



The BabyTok Project: Examining the Feasibility and Acceptability of a Light-Touch Social Media Project for Infant–Toddler Teachers

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Abstract

High-quality early care and education is a known protective factor for infants and toddlers who experience early childhood poverty, especially for early communication outcomes. However, the quality of care is variable in the United States, and efforts to increase the quality of interactions is impeded by cost and high rates of turnover in the field. In this paper, we explore a low-cost, light touch social media intervention that uses the TikTok platform to increase infant–toddler teachers' (ITTs) knowledge of early communication and social interactions while validating the important role that ITTs play in the lives of young children. We use a mixed method, pre-post design to explore the feasibility and acceptability of the BabyTok project from the vantage point of the ITT participants. Teachers offered positive feedback about the content, delivery of the intervention through TikTok and the impact on their feelings about their role in helping young children learn.

Keywords Early language development · Infant toddler teachers · Professional development

Introduction

Infants come into the world equipped with neurological systems that are primed and ready for learning, but they depend on frequent, responsive, and sensitive interactions with their caregivers to nurture early brain development (Brito et al., 2020; Romeo et al., 2018a, 2018b). Born communicators, infants signal their needs with increasing levels of complexity across the first two years of life- from cries, coos, and triadic gaze to gestures, words, and early word combinations. Caregivers support children's progression toward symbolic language through their responsiveness and linguistic input to the child. A considerable body of evidence indicates that caregiver-child interactions in the earliest years are critical, and that children's development is especially sensitive to a wide range of social and economic factors like family income, neighborhood safety, household stability, and caregivers' mental health (Justice et al., 2019; Vernon-Feagans et al., 2012). Children whose families experience economic

hardship are at greater risk of lower developmental outcomes than children from middle and upper-income households (National Academy of Sciences [NAS], 2019), although we are still learning about the pathways by which this takes place (Vernon-Feagans et al., 2020). Caregiver stress (Ward & Lee, 2020), maternal education broadly (Vernon-Feagans et al., 2020) and maternal knowledge of child development specifically (Rowe et al., 2016) have been identified as potential mediators of the relationship between SES and child language outcomes. Additional factors like neighborhood rates of poverty, food security, environmental risks like water safety and access to health care also influence child development and learning outcomes (NAS, 2019). While the impact of a child's early experiences are cumulative and multifaceted (Johnson et al., 2016), efforts to enhance the quality of early interactions between children and caregivers have long been a priority for policy efforts to reduce the impact of early childhood poverty (Leffel & Suskind, 2013), and some of these efforts focus on supporting caregiver-child interactions in center-based settings.

Many children across the United States spend waking hours in center-based early care and education (32% of infants under one year, and 47% of toddlers 1–2 years; U.S Department of Education, 2021). While children who experience poverty are less likely to access center-based care (Malik et al., 2018; Pilarz et al., 2022), early care and

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education (ECE) settings are an important early learning environment for many children (McCoy et al., 2017). Infants and toddlers who spend time in ECE have two sets of caregivers—parents and other home-based caregivers and their center-based teachers. Descriptive research indicates that among children who experience poverty and other risk factors, high-quality ECE can be a meaningful protective factor for children’s learning and development (Vernon-Feagans et al., 2013). High quality teacher–child interactions in ECE are characterized by frequent language input to children, high rates of responsiveness to child communication attempts, and include a larger focus on book sharing and interactions around print (Cabell et al., 2015). For infants and toddlers who are experiencing poverty, interactions that support language learning are especially beneficial and can lead to lasting gains in child outcomes (Bustamante et al., 2022). However, the quality of teacher–child interactions in early care and education settings is variable in the United States (Bratsch-Hines et al., 2020; Vernon-Feagans et al., 2013). Children who experience early childhood poverty are the least likely to access high-quality center-based interactions, although they would benefit the most from the potential “buffer effect” on early learning outcomes (Burchinal et al., 2010).

System Factors that Influence Quality in Early Care and Education

Efforts to support high-quality interactions in ECE are often stymied by systems-level factors in the United States. First, while we know that early educators who have greater knowledge of child development tend to engage young children in frequent language-rich interactions (Piasta et al., 2020), progress toward increasing knowledge and skills in the workforce is hindered by high rates of turnover (Grant et al., 2019). Low levels of compensation and employee benefits (Whitebrook et al., 2014) combined with high-stress levels of the job often lead to turnover, which can create instability in caregiver-child relationships (Pilarz et al., 2022). Expensive investments in early educator knowledge, then, could be lost if teachers who participate in costly professional development (PD) leave the field for higher paying jobs in other sectors. Teachers of infants and toddlers are paid less than preschool teachers (on average \$13.31 per hour vs. \$14.52 per hour; Bureau of Labor Statistics, 2022), although they are charged with the care and nurturance of children who are undergoing the most rapid period of neurological development. Early childhood teachers report feeling that their careers are not always respected or valued by wider society, and that they are sometimes viewed as babysitters who watch children play (Schachter et al., 2021). These factors create

instability in the ECE workforce (Pilarz et al., 2022), which undermines the continuity of care for infants and toddlers and the quality of ECE that children receive.

PD Efforts in Early Care and Education

A growing body of research analyzes PD approaches used in the field to increase teacher knowledge and the quality of caregiver-child interactions in ECE. Recent meta-analyses and research syntheses on PD interventions in ECE indicate that approaches that include a coaching component are the most effective at creating increases in teacher implementation of targeted practices (Brunsek et al., 2020; Elek & Page, 2019). Stronger effect sizes are also linked to interventions that are sustained over time (Desimone, 2009; Dunst, 2015), although there is some evidence that longer PD interventions are not always linked to stronger outcomes (Brunsek et al., 2020). While these features are impactful for teacher learning, they are often costly because they require staffing of coaches and the teachers’ time for PD activities (Bleses et al., 2021), unless the coaching takes place within the classroom during everyday classroom routines (e.g. Romano & Woods, 2018; Romano et al., 2021) or if they use low-cost means of delivery. Other approaches to PD in ECE include the use of online modules and hybrid approaches that include direct instruction (in person or online) with elements of coaching and feedback (e.g. Downer et al., 2009; Feuerstein & Landa, 2020). While many investigations aim to increase the quality of interactions with preschool-age children, fewer PD approaches support infant and toddler teachers during a critical period of early learning and brain development (Greenwood et al., 2020; Walker et al., 2020). In this article, we use the term “infant–toddler teachers” (ITTs) to refer to educators who teach and care for infants and toddlers from birth to three years. Targeted interventions with this group of teachers are needed to help establish feasible, effective, low-cost means of increasing the quality of interactions in ECE, particularly for children who experience poverty.

Teacher Knowledge and High-Quality Interactions in ECE

Increasing what teachers know about early language learning is one potential pathway by which interventions might increase the quality of teacher–child interactions. We define *early language learning* to describe the developmental sequences that infants and toddlers demonstrate before becoming fluent conversational partners as well as

the strategies that adult caregivers do to facilitate the progression through the developmental sequence. While most of the data on the relationship between teacher knowledge and teacher early literacy practices (such as building alphabetic knowledge, print awareness and phonological awareness) have taken place in preschool or elementary school settings (Markussen-Brown et al., 2017), one might imagine that teacher knowledge of early language learning has a role to play within interactions between teachers and infants and toddlers in their classrooms. A related body of research indicates that maternal knowledge of infant development predicts caregiving behaviors (Leung & Suskind, 2020) and child language skills in children and caregivers with low incomes (Rowe & Leech, 2019). As such, efforts to increase what teachers know about early language learning during the infant–toddler period is a logical area of inquiry and a potential mechanism for increasing the quality of interactions in ECE settings.

Light Touch Nano-learning Through Social Media

A growing body of research in education and public health examines the use of “light touch” interventions on adults’ learning and behavior change (Lewis, 2019). Light touch interventions are typically low-cost to the user and are widely accessible to recipients. Examples include the use of video clips sent via text messages to help parents use and respond to gestures with their infants (Choi & Rowe, 2021; Rowe et al., 2019), to improving nutrition (Chau et al., 2018), breastfeeding rates (Dauphin et al., 2020), and vaccine usage (O’Leary et al., 2019). Social media platforms offer a potential avenue for light-touch interventions, and their potential for PD grew during the COVID-19 pandemic. As the world quarantined for extensive periods of time and education sectors transitioned to virtual learning platforms, digital resources skyrocketed as the primary mode to access social, personal, professional, and educational tools.

During the pandemic, TikTok gained traction as a new social media application in which users create videos up to 1-min in length with ease, using a range of novel filters and graphics (Escamilla-Fajardo et al., 2021). Initially launched in 2017, TikTok was the most downloaded app in 2020 and has over 800 million users worldwide (Khlaif & Salha, 2021). TikTok’s popularization may be attributed to the short length of video duration, the engaging editing tools offered, and the convenience of sharing these clips. During the period of quarantine amidst COVID-19, TikTok videos were shared as sources of information—teaching viewers a variety of topics ranging from drawing to cooking to vocational training (Khlaif & Salha, 2021). While experimental studies using Tiktok are rare, Khlaif and Salha

(2021) explored the theoretical approaches underlying the app’s appeal for educational purposes. *Micro-learning* is one construct that describes how users might learn information in short increments to connect subdivided concepts related to a broader topic. Micro-learning delivers a learning objective as content which is divided into smaller elements and disseminated in short bursts. *Nano-learning*, a related concept, divides the units of content into even smaller pieces. The benefits of developing videos that present new information while only requiring the viewer’s attention for a limited time align with both *micro and nano learning* (Khalif & Salha, 2021). Short, “just in time” ideas can be revisited frequently, which offer the learner reminders that cue their memory about important content. Our intervention used the concept of *nano-learning* to plan and implement a light-touch intervention for infant–toddler teachers to increase their knowledge of early language development and interactional strategies.

The BabyTok Project

We developed and piloted an eight-week, video-based, light touch nano-learning intervention that used TikTok as a platform to share information about early language learning with infant–toddler teachers. We used an exploratory sequential mixed methods design to explore the feasibility, acceptability, and usability of the BabyTok intervention with ITTs in communities with high rates of poverty. We developed the BabyTok Project’s content to systematically introduce key concepts in very early language and social-emotional learning based on the literature in child language development and intervention (see Fig. 1). Information on social-emotional development, skills necessary to regulation emotions, build relationships, and explore environments, was included due to its close relationship with early language development and future academic success (Pontoppidan et al., 2017). Topics included infant brain development and serve and return interactions (Harvard Center on the Developing Child, 2018), the importance of everyday routines for learning (Spagnola & Fiese, 2007; Tamis-LeMonda, 2019), the development of early vocalizations, shared attention, and gestures (Rowe & Goldin-Meadow, 2009; Wetherby et al., 2007) as well as strategies to increase children’s use of each skill like responding, using descriptive language, and expanding child communication (Roberts et al., 2014). We also included content intended to support teachers’ feelings of self-efficacy and satisfaction in their role as teachers of infants and toddlers. This investigation aimed to determine whether teachers could enroll, access, use the platform, and whether they felt that they benefitted from watching and using the videos.

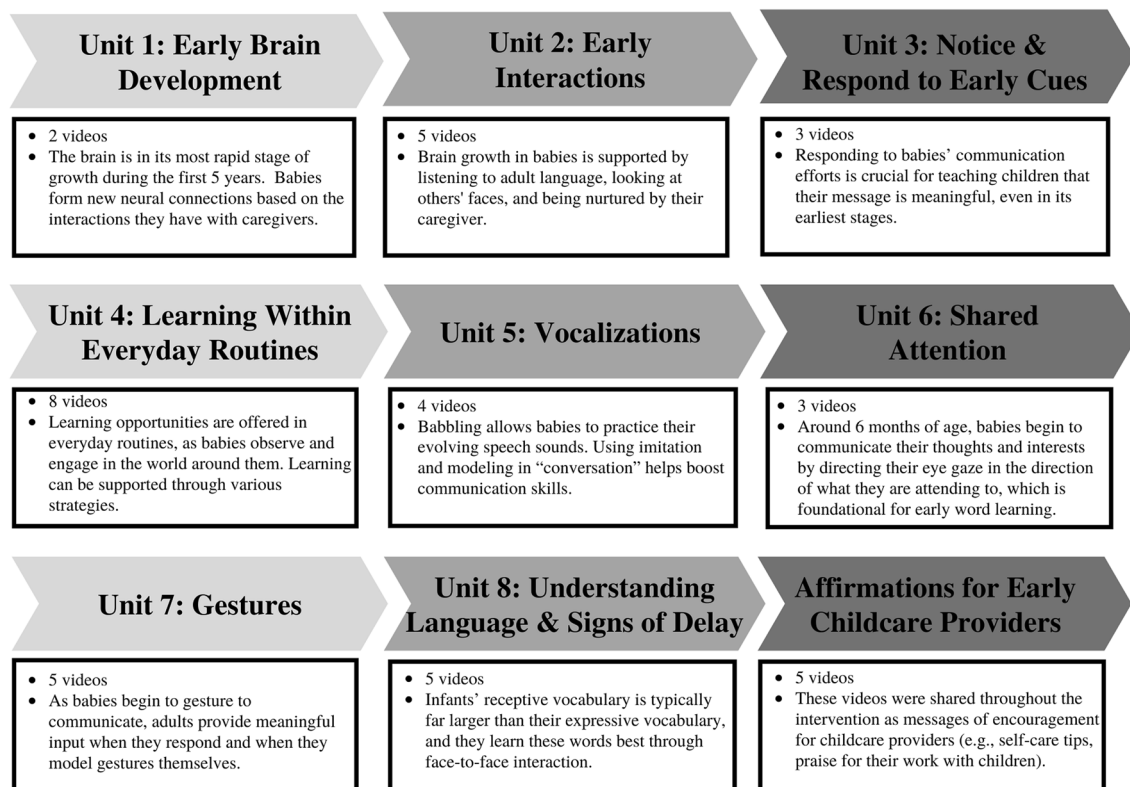


Fig. 1 BabyTok project video content units

We used quantitative and qualitative methods to examine the following research questions:

1. Were teachers able to independently access, comment, and like the BabyTok Project videos (feasibility)?
2. What were teachers' experiences with using social media for professional purposes and expectations from the BabyTok Project (feasibility)?
3. What were teachers' perceptions of the BabyTok Project intervention, including the relevance of the content, the convenience of the videos, and its potential impact on their teaching practices and their feelings of their roles as ITTs (usability and acceptability)?

Method

Participants

Twenty ITTs working in early-education centers in a small city in the southeastern United States participated in the study. The childcare centers included Early Head Start (EHS) programs and/or received funding from the local Early Learning Coalition (ELC) which distributes federal

childcare funds. Recruitment occurred through research staff meeting face-to-face with local childcare center directors and dissemination of flyers via social media pages (i.e., Facebook). All participants provided consent to the Institutional Review Board approved study (IRB#00,001,883) and received \$75 for their participation in the study. Payments were distributed after pre-data collection (\$25) and after the videos and post data collection (\$50).

A total of five administrators (i.e., center directors) and 15 ITTs completed the study. All participants were women between 18- and 62-years-old, and a majority identified as Black or African American (73.3%). Most ITTs ($n = 18$) worked in zip codes that had rates of poverty that exceeded the national average of 16% (Mean = 24.9%, range = 6.4–48.6%) according to data from the Florida Chamber of Commerce (2021). We used this data as a proxy to represent community rates of poverty.

Forty percent of participant teachers completed some high school courses but did not graduate and 53.3% had either a high school diploma or GED certificate as their highest level of education. ITTs' previous experience ranged from less than 1 year to over 20 years working in childcare. ITTs in our state are required to complete a 40-h introductory course that includes content on child

development, health, safety, abuse and neglect, among other topics (Florida Statute 402.26–402.319). While there are no individual requirements for levels of education, at least one staff member per 20 children must hold a child development associate credential (Florida Statute 402.26–402.319). Of the administrators included, 50% completed either trade, technical, or vocational training and 50% reported having worked with children for four to five years, although one had been in the field for over 18 years. While we did not gather data on teacher income, 50% of all the participants reported a combination of assistance (i.e., Medicaid, SNAP benefits, Supplemental Security Income, WIC supplements, etc.) and 25% selected ‘Other’ sources. Additional demographic

information is provided in Table 1. The recruitment period lasted about one month. One ITT was lost to attrition after the start of the video portion of the project, and two others consented but did not complete any study procedures.

BabyTok Project Videos

Forty-four project videos were developed by the first author and graduate students. The first author designed the sequence of videos outlined in Fig. 1 and narrated most of the videos. Videos that were not narrated were “slide show” style, in which images and text appeared on the screen with music in the background. The video content aligned with

Table 1 Participant demographic information

	Teachers (<i>n</i> = 15)		Administrators (<i>n</i> = 4)	
	<i>n</i>	%	<i>n</i>	%
Gender				
Female	15	100	4	100
Age				
18- to 25-years-old	6	40	0	0
26- to 30-years-old	1	6.7	2	50
31- to 40-years-old	3	20	0	0
41- to 50-years-old	3	20	1	25
51+ years-old	2	13.3	1	25
Race/Ethnicity				
White	2	13.3	1	25
Black or African American	11	73.3	3	75
Hispanic/Latino–White	2	13.3	0	0
Education level				
8th grade or less	1	6.7	0	0
Some HS, No Diploma	6	40	0	0
HS Graduate	5	33.3	0	0
GED Certificate	3	20	1	25
Some college credit	0	0	1	25
Trade/technical/vocational training	0	0	2	50
Years’ experience				
Less than 1	1	6.7	0	0
1–5	3	20	2	50
6–10	1	6.7	0	0
11–15	3	20	0	0
16–20	1	6.7	1	25
More than 21	1	6.7	0	0
Unknown	5	33.3	1	25
Supplemental government benefits				
Medicaid, SNAP benefits (food stamps, housing assistance, supplemental security income, and/or WIC supplements)	9	60	2	50
Other	3	20	1	25
Prefer not to say	3	20	1	25

Some participants received a combination of supplemental government benefits

best available research in early language learning and intervention, as outlined above. The videos were piloted during this study as a means to gain feedback on the content by teachers in the field. Videos were shared in the private group only to participants to maintain their confidentiality on the wider Tiktok platform.

Study Design

We used an exploratory sequential design within an intervention mixed methods framework (Fetters et al., 2013) to investigate the feasibility, usability, and acceptance of the BabyTok intervention. Consistent with an intervention mixed methods framework, we collected initial qualitative data through individual pre-interviews with ITTs to guide the development of the intervention by determining ITTs prior knowledge on child language development. Then, a quasi-experimental pre-post intervention design was used to determine the impact of the 8-week BabyTok Project (independent variable) on participants' knowledge of child language development and facilitation strategies (dependent variable) through completion of a survey (SPEAK-R). Additionally, qualitative data collected through post-interviews and quantitative TikTok engagement metrics were used to examine the acceptability and usability of the intervention. Data were merged for data analysis to report on the success of the BabyTok Project.

Measures

Teacher Interviews

The participants completed individual semi-structured interviews before and after the 8-week BabyTok experience for usability and acceptability data. Participants were interviewed by research assistants by phone, Zoom, or through in-person meetings according to their preference. Interviews lasted approximately 10–15 min, were audio-taped, and transcribed verbatim. Both the interviews and transcripts were completed by trained graduate student research assistants. A total of 19 interviews were analyzed (one participant did not complete the post interview).

Pre-interview

The pre-interview semi-structured protocol contained nine questions that explored the participants' previous experience with childcare, their knowledge of language development, skills for supporting early communication, and familiarity with social media platforms (see

Supplementary Material). Pre-interviews were used to guide and inform the choice of intervention content based on teacher prior knowledge, and also to assess teacher levels of comfort with the app. Data about participants' previous experience with childcare was collected to build rapport and is not presented in this paper as each participants' responses were individual.

Post-interviews

The post-interview semi-structured protocol contained 12 questions regarding the benefits of the BabyTok series including the use of TikTok as a learning platform, changes in teaching practices following the intervention, and how they feel about their role as ITTs (see Supplementary Material). Post interviews were used to evaluate teachers' perceptions of the feasibility, acceptability, and impact of the intervention.

TikTok Engagement Metrics

For videos posted by public TikTok accounts, the application allows users to review analytics including number of shares and average time viewers watched the video. However, this study utilized a private account in order to ensure a level of privacy for participants. As a result, the only details available to the researchers included total views for each video, likes, and comments, watch time data were not available. To collect data regarding the participants' use of the BabyTok video series, participants were asked to "like" the videos posted to indicate that they viewed them. They were also invited to comment on the videos if they felt inclined. Individual responses were manually tracked for each video, by clicking each post and reviewing who liked or commented in response. Once the study was completed, TikTok engagement metrics were comprehensively analyzed by reviewing the feedback received for individual videos and recording the total sums of each participant's likes and comments across the 8-week intervention. These metrics were gathered to examine the feasibility of the intervention.

SPEAK-R

The Survey of Parent/Provider Expectations and Knowledge-Research (SPEAK-R) is a self-administered questionnaire designed to assess information about early childhood cognitive and language development (Suskind et al., 2018). The research instrument is criterion-referenced and includes 22 items that evaluate evidence-based knowledge regarding learning development from birth to 5 years old. The questionnaire includes 4 items with multiple choice answers ranging by age (*as an infant, 0–6 months to in elementary schools, 6 years and up*) and 18 items rated on a 5-point

Likert Scale, with 14 items scored as *definitely true* (0) to *definitely not true* (4) and 4 items reverse-scored as *definitely not true* (0) to *definitely true* (4). Reliability of the SPEAK-II indices were supported in expert field testing with a Cronbach's alpha of 0.92 and scores on the indices increased with educational level (Suskind & Leung, n.d.). During development of the original SPEAK tool, significant correlations between increased scores and higher levels of education, stronger receptive language abilities, and language-rich home environments were found with the second version of the tool (SPEAK- II) through field testing (Suskind et al., 2018). For the purposes of this study, the SPEAK-R was used as an exploratory measure of change in teachers' understanding of early language learning. The SPEAK-R was conducted at entry and after intervention. The measure was gathered and scored using REDCAP and data were exported to Excel for analysis.

Procedures

After consenting to participate, the research team shared handouts via text, paper copies, and a short video that contained step by step instructions for setting up and accessing the BabyTok Project page. Research team members were available and helped teachers with direct assistance to access the page for the first time, when needed. Next, participants completed the demographic surveys, SPEAK-R and pre-interviews with graduate student research staff via in person or over Zoom as required during the COVID-19 pandemic.

After the group of participants completed the interviews, demographic forms and the SPEAK-R, the research team began to share the BabyTok videos with the participants every day during the week. The videos were posted to the page but were also sent via direct message to ensure that the participants could view them because Tiktok uses an algorithm to determine what appears on a user's page. Participants then watched the videos, "liked" the video so that we could see if they viewed it, and commented if they chose to. At the end of the eight weeks of videos, each teacher participated in post-interviews and a post-test measure using the SPEAK-R.

Data Analysis

We used a mixed method design to analyze the findings related to the feasibility and acceptability of the intervention, prioritizing the qualitative findings because they directly reflect the opinions of the participant teachers. We derived themes inductively from the semi-structured interview protocol, as outlined by Saldaña (2013). The second author (Coder 1) read through all interview transcripts and identified and defined common

codes that were shared across interviews. The first author (Coder 2) then read the transcripts and reviewed the suggested codes and made modifications (see Table 2 for a codebook). The codes fell under three general themes- *Desired Topics for the BabyTok Project, Thoughts and Feelings in Role as ITT, and Changes in Teacher Practices*. Next, Coder 1 reviewed the transcripts and coded statements with the final codes. After the transcripts were coded, Coder 1 categorized the transcripts using the sort feature on Google Docs by code. Finally, the second coder reviewed the transcripts and resolved disagreements via consensus. As such, credibility and trustworthiness were established by a team approach to analysis and multiple rounds of review and iterative coding to refine codes. We also looked for confirming and disconfirming evidence throughout the coding process to reflect varying viewpoints.

We also used a descriptive quantitative analysis to show means and ranges on the engagement metrics by obtaining simple counts per participant of videos "liked" and how many videos were commented on. We also used a pre-post, paired samples t-test on the SPEAK-R outcome measure to assess whether there were changes in teacher knowledge on the measure.

Results

Pre-intervention Teacher Interviews

Knowledge of Early Communication and Use of Strategies

Participants described their knowledge about how infants and toddlers communicate in their first 18 months and how children learn to communicate. See Table 3 for a depiction of responses by participants, and the frequency with which these responses were provided across the sample. In response to how babies and toddlers communicate, one ITT said:

Oh my gosh, everything from their needs: They're hungry, they're tired, they're thirsty, whatever it is... to excitement and they ask you questions whether they can talk or not. I mean, they're constantly looking for answers and looking for that engagement...

Participants also reported different strategies they already were using to support children's development (shown in Table 3). Many ITTs reported providing exposure to rich language through their daily classroom routines. For example, one ITT explained:

For instance, we in dramatic play, I will go there and say, 'You cook? What are you cooking?' and I get them to introduce what they're trying to cook. Or say we're building blocks, 'What are we building?' You know, getting them introduced to new words and stuff.

Table 2 Themes and codes for pre and post teacher interviews

Theme	Codes	Definition
Desired Topics for the BabyTok Project	New communication strategies	ITTs describe a desire to learn new ways to support children's communication
	Expand knowledge	ITTs describe wanting to expand on their pre-existing knowledge about early development
	Unknown expectations	ITTs describe being unsure about what to expect or what they hoped to learn from the project
Thoughts and Feelings in Role as ITT	Felt more knowledgeable and responsible for detecting early signs of communication delays	ITTs state that they are more aware of their role in identifying early delays
	Increased pride in role as an early educator	ITTs report feeling reinforced in their role as an early educator or an increased feeling of pride in their work
Changes in Teaching Practices	Increased eye contact/shared attention when interacting with children	ITTs describe the importance of face to face interactions and shared attention when engaging with infants and toddlers
	Increased patience when interacting with children	ITTs describe increased patience when interacting with infants and toddlers in their room
	Generated more ideas for classroom activities	ITTs state that the videos gave them ideas to implement in their rooms (i.e. songs, books, etc.)
	Discouraged use of baby talk	ITTs report using less “baby talk” and more descriptive language
	Increased language input when around children	ITTs describe talking more to children in their care
	Felt affirmed regarding current strategies used	ITTs state that the videos reaffirmed that strategies that they currently use are important and meaningful
	Positive behavioral support skills and emotional awareness	ITTs describe gaining more awareness of infant and toddler emotions and behavior management skills
Tiktok as a Learning Platform	Convenience	ITTs described Tiktok as a convenient means to learn for one or more of the following reasons: 1) flexible scheduling to complete videos, 2) ability to revisit videos, 3) additional resources, 4) concise information, 5) quick viewing, and 6) ease of integrating into daily social media use
	Engaging nature of videos	ITTs describe the videos as fun, easy to watch, and enjoyable
	Supportive of learning	ITTs described ways that Tiktok supported their learning because one or more of the following factors: (1) visual learning through videos, (2) ease of information retention, and (3) information-alreview of basic concepts.

Use of Social Media Platforms

Participant ITTs described a range of comfort, familiarity, and use of Tiktok and other social media platforms. Some ITTs were explicit about their newness to Tiktok. Several ITTs either recently downloaded it for the purposes of the project ($n = 7$), or had it downloaded but did not use it frequently ($n = 4$). Several ITTs ($n = 7$), though, were very familiar users who describe being on it daily for fun and for finding interesting information about a variety of topics. One experienced Tiktok user stated:

People have short attention spans, so if you can get everything that you're saying within 1–3 min, then

boom, that's perfect...I've definitely learned so much from TikTok. That wasn't my initial reason to get it, I just kind of wanted to look at funny things. But there's so much on that app which is really cool.

Several others noted the entertainment value of TikTok, stating that they love the videos that make them laugh ($n = 6$). ITTs that used TikTok prior to the study noted that they use it daily and during their lunch breaks.

Most ITTs who were not TikTok users prior to the study consistently used Facebook, Instagram, and Snapchat, primarily to stay connected to friends and family ($n = 9$). Only one ITT reported using social media for professional purposes. She said, “The only app I do with my job is Pinterest.

Table 3 Joint Display of Pre-Post Interview Data and SPEAK-R Data

<p>Interview Question: How do infants and toddlers communicate in their first 18 months? Related SPEAK-R Items: Item 1: Infants who are too young to talk might communicate by cooing or smiling; Item 2: When babies babble, they are practicing how to have a conversation</p>			
Pretest		Posttest	
Pre-Test Theme	SPEAK-R Score	Representative Quotes	SPEAK-R Score
<p>Infants and toddlers communicate for many different reasons ($n = 9$) through:</p> <ul style="list-style-type: none"> • Gesturing/signs ($n = 10$) • Crying ($n = 9$) • Some words ($n = 5$) • Babbling ($n = 5$) • Facial expressions ($n = 3$) 	<p>Item 1: $M = 2.94$ Item 2: $M = 2.88$</p>	<p>Infants and toddlers communicate for many different reasons ($n = 7$) through:</p> <ul style="list-style-type: none"> • Gesturing/signs ($n = 5$) • Babbling ($n = 4$) • Crying ($n = 2$) 	<p>Item 1: ($M = 2.94$) Item 2: ($M = 2.88$)</p>
<p>Interview Question: How do babies learn to communicate? Related SPEAK-R Items: Item 1*: Showing infants educational TV gives them a jump-start on learning how to talk; Item 2*: Answering only if a toddler uses words instead of just pointing better helps the toddler learn how to talk; Item 3*: Answering only if a toddler uses correct words for things instead of baby words (like "blanket" instead of "ba-ba") better helps the toddler learn how to talk; Item 4*: Letting a toddler move around while listening to a story teaches the toddler bad listening skills; Item 5*: Letting a toddler skip words and pages teaches the toddler bad reading habits. Item 6*: Children 0 to 2 years old can learn just as many words from educational TV as they can from their parents. Item 7*: Leaving the TV on in the background is a great way to give 0 to 2-year-olds extra chances to learn words.</p>			
Representative Quotes		SPEAK-R Score	
<p>Babies learn to communicate:</p> <ul style="list-style-type: none"> • Through exposure to adult language ($n = 7$) • By interacting with other people ($n = 4$) • By observing the world ($n = 4$) 		<p>Item 1: $M = 1.12$ Item 2: $M = 1.88$ Item 3: $M = 2.12$ Item 4: $M = 1.88$ Item 5: $M = 2.06$ Item 6: $M = 1.29$ Item 7: $M = 1.82$</p>	
<ul style="list-style-type: none"> • Through repetition of language stimuli ($n = 3$) • By responding to their communication partners ($n = 2$) • By making connections between stimuli and their referents ($n = 2$) 		<p>Representative Quotes</p> <p>Babies learn to communicate:</p> <ul style="list-style-type: none"> • Through exposure to adult language ($n = 3$) • By observing the world ($n = 3$) • Through repetition of language stimuli ($n = 1$) 	
		<ul style="list-style-type: none"> • By interacting with other people ($n = 1$) • By making connections between stimuli and their referents ($n = 1$) 	
<p>Interview Question: What strategies do you use to support language? Related SPEAK-R Items: Item 1: When infants babble, parents should respond as if the infant is saying real words; Item 2: If an infant is upset or crying, it's best for parents to talk in a warm and calming tone of voice.</p>			
Representative Quotes		SPEAK-R Score	
<p>To support language, I:</p> <ul style="list-style-type: none"> • Provide exposure through daily routines ($n = 8$) • Model language use ($n = 6$) • Encourage use of words to manage difficult behavior ($n = 2$) • Use visual supports/gestures ($n = 2$) • Prompt language use ($n = 2$) • Provide choices ($n = 1$) 		<p>Item 1: $M = 2.94$ Item 2: $M = 2.94$</p>	
		<p>Representative Quotes</p> <p>To support language, I:</p> <ul style="list-style-type: none"> • Use visual supports/gestures ($n = 4$) • Model language use ($n = 3$) • Provide exposure through daily routines ($n = 3$) • Prompt language use ($n = 2$) • Respond to communication attempts ($n = 2$) 	
		<p>Item 1: $M = 2.88$ Item 2: $M = 2.94$</p>	

SPEAK-R items were scored on a four-point scale ranging from 0 (Definitely Not True) to 3 (Definitely True). *These items were reverse scored, so that a score of 0 meant that the statement was Definitely True and a score of 3 meant that the statement was Definitely Not True

Because Pinterest has everything like they can look on there for classroom decorations, ideas, door ideas and that's what I've done in the past and activity ideas and also I think Tumblr." One participant ITT was not a frequent social media user, although she did have a Facebook account.

Desired Topics for BabyTok Project

When asked what they hoped to learn from the BabyTok project, the consensus across participants was a desire to fill the gaps in their current knowledge base regarding early communication skills and strategies to support development. We asked this question to help tailor content to their

preferences and to learn about their intentions in participating in the project. One administrator stated:

Obviously, more about babies. More on how to work with the babies and infants in the classroom. I don't have all the answers...I know about the nurturing part but just learning the communication from the babies, especially when they don't have the words to express themselves. That's more of a challenge than anything.

Participants also described an interest in learning new techniques to either improve or change their current practices ($n = 12$) with responses such as “even just tips on instead of going about it this way, go about it that way”. Although there was a shared sense of curiosity, three ITTs explicitly stated they were uncertain of their expectations entering the project.

Post-intervention Teacher Interviews

Knowledge of Early Communication and Use of Strategies

ITTs were again asked to describe their knowledge about how young children communicate, how they learn how to communicate, and what strategies are used to support language development. See Table 3 for a description of responses to these questions and the frequency of the responses across the participants. In response to what strategies participants use to support children's language, two participants replied that they respond to children's communication attempts, which was a response that was not provided at pre-test. In other cases, responses from the pre-interview data were more detailed than the post-interview data.

Changes in Teaching Practices

ITTs varied in the degree to which they believe the project changed their teaching practices. Some felt as if the content reinforced the positive interactions they had with children and helped them remember why those strategies are important ($n = 5$). When asked about changes in practice, one ITT said, “I would say no. It's kind of like you still do the same things. Just like you said, it was kind of reassuring us that we are doing it. So we didn't really change anything.”

Other teachers gave examples of specific ways that they use strategies with children ($n = 5$). For example, one participant stated: “I have changed certain ways I would communicate... the way I would ask them to ‘Okay, follow me now. Let's come this way and walk, walk, walk,’ instead of just being like ‘okay, well come on. Let's go.’” A few others noted that the intervention took place during COVID related closures or during the end of the school year ($n = 4$), so they did not have opportunities to immediately apply some of the

strategies into their practice in the classroom. Interestingly, two participants reported decreasing their use of “baby talk” or infant directed speech post-intervention although one of the BabyTok videos solely focused on infant-directed speech as a beneficial strategy for engaging infants. This finding may have resulted from variable ITT views about infant directed speech or confusion regarding the most appropriate strategies to prioritize, considering other topics like narrating during routines and descriptive talk.

Twelve BabyTok Project videos focused on very early communication skills like shared attention and the ways in which infants use their gaze to communicate with adults. Two teachers mentioned increasing their use of shared attention in their responses. One noted, “Mainly getting down on their level and trying to make eye contact better. That was probably my main one.”

Two teachers alluded to changes in their strategies to help children regulate their emotions through better communication together. One ITT stated,

Maybe being a little more patient with them and listening because you know, they know what they want and stuff, but sometimes they can't really, I don't know, sometimes they don't really tell me what they want when they cry. So, I sometimes have to stop, and I have to calm them down and get them to communicate with me.

Thoughts and Feelings About Role as ITT

Some ITTs reported increased feelings of pride in their role as a key player in children's learning as a result of the videos ($n = 3$). While some teachers ($n = 4$) reported that their work is important, they also described how others may minimize the impact and role of early educators. One teacher describes that while she never felt embarrassed about her job before, she now feels a little more pride in her work.

Well, now I really...I used to feel like when I communicate with people and I tell them, I'm a teacher, but it's just at the daycare, it's not a big deal. But now I see it way bigger than I used to see it, and so now I'm always like well, this they start. I'm they first teacher, so whatever I put into them, you know, it plays a big role into things. It's just like that when they go to real school.

Another teacher corroborated this viewpoint and said,

It kind of validated what I do. Because working in childcare, unless someone knows more about childcare, most people just kind of feel, for a lack of a better word, you're babysitting all day, and it's definitely not what it is. It kind of validated for me like I'm not

just sitting here watching people kids all day, it's more than that.

Other teachers ($n=3$) did not feel like it gave them a new appreciation of their role, but that it reinforced their previous feelings of pride in the importance of their work with children. One teacher said, “It didn't change it as much because I still knew we were making a big impact on the kids from letting them learn here so it didn't change it much, but it showed that like we really do make it impact on that from early on.”

Two teachers commented that they had not considered their role as it relates to helping to identify children who might show early signs of a delay. One ITT describes a video that discussed early signs of autism and the role of childcare providers in helping to identify delays. She describes a situation in which she noticed that a child was not communicating as she would have expected, but that she tried to balance that with individual differences in language learning. She said:

I've been a sub at a daycare center, there was a child in my class that... she did not communicate like the other kids. There were a lot of things that I was a little concerned about... You still have to teach them and talk to them as you would another child without autism, but it's just a way that you approach them and how to do things, so that would help when I return to work.

TikTok as a Learning Platform

A majority of ITTs ($n=17$) reported satisfaction and enjoyment from the professional development on the BabyTok social media account, and they listed several features that they appreciated. The most prominent advantage ITTs described was the convenience ($n=9$) of this delivery model, especially noted by flexible scheduling and ease of accessing information on a handheld device. The popularity of cellphone usage allowed participants to access the intervention in their free time and regular social-media users felt it was easy to integrate in their daily routine. One participant said: “At the same time, not only working, taking care of my own kids, I was in school also. It was convenient for me to go back and kind of look at them at my own leisure versus saying okay this is what you have to get done by this time.”

Other ITTs emphasized the ease of revisiting the videos and reviewing attached resources for additional information ($n=4$). ITTs appreciated BabyTok for sharing content quickly and concisely as opposed to traditional formats (e.g. lectures, webinars, in-service trainings, etc.) that were described as “long and daunting,” so that they could maintain their attention for a short video. Another participant compared the approaches by stating, “It's a lot easier to watch, I don't know a 60-s or 3-min video, versus sitting in

a lecture all day. Learning about the same stuff, but when the delivery is different, you're more interested.”

ITTs also felt that the content on BabyTok was supported by interesting visuals and engaging presentations, as summarized in the following response: “I mean this was my first time on TikTok and now I'm kind of obsessed. It just makes it more fun. When learning is more fun, you retain more, and you remember more, and learn more.” Another ITT noted that with longer online modules, she had to engage in an extensive amount of reading that did not always give her a lot of visuals to rely on. Others also commented that the video-based nature of the app made it appealing and brought opportunities to see strategies in action ($n=7$).

Two participants, however, expressed a preference for in-person, face-to-face trainings on a defined topic. Nonetheless, they suggested the videos could be used as a supplementary tool to assist with traditional forms of professional development.

TikTok Engagement Metrics

A total of 44 videos were shared across the eight-week intervention period. Participants mostly engaged with the BabyTok videos by “liking” the posts, as demonstrated by an average of 32.32 likes per participant (range = 4–41); ITTs also responded to posts by commenting, although this was noted less frequently considering the average of 13.37 comments per participant (range = 0–40.) Commenting was not required for the project. The difference in frequency between the engagement metrics suggests that users find “liking” a post by pressing a single icon more convenient than generating and inputting a written response.

In the comment section, participants shared how they implemented the technique discussed in the daily video first-hand. On a video about the importance of descriptive talk during everyday routines, one TikToker commented “Hand washing is my favorite. I explain what we're about to do and talk them through it. If they get fussy, I'll sing a song and say ‘all done.’” Comments also included remarks about what ITTs learned. In a post explaining infant-directed speech, participants stated, “I never knew there was a name for this!” and “That's pretty cool, I thought we all sounded crazy but could never stop doing it.” Other common responses featured emoticons expressing laughter, hearts, and signs of celebration, indicating positive feedback.

Speak-R Pre and Post

At pre-test, ITTs scored an average of 52.6 (range = 34–70) on the SPEAK-R measure, which increased to a mean of 54.4 (range = 43–70) at post-test. Although the one-sample t-test did not indicate these changes were statistically significant ($p=0.088$, $df=18$), the overall increase illustrates some

gains in the raw scores. It is important to note that the use of a one-sample t-test was underpowered with the size of our sample, but we chose to run the analysis to pilot the use of the measure for future investigations.

Integrated Results on Participant Knowledge

Data on participants' knowledge of young child communication and strategies to support language were merged across the pre- and post-test interviews and the SPEAK-R surveys. Table 3 depicts the three interview questions that targeted participant knowledge and the SPEAK-R items that aligned with these questions as well as participant responses and average scores for each item. While SPEAK-R data on items regarding how young children communicate were consistent from pre to post-test, responses from the interviews expanded on this information. In addition to cooing, smiling, and babbling (as collected via SPEAK-R Items 1 and 2), participants also reported that children use gestures and signs, crying, and using words/word approximations to communicate through interviews. Regarding how children learn to communicate, the related SPEAK-R items and interview responses were quite different. Average SPEAK-R scores increased on each item, indicating that participants learned more about this topic after the BabyTok videos. However, at post-test, interview responses were less frequent and more limited when compared to pre-test. Finally, the SPEAK-R items and interview responses relevant to strategies used to support children's language were somewhat different. Yet, a few participants did explain the importance of responding to children's communication attempts at post-test, which aligned well with one of the SPEAK-R items (see Table 3).

Integrated Results on Usability and Acceptability

By merging TikTok engagement metric data and participants interview responses at post-test, it becomes evident that the BabyTok project had high acceptability and usability. Participants generally had positive feedback about the convenience of the project, how engaging the content was, and new information that they learned from the project. TikTok engagement metrics supported this finding as individuals "liked" a majority of the videos, and also engaged through a variety of comments.

Discussion

We examined the feasibility, usability, and acceptability of the BabyTok Project video-based intervention for ITTs who teach infants and toddlers who are experiencing early childhood poverty. To our knowledge, this study represents one of the first investigations using TikTok to systematically

support ITTs with content related to early learning. Our findings suggest that the novel approach to increasing teacher knowledge of infant-toddler development and intervention strategies holds promise for future investigations as a light touch professional development intervention and that it is an engaging means to offer short, relevant, "just in time" pieces of content to ITTs to help increase what they know about early language learning.

Feasibility, Usability and Acceptability of the BabyTok Project for ITTs

In general, we found positive findings from the TikTok engagement metrics, although there was variability that warrants further exploration. While the average ITT watched 32 of the 44 videos, the range was wide, with the lowest ITT having watched only 4 videos. We hypothesize that the lower levels of ITT engagement might have been linked to participants who reported less frequent social media use overall, and those who were new to TikTok as a platform. It is possible that the BabyTok intervention is less feasible for ITTs who are unaccustomed to logging into social media for routine use. Others, who were self-described "Tiktokers," may have found that watching the videos fit seamlessly into their regular social media usage patterns.

When asked about the ease of use in the post-interviews, ITTs described the intervention as being convenient and fun to use. ITTs noted that they could watch the short videos any time- at lunch, on breaks, and in the evening around their own schedules. This accessibility could increase the frequency with which ITTs engage with language related content when compared to approaches that involve scheduled webinars, face-to-face trainings, and lengthy modules. Indeed, compared to more formal trainings that might span one or two days, the advantages of micro-learning is that it keeps learners in touch with the content because of its frequent delivery. ITTs also said that they would recommend the project to colleagues who want to learn more, and most continued to follow the page after the project ended. Even so, two teachers expressed a preference for traditional PD formats like webinars and workshops, but they believed that the videos could be a good supplement to those trainings. While we would not expect changes in teacher strategy use at the level that is achievable in the PD literature on coaching (Brunsek et al, 2020; Elek & Page, 2019), it might be possible to increase teacher knowledge and feelings of self-efficacy through an approach like the BabyTok Project.

Nano-learning in Action

This pilot study appears to be the first to utilize TikTok as a professional development platform for early childcare providers. Although previous studies investigated web-based

professional development approaches, few explored social media and were completed prior to the inception of COVID-19 and TikTok's widespread use thereafter. It is evident that there are a range of promising technologically-delivered professional development opportunities that use modules, webinars, and remote coaching. However, the present study intended to build on this foundation by adapting the content to cater to adult learning styles in an engaging, user-friendly format that resonates with a new generation of users. The benefits of TikTok allow early childcare professionals to access these videos easily on their device of choice and with flexibility regarding their particular schedule. The nature of TikTok also allows content to be created and shared based on the needs and interests of the teachers. The participant ITTs described several features of Tiktok videos that seemed to make it conducive to learning. First, they noted that the videos themselves were short and that the video format made it easy to watch and review when compared to approaches that require significant time and amounts of reading, like online modules. A few ITTs completed 8th grade as their highest level of formal schooling, and presenting information in a video might have avoided barriers related to literacy levels. Other participants had college degrees, so the content was intended to fit all learners. To scaffold learning for the ITTs, we also attached supplemental resources with weblinks, articles and other resources to increase access to more information when desired by the ITTs.

While the BabyTok videos were short, they were systematically planned in a sequence and with attention to core early communication skills from birth, while interweaving content about strategies and messaging to promote ITT feelings of self-efficacy. We believe that planning content is an important consideration for the use of social media for light touch interventions, to make the most out of short-form videos that are intended to achieve a particular learning outcome. The curricular nature of the intervention helped to align it with theories of nano-learning in which small pieces of content fit into a bigger unit or theme (Khlaif & Salha, 2021). For the BabyTok Project, our "big picture" was that babies are born communicators, but they rely on their caregivers to provide them with contexts for early learning within everyday routines to advance their brain development and communication skills. The sub-themes within this big picture included content on key prelinguistic skills, strategies, and the critical role of ITTs in promoting child development.

Changes in Teacher Knowledge, Skill, and Self-efficacy

Several participant ITTs ($n=5$) described increased use of evidence-based communication behaviors that promote early language development as a result of watching the BabyTok

videos, like improving face-to-face time and shared attention, and pointing when interacting with the children. While we do not have observational evidence that these changes took place within classroom interactions, it was a positive finding that some teachers described strategies in action. Similarly, some ITTs reported more intentional and frequent language input in their early childhood centers, using more descriptive vocabulary and exaggerated intonation. Others noted a lack of opportunities to try the strategies due to COVID closures. These findings are similar to past examinations of impacts of web-based professional development programs on teacher knowledge, including web-based modules (Ascetta et al., 2019; Gardner-Neblett et al., 2020; Sheridann & Wen, 2021).

On the contrary, participant descriptions of their knowledge about child language were variable from pre to post-test, with breadth and depth of descriptions generally reducing at post-test. This may be due to participants' familiarity with the interview questions and recency of completing the interviews, as these remained the same across both time points and were only about 8 weeks apart in time. SPEAK-R scores either remained consistent or slightly improved in between the two time points. This conflicting evidence of changes in teacher knowledge indicates that the measures used in this study may need to be refined to detect more sensitive changes in teacher knowledge with measures that specifically measure the concepts in the videos.

Several participant ITTs expressed a feeling of being reaffirmed in their roles as early educators. Encouraging commenting and sharing ideas among the professionals that interact with infants and toddlers daily may promote innovative and engaging practices that support language development in an entertaining format, motivating both children and ITT participation in the early childhood environment. Overall, ITT participants felt that the information shared through the BabyTok videos reaffirmed the current practices they were already implementing with the infants and toddlers in their centers and that it bolstered their feelings about the importance of their job and their role in early learning. Considering high turnover and stress levels among ITTs in the field (Grant et al., 2019; Whitebrook et al., 2014), this sense of validation could be especially important for empowering ITTs in their role and supporting ITT well-being.

Limitations

Because this was a preliminary investigation of the BabyTok Project, there are several limitations to note. First, we used a pre-post quasi-experimental design, so additional studies are needed to pilot the study with a larger group of teachers, followed by experimental studies that use random assignment. Our small sample size made it difficult to detect any pre and post changes on the SPEAK-R, and it prevented

us from doing more sophisticated analyses like examining whether levels of engagement mediated the effects of the intervention on SPEAK-R scores, since one would imagine that lower engagement would be less likely to lead to gains in knowledge. Although SPEAK-R is an well-defined measure of early developmental knowledge, it includes items that were not covered by the BabyTok Project videos as seen by our analysis of the alignment between the SPEAK-R items and participant responses to interviews, thereby limiting the breadth of knowledge the ITTs could demonstrate following intervention. In the future, an intervention-specific measure testing items that were explicitly discussed may be more representative of potential treatment effects and could be developed and used alongside the SPEAK-R. Also, we did not collect any observational data as part of this study to investigate whether there were noticeable changes in the classroom wide interactions among ITTs and the children in their care.

Future Directions

The BabyTok Project has several potential next steps for further testing and scale-up. Next, it would be useful to first test the intervention with a larger group of ITTs, then with a group randomized to conditions to explore their thoughts, changes in knowledge, and their reports of the impact of the project on their practice across conditions. Next generation studies would likely focus on ITTs who report using social media already, to increase the chance of strong engagement with the videos. Given the feedback of the initial teachers, we will also include a larger focus on identifying and supporting infants and toddlers with communication delays within their interactions. Future interactions of the project could also use more features of Tiktok to engage ITTs. For instance, there is a Q & A function that lets users post questions to the owner of a page, this could be used to solicit ideas from teachers in real-time, which could be responded to in a video format. Next steps also include expanding the model to parents and others who are children's primary day time caregivers. The videos can be easily adapted for parents, sharing similar developmental information and strategies with them as well. Like the project for ITTs, videos could be used to reinforce the important role that caregivers play in the lives of their young children.

Conclusion

The primary purpose of the BabyTok Project was to build a low-cost, easy-to-access platform to meet the learning needs of ITTs to better support early interactions with the

infants and toddlers they serve. While Tiktok is still a new social media platform that has not been widely studied, ITTs offered initial evidence that it is an engaging and fun way to expand and reinforce their learning about early communication. With additional testing and development, the BabyTok Project could be a cost-effective means to reach ITTs nationwide, with content to promote their learning, to celebrate their role in the lives of young children, and to marvel at the incredible pace of learning in a child's first few years of life.

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Declarations

Conflict of interest We have no conflicts of interest to disclose.

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