.7
2-2 They have stranger anxiety. (True/False type)	9 (42.9)	10 (71.4)	20.0
3 What should you do when a baby cries?			
3-1 Wait. (True/False type)	4 (28.6)	9 (64.3)	54.5
3-2 Hold them. (True/False type)	14 (100.0)	14 (100.0)	0.0
3-3 Speak to them in a gentle voice. (True/False type)	14 (100.0)	14 (100.0)	0.0
3-4 Change their diaper if it's dirty. (True/False type)	13 (92.9)	13 (92.9)	50.0
3-5 Burp them. (True/False type)	11 (78.6)	13 (92.9)	50.0
3-6 Breastfeed them. (True/False type)	12 (85.7)	14 (100.0)	100.0
3-7 Check if they are hot. (True/False type)	9 (64.3)	13 (92.9)	80.0
3-8 Check if they are cold. (True/False type)	8 (57.1)	12 (85.7)	66.7
4 How can you stop a baby from crying? (True/False type)			
4-1 Swaddle them so their back is rounded. (True/False type)	9 (64.3)	12 (85.7)	66.7
4-2 Cradle them, allowing their back to curve. (True/False type)	10 (71.4)	12 (85.7)	60.0
4-3 Gently pat their bottom. (True/False type)	8 (57.1)	13 (92.9)	83.3
4-4 Play white noise sounds, like a hair dryer, on a smartphone. (True/False type)	3 (21.4)	7 (50.0)	36.4
4-5 Walk with them in your arms. (True/False type)	12 (85.7)	11 (78.6)	0.0
5 Are newborn babies able to hear? (True/False type)	6 (42.9)	11 (78.6)	62.5
6 Are newborn babies able to see? (True/False type)	5 (35.7)	8 (57.1)	40
7 Are newborn babies able to smell? (True/False type)	7 (50.0)	10 (71.4)	50.0
8 Are newborn babies able to taste? (True/False type)	2 (14.3)	9 (64.3)	58.3
9 What are good ways to communicate with a baby?			
9-1 Speak to them face to face. (True/False type)	13 (92.9)	13 (92.9)	0.0
9-2 Talk to them as if you understand their feelings. (True/False type)	11 (78.6)	14 (100.0)	100.0
9-3 Verbalize what they might be feeling. (True/False type)	8 (57.1)	10 (71.4)	42.9
10 Is it easy for babies to wake up when they first fall asleep? (Multiple-choice type)	9 (64.3)	12 (85.7)	60.0
11 What should you do after a baby falls asleep in your arms? (Multiple-choice type)	11 (78.6)	11 (78.6)	25.0
12 Babies around one month old often sleep during the day and are awake at night. (True/False type)	7 (50.0)	9 (64.3)	37.5
13 What are some good ways to establish a daily routine for a baby?			
13-1 Wake them up early and brighten the room. (True/False type)	8 (57.1)	10 (71.4)	42.9
13-2 Take them for walks and play with them in the daytime. (True/False type)	12 (85.7)	12 (85.7)	0.0
13-3 Put them down for a nap. (True/False type)	12 (85.7)	12 (85.7)	0.0
13-4 Give them a bath at around the same time every day. (True/False type)	11 (78.6)	13 (92.9)	66.7
13-5 Put them to bed by 8 p.m. (True/False type)	10 (71.4)	13 (92.9)	75.0
14 How do you know when a baby around 2 months old is sleepy?			
14-1 They rub their eyes. (True/False type)	9 (64.3)	11 (78.6)	50.0
14-2 They stare into the distance. (True/False type)	7 (50.0)	8 (57.1)	25.0
14-3 They yawn. (True/False type)	12 (85.7)	13 (92.9)	50.0
14-4 They get grumpy. (True/False type)	11 (78.6)	10 (71.4)	20.0
14-5 They rub their face against your chest. (True/False type)	7 (50.0)	10 (71.4)	42.9

15 What are some good ways to get a baby to sleep? (True/False type)			
15-1 Speak to them in a gentle voice. (True/False type)	10 (71.4)	11 (78.6)	25.0
15-2 Gently pat their belly in a rhythmic motion while they lie on their back. (True/False type)	9 (64.3)	9 (64.3)	0.0
15-3 Hold their hands in your warm hands. (True/False type)	5 (35.7)	7 (50.0)	30.0
15-4 Gently pat their bottom in a rhythmic motion while holding them. (True/False type)	11 (78.6)	10 (71.4)	20.0
15-5 Hold a baby and gently rock them. (True/False type)	11 (78.6)	11 (78.6)	0.0
15-6 Walk slowly while holding a baby or carrying them. (True/False type)	9 (64.3)	9 (64.3)	28.6
15-7 Sing to the baby to help them sleep. (True/False type)	12 (85.7)	11 (78.6)	0.0
15-8 Read a picture book to the baby. (True/False type)	9 (64.3)	9 (64.3)	0.0
16 What can you do to create a sleep-friendly environment? (True/False type)			
16-1 Darken the room. (True/False type)	9 (64.3)	13 (92.9)	80.0
16-2 Make the room quiet. (True/False type)	11 (78.6)	11 (78.6)	0.0
16-3 Put mittens on a baby's hands. (True/False type)	6 (42.9)	10 (71.4)	50.0
16-4 Put socks on the baby's feet. (True/False type)	9 (64.3)	11 (78.6)	50.0
16-5 Use a firm mattress. (True/False type)	4 (28.6)	7 (50.0)	30.0

† Improvement rate calculated as percentage of incorrect/unknown pre-test responses that changed to correct post-test responses

Table 3 Response pattern details by question item

n (%) (N=14)									
Question category and items	Patterns								
	Improvement 2.4 (42.4)		No change		Uncertain		Decline		Correct-maintaining 8.6 (61.7)
	UC	IC	UU	II	IU	UI	CU	CI	CC
1 What are the reasons why babies cry?									
1-1 Their diaper is dirty. (True/False type)	2	0	2 (100.0)	0	0	0	0	0	12 (85.7)
1-2 They are hot. (True/False type)	2	1	3 (50.0)	2	0	0	0	1	8 (57.1)
1-3 They are hungry. (True/False type)	1	0	1 (50.0)	0	0	0	1	0	12 (85.7)
1-4 The baby can't burp and their stomach feels uncomfortable. (True/False type)	0	1	1 (16.7)	3	0	0	1	1	8 (57.1)
1-5 They are tired. (True/False type)	4	3	7 (70.0)	0	2	0	1	0	4 (28.6)
1-6 They are in pain. (True/False type)	1	1	2 (33.3)	0	1	0	2	2	8 (57.1)
1-7 They are itchy. (True/False type)	3	3	6 (60.0)	0	1	2	1	0	4 (28.6)
1-8 They are sleepy. (True/False type)	1	1	2 (50.0)	0	0	0	0	1	10 (71.4)
1-9 They feel lonely. (True/False type)	2	1	3 (60.0)	0	0	0	0	1	9 (64.3)
2 What are the reasons why babies around 6 months old cry?									
2-1 They have separation anxiety. (True/False type)	2	0	2 (66.7)	0	0	0	0	1	11 (78.6)
2-2 They have stranger anxiety. (True/False type)	1	0	1 (20.0)	2	0	0	0	0	9 (64.3)
3 What should you do when a baby cries?									
3-1 Wait. (True/False type)	3	3	6 (54.5)	0	4	0	0	0	3 (21.4)
3-2 Hold them. (True/False type)	0	0	0 (0.0)	0	0	0	0	0	14 (100.0)
3-3 Speak to them in a gentle voice. (True/False type)	0	0	0 (0.0)	0	0	0	0	0	14 (100.0)
3-4 Change their diaper if it's dirty. (True/False type)	0	1	1 (50.0)	0	0	0	1	0	12 (85.7)
3-5 Burp them. (True/False type)	1	1	2 (50.0)	0	0	0	0	1	10 (71.4)
3-6 Breastfeed them. (True/False type)	1	1	2 (100.0)	0	0	0	0	0	12 (85.7)
3-7 Check if they are hot. (True/False type)	3	1	4 (80.0)	1	0	0	0	0	9 (64.3)
3-8 Check if they are cold. (True/False type)	3	1	4 (66.7)	1	0	1	0	0	8 (57.1)
4 How can you stop a baby from crying? (True/False type)									
4-1 Swaddle them so their back is rounded. (True/False type)	3	1	4 (80.0)	0	0	1	0	0	8 (57.1)
4-2 Cradle them, allowing their back to curve. (True/False type)	2	1	3 (60.0)	1	0	0	0	1	9 (64.3)
4-3 Gently pat their bottom. (True/False type)	2	3	5 (83.3)	1	0	0	0	0	8 (57.1)
4-4 Play white noise sounds, like a hair dryer, on a smartphone. (True/False type)	1	3	4 (36.4)	2	2	1	2	0	3 (21.4)
4-5 Walk with them in your arms. (True/False type)	0	0	0 (0.0)	0	2	0	1	0	11 (78.6)
5 Are newborn babies able to hear? (True/False type)	0	5	5 (62.5)	0	2	0	1	0	6 (42.9)
6 Are newborn babies able to see? (True/False type)	0	4	4 (40.0)	0	3	0	2	0	4 (28.6)
7 Are newborn babies able to smell? (True/False type)	0	4	4 (50.0)	0	3	0	0	1	6 (42.9)
8 Are newborn babies able to taste? (True/False type)	0	7	7 (58.3)	4	4	1	0	0	2 (14.3)
9 What are good ways to communicate with a baby?									

9-1 Speak to them face to face. (True/False type)	0	0	0 (0.0)	0	0	0	0	0	0	13 (92.9)
9-2 Talk to them as if you understand their feelings. (True/False type)	2	1	3 (100.0)	0	0	0	0	0	0	11 (78.6)
9-3 Verbalize what they might be feeling. (True/False type)	3	0	7 (42.9)	2	1	0	0	1	0	7 (50.0)
10 Is it easy for babies to wake up when they first fall asleep? (Multiple-choice type)	1	2	3 (60.0)	0	0	0	0	0	0	9 (64.3)
11 What should you do after a baby falls asleep in your arms? (Multiple-choice type)	1	0	1 (25.0)	0	2	0	0	1	0	10 (71.4)
12 Babies around one month old often sleep during the day and are awake at night. (True/False type)	1	2	3 (37.5)	1	0	1	2	0	1	6 (42.9)
13 What are some good ways to establish a daily routine for a baby?										
13-1 Wake them up early and brighten the room. (True/False type)	0	3	3 (42.9)	2	1	0	0	1	0	7 (50.0)
13-2 Take them for walks and play with them in the daytime. (True/False type)	0	0	0 (0.0)	0	1	0	1	0	0	12 (85.7)
13-3 Put them down for a nap. (True/False type)	0	0	0 (0.0)	0	0	0	2	0	0	12 (85.7)
13-4 Give them a bath at around the same time every day. (True/False type)	1	1	2 (66.7)	1	0	0	0	0	0	11 (78.6)
13-5 Put them to bed by 8 p.m. (True/False type)	3	0	3 (75.0)	0	1	0	0	0	0	10 (71.4)
14 How do you know when a baby around 2 months old is sleepy?						0				
14-1 They rub their eyes. (True/False type)	2	1	3 (50.0)	1	0	0	1	1	0	8 (57.1)
14-2 They stare into the distance. (True/False type)	2	0	2 (25.0)	2	1	0	2	1	0	6 (42.9)
14-3 They yawn. (True/False type)	1	0	1 (50.0)	1	0	0	0	0	0	12 (85.7)
14-4 They get grumpy. (True/False type)	1	0	1 (20.0)	0	1	0	0	2	0	9 (64.3)
14-5 They rub their face against your chest. (True/False type)	2	1	3 (42.9)	3	1	0	0	0	0	7 (50.0)
15 What are some good ways to get a baby to sleep? (True/False type)										
15-1 Speak to them in a gentle voice. (True/False type)	1	0	1 (25.0)	1	1	0	1	0	0	10 (71.4)
15-2 Gently pat their belly in a rhythmic motion while they lie on their back. (True/False type)	0	0	0 (0.0)	2	1	1	1	0	0	9 (64.3)
15-3 Hold their hands in your warm hands. (True/False type)	2	1	3 (30.0)	2	3	0	1	1	0	4 (28.6)
15-4 Gently pat their bottom in a rhythmic motion while holding them. (True/False type)	1	0	1 (20.0)	1	0	0	1	1	1	9 (64.3)
15-5 Hold a baby and gently rock them. (True/False type)	0	0	0 (0.0)	1	0	0	2	0	0	11 (78.6)
15-6 Walk slowly while holding a baby or carrying them. (True/False type)	2	0	2 (28.6)	1	1	0	1	1	1	7 (50.0)
15-7 Sing to the baby to help them sleep. (True/False type)	0	0	0 (0.0)	2	0	0	0	1	0	11 (78.6)
15-8 Read a picture book to the baby. (True/False type)	0	0	0 (0.0)	2	1	0	1	0	0	9 (64.3)
16 What can you do to create a sleep-friendly environment? (True/False type)										
16-1 Darken the room. (True/False type)	2	2	2 (40.0)	1	0	0	0	0	0	9 (64.3)
16-2 Make the room quiet. (True/False type)	0	0	0 (0.0)	1	1	0	1	0	0	11 (78.6)
16-3 Put mittens on a baby's hands. (True/False type)	3	1	4 (50.0)	3	1	0	0	0	0	6 (42.9)
16-4 Put socks on the baby's feet. (True/False type)	1	2	3 (50.0)	2	0	0	0	0	1	8 (57.1)
16-5 Use a firm mattress. (True/False type)	2	1	3 (30.0)	2	4	0	1	0	0	4 (28.6)

† Response pattern codes: CC: Correct-Correct (pre-test correct, post-test correct); UC: Unknown-Correct (pre-test unknown, post-test correct); IC: Incorrect-Correct (pre-test incorrect, post-test correct); UU: Unknown-Unknown (pre-test unknown, post-test unknown); II: Incorrect-Incorrect (pre-test incorrect, post-test incorrect); IU: Incorrect-Unknown (pre-test incorrect, post-test unknown); UI: Unknown-Incorrect (pre-test unknown, post-test incorrect); CU: Correct-Unknown (pre-test correct, post-test unknown); CI: Correct-Incorrect (pre-test correct, post-test incorrect)

Table 4 Comparison of correct response rates by prior childcare experience

Question category and items	n (%) (N=14)			
	Without experience (n=6)		With experience (n=8)	
	Pre-test	Post-test	Pre-test	Post-test
1 What are the reasons why babies cry?				
1-1 Their diaper is dirty. (True/False type)	4 (66.7)	6 (100.0)*	8 (100.0)	8 (100.0)
1-2 They are hot. (True/False type)	2 (33.3)	4 (66.7)	7 (87.5)	7 (87.5)
1-3 They are hungry. (True/False type)	5 (83.3)	5 (83.3)	8 (100.0)	8 (100.0)
1-4 The baby can't burp and their stomach feels uncomfortable. (True/False type)	3 (50.0)	2 (33.3)	6 (75.0)	7 (87.5)
1-5 They are tired. (True/False type)	2 (33.3)	5 (83.3)	2 (25.0)	6 (75.0)
1-6 They are in pain. (True/False type)	2 (33.3)	3 (50.0)	6 (75.0)	6 (75.0)
1-7 They are itchy. (True/False type)	2 (33.3)	4 (66.7)	2 (25.0)	6 (75.0)
1-8 They are sleepy. (True/False type)	5 (83.3)	5 (83.3)	7 (87.5)	7 (87.5)
1-9 They feel lonely. (True/False type)	4 (66.7)	5 (83.3)	7 (87.5)	7 (87.5)
2 What are the reasons why babies around 6 months old cry?				
2-1 They have separation anxiety. (True/False type)	4 (66.7)	6 (100.0)*	8 (100.0)	7 (87.5)

2-2 They have stranger anxiety. (True/False type)	3 (50.0)	4 (66.7)	6 (75.0)	6 (75.0)
3 What should you do when a baby cries?				
3-1 Wait. (True/False type)	1 (16.7)	3 (50.0)	3 (37.5)	6 (75.0)
3-2 Hold them. (True/False type)	6 (100.0)	6 (100.0)	8 (100.0)	8 (100.0)
3-3 Speak to them in a gentle voice. (True/False type)	6 (100.0)	6 (100.0)	8 (100.0)	8 (100.0)
3-4 Change their diaper if it's dirty. (True/False type)	4 (66.7)	5 (83.3)	8 (100.0)	8 (100.0)
3-5 Burp them. (True/False type)	5 (83.3)	5 (83.3)	6 (75.0)	7 (87.5)
3-6 Breastfeed them. (True/False type)	5 (83.3)	6 (100.0)*	7 (87.5)	8 (100.0)*
3-7 Check if they are hot. (True/False type)	3 (50.0)	5 (83.3)	6 (75.0)	8 (100.0)*
3-8 Check if they are cold. (True/False type)	3 (50.0)	4 (66.7)	5 (62.5)	8 (100.0)*
4 How can you stop a baby from crying? (True/False type)				
4-1 Swaddle them so their back is rounded. (True/False type)	3 (50.0)	5 (83.3)	6 (75.0)	7 (87.5)
4-2 Cradle them, allowing their back to curve. (True/False type)	3 (50.0)	5 (83.3)	7 (87.5)	7 (87.5)
4-3 Gently pat their bottom. (True/False type)	3 (50.0)	5 (83.3)	5 (62.5)	8 (100.0)*
4-4 Play white noise sounds, like a hair dryer, on a smartphone. (True/False type)	1 (16.7)	1 (16.7)	2	6 (75.0)
4-5 Walk with them in your arms. (True/False type)	4 (66.7)	4 (66.7)	7 (87.5)	7 (87.5)
5 Are newborn babies able to hear? (True/False type)	2 (33.3)	4 (66.7)	4 (50.0)	7 (87.5)
6 Are newborn babies able to see? (True/False type)	0 (0.0)	3 (50.0)	5 (62.5)	5 (62.5)
7 Are newborn babies able to smell? (True/False type)	3 (50.0)	3 (50.0)	4 (50.0)	7 (87.5)
8 Are newborn babies able to taste? (True/False type)	0 (0.0)	5 (83.3)	2	7 (87.5)
9 What are good ways to communicate with a baby?				
9-1 Speak to them face to face. (True/False type)	6 (100.0)	5 (83.3)	8 (100.0)	8 (100.0)
9-2 Talk to them as if you understand their feelings. (True/False type)	4 (66.7)	6 (100.0)*	7 (87.5)	8 (100.0)*
9-3 Verbalize what they might be feeling. (True/False type)	2 (33.3)	3 (50.0)	6 (75.0)	7 (87.5)
10 Is it easy for babies to wake up when they first fall asleep? (Multiple-choice type)	3 (50.0)	5 (83.3)	6 (75.0)	7 (87.5)
11 What should you do after a baby falls asleep in your arms? (Multiple-choice type)	3 (50.0)	4 (66.7)	7 (87.5)	7 (87.5)
12 Babies around one month old often sleep during the day and are awake at night. (True/False type)	2 (33.3)	2 (33.3)	5 (62.5)	7 (87.5)
13 What are some good ways to establish a daily routine for a baby?				
13-1 Wake them up early and brighten the room. (True/False type)	2 (33.3)	3 (50.0)	6 (75.0)	7 (87.5)
13-2 Take them for walks and play with them in the daytime. (True/False type)	5 (83.3)	5 (83.3)	7 (87.5)	7 (87.5)
13-3 Put them down for a nap. (True/False type)	5 (83.3)	5 (83.3)	7 (87.5)	7 (87.5)
13-4 Give them a bath at around the same time every day. (True/False type)	3 (50.0)	5 (83.3)	8 (100.0)	8 (100.0)
13-5 Put them to bed by 8 p.m. (True/False type)	5 (83.3)	6 (100.0)*	5 (62.5)	7 (87.5)
14 How do you know when a baby around 2 months old is sleepy?				
14-1 They rub their eyes. (True/False type)	3 (50.0)	4 (66.7)	6 (75.0)	7 (87.5)
14-2 They stare into the distance. (True/False type)	2 (33.3)	3 (50.0)	5 (62.5)	5 (62.5)
14-3 They yawn. (True/False type)	4 (66.7)	5 (83.3)	8 (100.0)	8 (100.0)
14-4 They get grumpy. (True/False type)	4 (66.7)	5 (83.3)	5 (62.5)	5 (62.5)
14-5 They rub their face against your chest. (True/False type)	1 (16.7)	2 (33.3)	6 (75.0)	7 (87.5)
15 What are some good ways to get a baby to sleep? (True/False type)				
15-1 Speak to them in a gentle voice. (True/False type)	3 (50.0)	4 (66.7)	7 (87.5)	7 (87.5)
15-2 Gently pat their belly in a rhythmic motion while they lie on their back. (True/False type)	3 (50.0)	3 (50.0)	6 (75.0)	6 (75.0)
15-3 Hold their hands in your warm hands. (True/False type)	1 (16.7)	3 (50.0)	4 (50.0)	4 (50.0)
15-4 Gently pat their bottom in a rhythmic motion while holding them. (True/False type)	3 (50.0)	3 (50.0)	7 (87.5)	7 (87.5)
15-5 Hold a baby and gently rock them. (True/False type)	4 (66.7)	4 (66.7)	7 (87.5)	7 (87.5)
15-6 Walk slowly while holding a baby or carrying them. (True/False type)	2 (33.3)	3 (50.0)	7 (87.5)	6 (75.0)
15-7 Sing to the baby to help them sleep. (True/False type)	4 (66.7)	4 (66.7)	7 (87.5)	7 (87.5)
15-8 Read a picture book to the baby. (True/False type)	4 (66.7)	4 (66.7)	6 (75.0)	5 (62.5)
16 What can you do to create a sleep-friendly environment? (True/False type)				
16-1 Darken the room. (True/False type)	4 (66.7)	5 (83.3)	5 (62.5)	8 (100.0)*
16-2 Make the room quiet. (True/False type)	4 (66.7)	4 (66.7)	7 (87.5)	7 (87.5)
16-3 Put mittens on a baby's hands. (True/False type)	1 (16.7)	3 (50.0)	5 (62.5)	7 (87.5)
16-4 Put socks on the baby's feet. (True/False type)	2 (33.3)	4 (66.7)	7 (87.5)	7 (87.5)
16-5 Use a firm mattress. (True/False type)	1 (16.7)	2 (33.3)	3 (37.5)	6 (75.0)

* Items where all participants who answered incorrectly or "don't know" in pre-test answered correctly in post-test (100% improvement rate)

accuracy, resulting in a total of eight items. These findings show that participants with prior childcare experience demonstrated a higher initial knowledge base, as evidenced by the greater number of items with 100% accuracy in the pre-test, and exhibited a more substantial knowledge gain, as reflected in the larger increase in items with 100% accuracy in the post-test.

4.2.4 Comparison of pre-post answer patterns and classification of ID (Table 5)

In the group with mild ID, the pre-test revealed that nine items (1-1, 1-3, 2-1, 3-2, 3-3, 3-4, 9-1, 13-4, 14-3) achieved a 100% correct response rate. Among these, eight items maintained a 100% correct response rate in the post-test, while one item (2-1) had a single incorrect response, resulting in a slightly lower percentage. In the post-test, eight additional items (3-6, 3-7, 3-8, 4-3, 9-2, 16-1, 16-3, 16-4) reached 100% accuracy, bringing the total to sixteen items. Conversely, in the group with moderate ID, the pre-test showed that three items (3-2, 3-3, 9-1) achieved a 100% correct response rate, both of which exhibited correct-correct patterns. These two items, along with eight additional items (1-1, 2-1, 3-6, 9-2, 13-5, 14-3, 14-4), reached 100% accuracy in the post-test, totaling nine items. Thus, participants with mild ID demonstrated both a higher baseline knowledge level and greater improvement.

Table 5 Comparison of correct response rates by ID certificate type

Question category and items	n (%) (N=14)			
	B1 (Moderate) (n=6)		B2 (Mild) (n=8)	
	Pre-test	Post-test	Pre-test	Post-test
1 What are the reasons why babies cry?				
1-1 Their diaper is dirty. (True/False type)	4 (66.7)	6 (100.0)*	8 (100.0)	8 (100.0)
1-2 They are hot. (True/False type)	2 (33.3)	4 (66.7)	7 (87.5)	7 (87.5)
1-3 They are hungry. (True/False type)	4 (66.7)	5 (83.3)	8 (100.0)	8 (100.0)
1-4 The baby can't burp and their stomach feels uncomfortable. (True/False type)	2 (33.3)	2 (33.3)	7 (87.5)	7 (87.5)
1-5 They are tired. (True/False type)	2 (33.3)	5 (83.3)	2 (25.0)	6 (75.0)
1-6 They are in pain. (True/False type)	2 (33.3)	3 (50.0)	6 (75.0)	6 (75.0)
1-7 They are itchy. (True/False type)	1 (16.7)	4 (66.7)	3 (37.5)	6 (75.0)
1-8 They are sleepy. (True/False type)	5 (83.3)	5 (83.3)	7 (87.5)	7 (87.5)
1-9 They feel lonely. (True/False type)	4 (66.7)	5 (83.3)	7 (87.5)	7 (87.5)
2 What are the reasons why babies around 6 months old cry?				
2-1 They have separation anxiety. (True/False type)	4 (66.7)	6 (100.0)*	8 (100.0)	7 (87.5)
2-2 They have stranger anxiety. (True/False type)	3 (50.0)	4 (66.7)	6 (75.0)	6 (75.0)
3 What should you do when a baby cries?				
3-1 Wait. (True/False type)	2 (33.3)	4 (66.7)	2 (25.0)	5 (62.5)
3-2 Hold them. (True/False type)	6 (100.0)	6 (100.0)	8 (100.0)	8 (100.0)
3-3 Speak to them in a gentle voice. (True/False type)	6 (100.0)	6 (100.0)	8 (100.0)	8 (100.0)
3-4 Change their diaper if it's dirty. (True/False type)	5 (83.3)	5 (83.3)	8 (100.0)	8 (100.0)
3-5 Burp them. (True/False type)	4 (66.7)	5 (83.3)	7 (87.5)	7 (87.5)
3-6 Breastfeed them. (True/False type)	5 (83.3)	6 (100.0)*	7 (87.5)	8 (100.0)*
3-7 Check if they are hot. (True/False type)	2 (33.3)	5 (83.3)	7 (87.5)	8 (100.0)*
3-8 Check if they are cold. (True/False type)	2 (33.3)	4 (66.7)	6 (75.0)	8 (100.0)*
4 How can you stop a baby from crying? (True/False type)				
4-1 Swaddle them so their back is rounded. (True/False type)	3 (50.0)	5 (83.3)	6 (75.0)	7 (87.5)
4-2 Cradle them, allowing their back to curve. (True/False type)	3 (50.0)	5 (83.3)	7 (87.5)	7 (87.5)
4-3 Gently pat their bottom. (True/False type)	2 (33.3)	5 (83.3)	6 (75.0)	8 (100.0)*
4-4 Play white noise sounds, like a hair dryer, on a smartphone. (True/False type)	0	0 (0.0)	3 (37.5)	7 (87.5)
4-5 Walk with them in your arms. (True/False type)	4 (66.7)	4 (66.7)	7 (87.5)	7 (87.5)
5 Are newborn babies able to hear? (True/False type)	2 (33.3)	4 (66.7)	4 (50.0)	7 (87.5)
6 Are newborn babies able to see? (True/False type)	1 (16.7)	2 (33.3)	4 (50.0)	6 (75.0)
7 Are newborn babies able to smell? (True/False type)	4 (66.7)	3 (50.0)	4 (50.0)	7 (87.5)

8 Are newborn babies able to taste? (True/False type)	1 (16.7)	2 (33.3)	1 (12.5)	7 (87.5)
9 What are good ways to communicate with a baby?				
9-1 Speak to them face to face. (True/False type)	6 (100.0)	5 (83.3)	8 (100.0)	8 (100.0)
9-2 Talk to them as if you understand their feelings. (True/False type)	4 (66.7)	6 (100.0)*	7 (87.5)	8 (100.0)*
9-3 Verbalize what they might be feeling. (True/False type)	4 (66.7)	3 (50.0)	6 (75.0)	7 (87.5)
10 Is it easy for babies to wake up when they first fall asleep? (Multiple-choice type)	3 (50.0)	5 (83.3)	6 (75.0)	7 (87.5)
11 What should you do after a baby falls asleep in your arms? (Multiple-choice type)	3 (50.0)	4 (66.7)	7 (87.5)	7 (87.5)
12 Babies around one month old often sleep during the day and are awake at night. (True/False type)	3 (50.0)	3 (50.0)	4 (50.0)	6 (75.0)
13 What are some good ways to establish a daily routine for a baby?				
13-1 Wake them up early and brighten the room. (True/False type)	2 (33.3)	3 (50.0)	6 (75.0)	7 (87.5)
13-2 Take them for walks and play with them in the daytime. (True/False type)	5 (83.3)	5 (83.3)	7 (87.5)	7 (87.5)
13-3 Put them down for a nap. (True/False type)	5 (83.3)	5 (83.3)	7 (87.5)	7 (87.5)
13-4 Give them a bath at around the same time every day. (True/False type)	3 (50.0)	5 (83.3)	8 (100.0)	8 (100.0)
13-5 Put them to bed by 8 p.m. (True/False type)	5 (83.3)	6 (100.0)*	5 (62.5)	7 (87.5)
14 How do you know when a baby around 2 months old is sleepy?				
14-1 They rub their eyes. (True/False type)	4 (66.7)	5 (83.3)	5 (62.5)	6 (75.0)
14-2 They stare into the distance. (True/False type)	3 (50.0)	4 (66.7)	4 (50.0)	4 (50.0)
14-3 They yawn. (True/False type)	5 (83.3)	6 (100.0)*	8 (100.0)	8 (100.0)
14-4 They get grumpy. (True/False type)	5 (83.3)	6 (100.0)*	4 (50.0)	4 (50.0)
14-5 They rub their face against your chest. (True/False type)	2 (33.3)	4 (66.7)	5 (62.5)	6 (75.0)
15 What are some good ways to get a baby to sleep? (True/False type)				
15-1 Speak to them in a gentle voice. (True/False type)	4 (66.7)	5 (83.3)	6 (75.0)	6 (75.0)
15-2 Gently pat their belly in a rhythmic motion while they lie on their back. (True/False type)	4 (66.7)	4 (66.7)	5 (62.5)	5 (62.5)
15-3 Hold their hands in your warm hands. (True/False type)	0 (0.0)	3 (50.0)	4 (50.0)	4 (50.0)
15-4 Gently pat their bottom in a rhythmic motion while holding them. (True/False type)	3 (50.0)	4 (66.7)	6 (75.0)	6 (75.0)
15-5 Hold a baby and gently rock them. (True/False type)	5 (83.3)	5 (83.3)	6 (75.0)	6 (75.0)
15-6 Walk slowly while holding a baby or carrying them. (True/False type)	2 (33.3)	4 (66.7)	6 (75.0)	5 (62.5)
15-7 Sing to the baby to help them sleep. (True/False type)	5 (83.3)	5 (83.3)	7 (87.5)	6 (75.0)
15-8 Read a picture book to the baby. (True/False type)	5 (83.3)	5 (83.3)	5 (62.5)	4 (50.0)
16 What can you do to create a sleep-friendly environment? (True/False type)				
16-1 Darken the room. (True/False type)	4 (66.7)	5 (83.3)	5 (62.5)	8 (100.0)*
16-2 Make the room quiet. (True/False type)	4 (66.7)	5 (83.3)	7 (87.5)	7 (87.5)
16-3 Put mittens on a baby's hands. (True/False type)	1 (16.7)	3 (50.0)	6 (75.0)	8 (100.0)*
16-4 Put socks on the baby's feet. (True/False type)	2 (33.3)	4 (66.7)	7 (87.5)	8 (100.0)*
16-5 Use a firm mattress. (True/False type)	1 (16.7)	2 (33.3)	3 (37.5)	5 (62.5)

ID: intellectual disabilities

* Items where all participants who answered incorrectly or "don't know" in pre-test answered correctly in post-test (100% improvement rate)

4.2.5 Evaluation of readability and reasons by participants with ID

Table 6 presents the readability evaluations and reasons provided by participants with ID. The proportion of "good" ratings was 42.9% for illustrations, 57.1% for manga, and 42.9% for texts. However, evaluations showed considerable variation: illustrations received equal proportions of "average" and "bad" ratings (28.6% each), while text showed 35.7% "average" and 21.4% "bad" ratings. Manga demonstrated the most positive reception with 57.1% "good" ratings, though 21.4% rated it as "average" and 21.4% as "bad". Participants who rated the text as "bad" cited the need for a larger font size and shorter sentences. The illustrations were negatively evaluated due to their yellow-toned base color and cluttered, difficult-to-view composition. Conversely, positive evaluations cited the presence of explanations accompanying large, high-quality illustrations, as well as their overall clarity. The text was criticized for its small font size, while positive remarks highlighted the use of larger fonts and carefully written explanations. The manga received negative feedback for its small speech bubble text, but was praised for its contextually appropriate depictions, high quality, and ease of understanding. Overall, the evaluations were mixed, with comments

Table 6 Readability evaluation by participants with ID

(n=14)			
Evaluation	Good n (%)	Average n (%)	Bad n (%)
Illustrations	6 (42.9)	4 (28.6)	4 (28.6)
Text	6 (42.9)	5 (35.7)	3 (21.4)
Manga	8 (57.1)	3 (21.4)	3 (21.4)
Representative comments by evaluation aspect and rating:			
Illustrations			
Good:	• "They were very good illustrations." • "It was easy to understand."		
Average:	• "It's hard to see because there's too much yellow." • "The illustrations were easy to understand."		
Bad:	• "It was hard to read because there was too much yellow."		
Text			
Good:	• "It's too crowded and hard to see." • "Because it was written in large letters. The words are simple and I can read them." • "Because they explain it carefully."		
Average:	• "Because the text wasn't too big or too small." • "Text size was neither too big nor too small."		
Bad:	• "Font size is too small." • "The text was hard to read."		
Manga			
Good:	• "Because it depicted the situation at that time." • "It was a very good manga." • "It was easy to understand."		
Average:	• "There were some manga that were easy to understand, and some that weren't."		
Bad:	• "The text in the speech bubbles is too small."		
Overall feedback from participants:			
• "The text was hard to read, but the illustrations and manga were good." • "It would have been better if it was all manga." • "It was easy to understand and I learned a lot." • "It was helpful for parenting."			

ID: intellectual disabilities

noting the presence of both simple and more complex manga.

4.2.6 Evaluation of comprehensibility, readability, and intention to use by participating healthcare professionals

Regarding the evaluation of comprehensibility, 95.1% of respondents provided positive ratings (combining "good" and "fairly good" responses), with 4.9% giving neutral evaluations and no negative ratings. Readability was similarly well-received, with 92.7% of respondents giving positive assessments, 4.9% neutral, and none negative (with 2.4% not providing an answer). For content structure, 82.9% of healthcare professionals provided positive ratings, 12.2% were neutral, and 2.4% gave negative evaluations. With respect to intention to use, 87.8% of respondents expressed positive intentions (combining "likely" and "somewhat likely"), 7.3% were neutral, and none indicated negative intentions. Positive feedback highlighted the clear depiction of

Table 7 Healthcare professionals' evaluation of the infant crying and sleep pamphlet

(N=41)

Evaluation	Positive [†] n (%)	Neutral ^{††} n (%)	Negative ^{††} n (%)	No answer n (%)
Comprehensibility	39 (95.1)	2 (4.9)	0 (0.0)	0 (0.0)
Readability	38 (92.7)	2 (4.9)	0 (0.0)	1 (2.4)
Content structure	34 (82.9)	5 (12.2)	1 (2.4)	0 (0.0)
Intention to use	36 (87.8)	3 (7.3)	0 (0.0)	0 (0.0)
Representative comments by evaluation aspect:				
Comprehensibility:				
Positive:	"I appreciate the abundance of concrete details. The inclusion of both positive and negative examples makes it very clear." "I noticed a lot of small print, and the content felt very comprehensive."			
Neutral:	"I'm not sure how well someone with intellectual disability would comprehend it. However, I believe this is an excellent, clear pamphlet for young individuals, those new to parenting, or anyone feeling anxious without support." "A more straightforward explanation would seem easier to convey"			
Readability:				
Positive:	"It's great that there are so many illustrations. Plus, the manga is easy to read." "I feel like there are a few too many words per page." "Illustrations alone can easily convey the message"			
Neutral:	"[Two neutral responses recorded with no specific comments provided]"			
Content structure:				
Positive:	"The number of pages is just right, not too many. The spacing between the characters is also very good, making it appealing to read." "I think it would be better if '② Newborn baby's sleep (p19)' and the column 'Babies who cry a lot (p8)' were placed earlier in the section."			
Neutral:	"[Five neutral responses recorded with no specific comments provided]"			
Negative:	"[One negative response recorded with no specific comment provided]"			
Intention to use:				
Positive:	"The story was easy to read and understand, with the situation changing one after another and the problems evolving. The nuance of 'feel free to consult me anytime with any concerns' came across well." "It's easy for anyone to understand! I definitely want to make good use of it."			
Neutral:	"I thought that people who can understand the volume of content and the amount of text would find it useful." "There are some places where I'd like to add or correct a few things here and there."			
Key suggestions for improvement:				
Content clarity:	"On page 6, the first step for when a baby cries is listed as 'wait and see.' I'm concerned that this might lead to misunderstanding the priority. It would be helpful to specify how long to wait, at least." "The prone position is dangerous for babies who cannot roll over, but there is no explanation of this."			
Design aspects:	"The illustration appears to be a baby crib, but the height makes it look like a table. There have been cases where people laid their babies on tables because they thought it was 'easier to see.' Please make the depiction clearly recognizable as a crib." "Depending on the level of intellectual disability targeted, I think it might be better to have a text volume and picture ratio closer to that of a picture book, depending on the degree of cognitive ability."			
Positive feedback:	"I felt that it not only leads to a reduction in anxiety and worry, but also fosters a stronger sense of bonding by understanding the baby's feelings." "I think it's a tool that allows you to check your understanding step by step by reading clear explanations along with the cases. I'd love to see other things like this created." "I found it very reassuring and easy for mothers to understand, as it included specific examples of sounds that can stop a baby from crying, and indicated that videos on platforms like YouTube could also be used to produce those sounds. Furthermore, the final page allowed for a personalized message from support staff to the mother, which I found to be extremely useful."			

† Positive: Combined "Good" and "Fairly good" responses for comprehensibility, readability, and content structure; Combined "Likely" and "Somewhat likely" responses for intention to use

† † Negative: Combined "Fairly bad" and "Bad" responses for comprehensibility, readability, and content structure; Combined "Somewhat unlikely" and "Unlikely" responses for intention to use

† † † Neutral: "Neutral" responses for all categories

problem resolution and overall ease of understanding for various individuals. The overall comments from healthcare professionals indicated a generally positive reception, with feedback emphasizing the step-by-step explanations based on examples, the potential to foster bonding by understanding the baby's feelings (in addition to reducing parental anxiety), the reassurance provided by specific sound examples and suggestions for using online videos, the usefulness of the personalized message section, and a desire for similar tools. These findings suggest a generally positive reception, although suggestions for refinement were also provided. Suggestions for improvement included modifying the illustration of the crib, which was sometimes mistaken for a table and led to unsafe practices, expanding the explanation on the benefits of a firm mattress (page 24), and adding an explanation about the dangers of placing non-rolling infants in a prone position. It was also suggested that the text-to-image ratio be adjusted to resemble a picture book more closely, depending on the target audience's level of intellectual disability, to better accommodate varying cognitive abilities.

5. Discussion

The comparison of pre- and post-test results, demonstrating an increase in items answered correctly by 100% of participants, indicates observed knowledge gains related to the educational pamphlet among individuals with mild to moderate ID. However, while 14 items showed instances where one participant answered correctly in the pre-test but incorrectly in the post-test, these inconsistencies might be attributed to chance, potentially occurring more frequently among individuals with ID due to cognitive limitations affecting memory, reasoning, prediction, logic, and attention. In the context of this study, care staff were instructed not to assist with answers; however, in clinical settings, this pamphlet would likely be used as an auxiliary teaching material during oral instruction, potentially reducing such inconsistencies.

Furthermore, observed differences in knowledge gains related to the pamphlet were noted based on the degree of ID and prior childcare experience. Participants with prior childcare experience and those with mild ID showed a tendency towards higher knowledge improvement after reading the pamphlet. This disparity suggests that understanding of new information is facilitated by past similar experiences, and highlights the utility of connecting new information to past experiences for individuals with ID. These findings contribute to the growing evidence base for LL manga-based educational materials as an effective approach for parents with ID. The observed patterns of knowledge improvement, particularly among participants with prior childcare experience and mild ID classifications, suggest that tailored visual educational resources can successfully address the learning needs of this population across different domains of parental knowledge.

Consistent with the positive reception of the pamphlet, the evaluation of its readability and comprehensibility by both participants with ID and healthcare professionals was generally favorable. Illustrations and manga, in particular, were identified as key elements that aided understanding. However, areas for improvement, such as text size and illustration methods, were also noted. Based on this feedback, it is necessary to revise the pamphlet to enhance its comprehensibility for a wider range of participants.

The high intention to use the pamphlet expressed by healthcare professionals further suggests its potential utility as a support tool in clinical settings. Although some comments indicated difficulty in evaluation due to the perceived unclear level of ID among parents, it is important to note that the majority of parents with intellectual disabilities are reported to have mild to borderline intellectual functioning¹⁾. As defined by the DSM-5⁴⁾, mild ID involves impairments of general mental abilities that impact adaptive functioning in three domains: the conceptual domain, the social domain, and the practical domain. Therefore, it is necessary to inform healthcare professionals of these characteristics to facilitate accurate assessment and effective support.

The successful use of the LL manga principles in this study indicates that this approach appeared to be a comprehensible means of providing information for parents with ID. Although visual information is generally more effective than text alone, feedback indicated that some manga expressions could lead to

misunderstandings. Thus, in creating LL manga, it is crucial to use simple, realistic, and unambiguous expressions based on clinical expertise.

These findings contribute to the growing body of work on developing accessible health information for individuals with intellectual disabilities, building upon initiatives in other countries. For example, in the United Kingdom, National Health Service (NHS) Trusts utilize a Health Passport or Hospital Passport system as a reasonable adjustment for patients with autism or intellectual disabilities. This document allows patients to record their characteristics and desired accommodations, which healthcare professionals then share. Additionally, over 100 easy-to-read pamphlets on various illnesses and medical examinations have been developed specifically for individuals with intellectual disabilities, including materials related to obstetrics²⁵⁾. In Japan, as of March 2025, a system specifically designed to address the needs of individuals with intellectual disabilities, such as the Health Passport, does not yet exist, to the best of the authors' knowledge. While "Easy-to-read Japanese" has gained prominence in Japan, with its development initiated in response to the challenges of providing information to foreign residents, and some medical materials have been developed^{26,27)}, caution is warranted when equating the comprehension levels of non-disabled non-native Japanese speakers with those of Japanese native speakers who have intellectual disabilities, given the specific cognitive characteristics of intellectual disabilities. Therefore, the development and evaluation of tailored, visually-supported materials like the pamphlet in this study remain crucial for effectively supporting parents with ID in Japan.

6. Outlook

Based on the findings of this study, it is imperative to continue research on the development and evaluation of parenting support tools tailored to the needs of parents with ID. Further studies are warranted to validate the effectiveness of the LL manga approach, employing a wider range of themes. Additionally, future research should consider longitudinal follow-up studies to assess the long-term effects of the pamphlets, as well as observational studies to understand their utilization in actual parenting situations.

7. Limitations

Several limitations impact the interpretation of this study. First, the use of convenience sampling restricts generalizability. Second, the sample size (N=14) remains small and may not fully represent the diverse population of parents with ID. Third, the presence of care staff during data collection, while necessary for ethical reasons and participant support, could have introduced response bias. Fourth, the study design did not include a control group, limiting our ability to attribute knowledge changes solely to the pamphlet intervention. Fifth, the study was conducted in a controlled environment rather than in real-world clinical settings, which may limit the ecological validity of the findings.

8. Conclusion

In conclusion, this study indicates that the educational pamphlet, based on the principles of LL manga, appeared to increase knowledge regarding infant crying and sleep among individuals with mild to moderate ID. The observed improvement in pre- and post-test scores, particularly evident in participants with prior childcare experience and those with mild ID, highlights the observed knowledge gains and the potential utility of this approach. Furthermore, the positive feedback from both participants and healthcare professionals regarding the pamphlet's readability and comprehensibility underscores its potential as a valuable educational tool. The incorporation of visual aids, such as illustrations and manga, proved to be instrumental in facilitating information absorption. However, the study also identified areas for refinement, including adjustments to text size, illustration clarity, and content specificity, to ensure optimal comprehension across diverse cognitive profiles. The high reported intention to use the material among healthcare professionals suggests its practical utility in clinical settings. This study provides valuable insights into the development of accessible and impactful educational materials for parents with

ID. The successful application of LL manga principles in this context offers a promising direction for future interventions aimed at empowering this population and potentially contributing to improved childcare practices.

Ethical considerations

This study received ethical approval from the Research Ethics Committee of Nagoya Women's University (Approval No. 2022-12) and the Research Ethics Committee of Seinan Jo Gakuin University (Approval No. 2023-2). Participants were provided with written documentation detailing the study's purpose, methods, potential benefits and risks associated with participation, protection of personal information, voluntary nature of participation, disclosure and publication of research findings, and data storage procedures. Informed consent was obtained via a confirmation checkbox at the beginning of the questionnaire. To ensure participation was entirely voluntary and free from coercion, procedures were established requiring intermediaries (facility administrators and care staff) to carefully explain the right to refuse participation and obtain consent without undue influence.

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Conflict of interest

The authors declare no conflict of interest.

Notes

- † 1) The latest version of the pamphlet can be downloaded directly here: https://researchmap.jp/read0123877/published_works
- † 2) Participants' intellectual disability levels were classified according to the Japanese 'Ryōiku Techo' (Rehabilitation Handbook) certification system, a national system based on comprehensive assessments of intellectual functioning (typically IQ) and adaptive behavior. Within this system, B-1 corresponds to a moderate level of intellectual disability, and B-2 corresponds to a mild level.

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