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Empirical Article

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Impacts and costs of a mass media program on children's emotion knowledge, recognition, and regulation in Jordan: A cluster-randomized controlled trial

Casey Moran[1], Hirokazu Yoshikawa[2,*], Dennis Hilgendorf[2], Vicky Yiran Zhao[2], Dalia Al-Ogaily[2], Kate Schwartz[2], Joyce Rafla[2], Andrés Molano[1], Kendra Strouf[2], Mohammad Khanji[3], Rawan Abu Seriah[3], Mohammad Al-A'abed[3], Ragheb Fityan[3], Phoebe Sloane[3], Laila Hussein[3], Da'ad Hidayah[3], Manar Shukri[3], Tareq Sharawi[3], Kim Foulds[4], A. Brooks Bowden[5], Sangyoo Lee[5], Priyamvada Tiwari[2], and Jere Behrman[5]

[1]Teachers College, Columbia University, New York, United States
[2]Global TIES for Children, New York University, New York, United States
[3]International Rescue Committee, Amman, Jordan
[4]Sesame Workshop, Research and Insights, New York, United States
[5]University of Pennsylvania, Center for Benefit-Cost Studies of Education, Philadelphia, United States
*Corresponding author: Global TIES for Children, New York University, 726 Broadway Room 815, New York, NY 10012, United States. Email: hiro.yoshikawa@nyu.edu

Abstract

We evaluate *Ahlan Simsim*, an emotional development-focused television show produced by Sesame Workshop and Jordan Pioneers, through a cluster-randomized controlled trial in Jordan preprimary classrooms ($n = 216$ schools, 4,369 children; endline $M_{age} = 66.9$ months; 51% female; 97% Jordanian, 3% Syrian; data collected 2021–2022). Treatment classrooms received daily *Ahlan Simsim* viewing added to the KG2 curriculum for 12 weeks; control classrooms received the curriculum alone. Significant positive impacts were found on expressive emotion recognition, emotion situation knowledge, and one emotion regulation strategy, *breathing*, but not receptive emotion recognition or other emotion regulation strategies. Effect sizes (*d*) range from 0.11 to 0.36. Costs of intervention delivery are estimated at $3–7 per child. Implications for children's media and social-emotional learning interventions are discussed.

Keywords educational media, Middle East, social-emotional learning intervention

Lay summary

We evaluate *Ahlan Simsim*, a television show for young children produced by Sesame Workshop and Jordan Pioneers and designed to foster children's emotional development. We conducted an impact evaluation in Jordanian government preschool classrooms across three regions of the country. The sample included 4,369 kindergarten-age children from 216 schools (51% female; 97% Jordanian, and 3% Syrian). We evaluated daily Ahlan Simsim viewing added to the country's usual government preschool curriculum for 12 weeks; control classrooms received the government preschool curriculum alone. We found that Ahlan Simsim improved children's expressive emotion recognition, emotion situation knowledge, and one emotion regulation strategy, breathing, but not receptive emotion recognition or other emotion regulation strategies. Costs of intervention delivery are estimated at $3–7 per child. We discuss implications for children's media and social-emotional learning interventions.

There is a growing global consensus on the need to support young children's social-emotional development. The United Nations included social-emotional learning (SEL) in its early childhood target of Sustainable Development Goal 4 on lifelong learning and education (United Nations, 2015). However, low- and middle-income countries (LMICs), as well as humanitarian contexts, are underrepresented in the literature on SEL interventions (Haslam et al., 2019). Communities hosting large refugee populations experience significant service disruptions, especially when the communities themselves are already under-resourced (Jones et al., 2022).

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And yet, despite the integration of social-emotional learning in global goals for early childhood development (United Nations, 2015), there is a dearth of evidence on effective, cost-efficient strategies for doing so in under-resourced, conflict-affected settings.

In this study, we evaluate *Ahlan Simsim*, an educational television show designed to support children's emotional development in the Middle East. To assess its impact, we implemented an intervention showing a selection of *Ahlan Simsim* episodes (curated to represent the key themes of the entire show) in preprimary classrooms in Jordan, and conducted a cluster-randomized controlled trial examining its effects on children's emotion recognition, emotion situation knowledge, and emotion regulation.

Early childhood emotion knowledge and regulation

Emotional competencies in early childhood are critical for children's social-emotional development and academic success (Chaux et al., 2017; Murphy et al., 2018; Ndijuye, 2022). Two key components of early emotional development are emotion knowledge (i.e., emotion vocabulary, identification, and recognition) and emotion regulation (also known as emotion management or adjustment). Both are predicted by environmental factors such as modeling by others in the home (Raver, 2002; Zeman et al., 2006), and each has strong links to school readiness, long-term academic success, social competence, and positive mental and emotional health outcomes (Harrington et al., 2020; Izard et al., 2001). While most of this research comes from high-income countries, two recent studies in Jordan showed that emotion regulation was associated with higher levels of general social competence in 5- and 6-year-old children. One study used teacher ratings of these constructs (Qashmer, 2023), while another used child-reported measures (Hamaidi et al., 2021). Social-emotional skills are also a prominent part of the Jordanian preprimary curriculum, reflecting education leaders' perceptions of the importance of this domain (Ministry of Education Jordan, 2019). Finally, emotion knowledge and regulation have predicted child social skills and behavior in correlational studies in other LMICs such as Brazil (Reis et al., 2016), Colombia (Di Giunta et al., 2017), and Turkey (Orta et al., 2013).

Children demonstrate emotion knowledge through accurate perception of what a feeling is (their own or one being expressed to them) and the ability to assign the right label (i.e., vocabulary) to that feeling. Emotion knowledge is the general ability to identify and express emotions, while emotion situation knowledge is the ability to assess and determine the emotion that matches specific social scenarios. These skills predict children's success in early education environments (Heinze et al., 2015). For the purpose of this study, we focus on both general emotion knowledge and emotion situation knowledge.

Emotion regulation encompasses the management and expression of emotions (e.g., their intensity and how they are displayed) and the integration of environmental characteristics, cultural norms, and personal goals into that management (Qashmer, 2023; Raver, 2002). Children's abilities to appropriately regulate their emotions and behaviors play particularly tangible roles in their classroom functioning: these skills enable (or inhibit) acceptance from peers and teachers, participation in classroom instruction and activities, and positive experiences of school in general (Orta et al., 2013; Reis et al., 2016). Regulation skills include use of appropriate external (e.g., a parent) or internal (e.g., deep breathing) resources. By the preschool years, children adapt their emotional responses to match specific social situations, modifying behaviors in accordance with the social/cultural demands of those scenarios (Zeman et al., 2006).

Adverse experiences may disrupt development of these skills. Exposure to significant stressors and traumatic events predicted lower emotion recognition in Sierra Leone (Umilta et al., 2013). The ability to recognize and manage emotions can also buffer children from adverse outcomes associated with traumatic experiences and other stressors (Buckner et al., 2003). For example, preschool-age children with multiple adverse experiences showed fewer depressive symptoms when they were better able to recognize emotions (Sudit et al., 2022).

Early childhood SEL interventions: mass media and *Sesame Street*

Young children's emotion knowledge and regulation skills can improve through programs providing clear activities focused on identifying and managing emotions (Greenberg, 2006; Izard et al., 2008). While these processes can be taught and learned in a variety of ways, programs have tended to be school-based and teacher-implemented, leaving community-based and mass media programs less evaluated. Mass media in the form of broadcast television offers an accessible means through which to target these skills (Kohn et al., 2021). Impact evaluations of mass media content in early childhood in various LMIC contexts have found positive effects on a range of child outcomes including literacy and numeracy; inclusion of and positive attitudes toward outgroups; and prosocial behaviors (Borzekowski et al., 2019; Connolly et al., 2010; Kauffman et al., 2022; Mares & Pan, 2013; Zielinska & Chambers, 1995). Only one evaluation, however, has explored the impact of broadcast programming focused on emotion recognition and regulation, and it found no effects (Kauffman et al., 2022).

Sesame Workshop has been at the forefront of television and other media to support children's development and well-being since 1969; there is evidence that its programming can be effective in promoting SEL in young children. A meta-analysis of quasi-experimental and experimental studies found significant positive effects of exposure to *Sesame Street* on general social development (Mares & Pan, 2013), but only two studies have explored more specific emotional development outcomes. Correlational analysis of a program in Tanzania found that children's ability to recall show characters (a proxy for exposure to and retention of the show) predicted improvement in emotion recognition, whereas an experimental study in India showed no effects on emotion recognition (Borzekowski & Macha, 2010; Borzekowski et al., 2019).

Ahlan Simsim overview and outcomes of interest

Outside the United States, Sesame Workshop employs a co-production model, working with local production companies and other specialists to apply the *Sesame Street* format to producing original content in line with local culture, circumstances, and

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educational needs (Cole et al., 2014). Sesame's "Children's Television Workshop (CTW) Model" engages experts in television production, content development, and education research throughout the entirety of program development, delivery, and evaluation in order to iteratively produce and assess content in line with their goals (Fisch, 2000). First broadcast in February 2020 across 20 countries via the satellite channel MBC3, *Ahlan Simsim*, "Welcome Sesame" in Arabic, offers early learning via mass media to young children in the Middle East and North Africa (MENA). *Ahlan Simsim* is one element of the overall Ahlan Simsim initiative, a partnership between Sesame Workshop and the International Rescue Committee (IRC) that provides a variety of early childhood programming to families affected by conflict and crisis in Iraq, Jordan, Lebanon, and Syria (Foulds, 2022). Watched by over 23 million children across MENA, each season consists of 26 episodes guided by an educational curriculum (Sesame Workshop, 2023).

Sesame Workshop worked with Jordan Pioneers Multimedia Company to produce *Ahlan Simsim*. Caregiver and practitioner needs assessments, child-centered formative research, and an educational content seminar with advisors in Iraq, Jordan, Lebanon, and Syria informed the show's focus on emotion vocabulary and regulation (Kohn et al., 2021). Caregivers and practitioners spoke of the importance of social-emotional skills, including teamwork and cooperation, sharing and helping, expressing feelings and emotions, and communication skills.

The language used in *Ahlan Simsim* is primarily Levantine Arabic, including regional dialects spoken by different characters, as well as some Modern Standard Arabic (MSA) when teaching key terms and phrases. The intent of this approach was to balance accessibility to and engagement from children and families of different backgrounds, while providing more broadly understood terms for key concepts. The use of multiple dialects and MSA was also identified as useful for modeling the different contexts where each is appropriate.

In addition, because *Ahlan Simsim* aims to promote conversations about emotions between children and families, producers prioritized use of the home language over that of formal schooling for portraying central storylines. Specific emotion terms were selected in consultation with mental health experts in the region, with the goal of maintaining relevance in both MSA and dialect, to make them as neutral and broadly understandable as possible. In addition to extensive initial discussion, language advisors provided feedback on the use of language and dialects in Season 1, as well as on set with Jordan Pioneers throughout production.

Research questions

Children's knowledge of and strategies for regulating emotions are the key curriculum-based targets of the first four seasons of *Ahlan Simsim*, and the focus of this study. To test *Ahlan Simsim*'s impact on these outcomes, we implemented a 12-week randomized controlled trial in Jordan government (KG2 level) preschools. The treatment arm classrooms showed 26 episodes of *Ahlan Simsim* (a selection from the first four seasons) during regular school hours, and the control condition continued with the normal curriculum (the broadcast was already available for home viewing throughout Jordan). Each episode, ~25 min long, was shown two times. All impact and cost analysis questions are in comparison to the business-as-usual control condition. In addition to our main outcomes, we include children's familiarity with the program content, a first-order set of impacts related to basic attention to the program that we expect to observe if we are to find more distal effects on children's social-emotional skills. Additionally, moderation of early education impacts by gender and age has been a longstanding issue in the field (e.g., Magnuson et al., 2016). We therefore examined these factors as exploratory moderators.

1. Do children exposed to the curated *Ahlan Simsim* episodes in school demonstrate greater character recognition and knowledge, and home use of key program phrases? [Implementation check]
2. What are the impacts of exposure to the curated *Ahlan Simsim* episodes in school on children's home viewing of the *Ahlan Simsim* broadcast?
3. What are the impacts of exposure to the curated *Ahlan Simsim* episodes in school on children's emotion knowledge and emotion regulation?
4. Do some children benefit more than others from the program (by age or gender)?
5. What is the cost of delivering *Ahlan Simsim* in KG2 classrooms in Jordan?

We hypothesize increases in implementation (character recognition, positive responses to characters, home use of key phrases, and home viewing) as well as child (emotion recognition, situation knowledge, and regulation) outcomes.

Method

Research design and intervention

This two-arm, cluster-randomized controlled trial took place in public schools in three governorates of Jordan in the 2021–2022 academic year. We randomized schools in each of these three governorates to: (a) a treatment group of KG2 classrooms showing *Ahlan Simsim* once a day to 5–6-year-old children for 12 weeks alongside the Jordan Ministry of Education (MoE) standard KG2 curriculum; or (b) a control group of KG2 classrooms receiving just the standard KG2 curriculum. The treatment condition classrooms received installation (1.5 m above the floor) of a 55-inch TV as a donation that they kept after the intervention (none of the Jordanian public school KG2 classrooms had a TV prior to this study). Treatment classroom teachers also received flash drives with *Ahlan Simsim* episodes loaded onto them, instructions for showing the episodes, and access to implementation supervisors for support in sharing the TV show each day in class. Implementation supervisors received WhatsApp messages from teachers each day to confirm viewing of the correct episode according to a pre-set schedule and were present during viewing of the show within the classroom during weekly visits. Teachers did not receive any further guidance or structured materials for delivering the intervention. They were not instructed to remove any portion of the KG2 curriculum during the 12 weeks they showed the program, and maintained the same school day hours as control classrooms.

Procedures

Sample and randomization

In collaboration with the Jordan MoE, the research and program team identified Irbid, Balqa, and Karak (representing northern,

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central, and southern parts of the Jordan Valley) for this study. From among 338 schools with at least one KG2 classroom (per 2020–2021 records), the team selected 216 schools based on location and feasibility. The MoE contacted these schools, and all 216 school principals consented to the study. Within each school, one classroom participated in the study. This selection was primarily determined by Ministry designation as an "essential" KG2 classroom. In some cases, additional factors such as size of classroom or strong principal preference were considered. Within selected classrooms, we recruited all children for the research sample. Of the 4,614 families contacted, 95% ($n = 4{,}369$) consented and completed the baseline caregiver survey. There were no statistically significant differences in consent rates across the governorates. In alignment with MoE enrollment data (7% of KG2 students across Jordan and 4% of those in these three governorates report Syrian nationality), this sample is 97% Jordanian host community and 3% Syrian refugee families.

The final sample included 216 KG2 schools/classrooms: 108 randomized to the *Ahlan Simsim* treatment condition and 108 to the business-as-usual control condition. We found no statistically significant differences between treatment and control groups on children's age, gender, nationality, baseline at-home viewing of *Ahlan Simsim*, or caregivers' age, gender, education, social resources, and parenting stress. Thus, the randomization of the sample to treatment and control groups appeared successful in balancing the experimental groups on observed baseline characteristics (see Appendix A).

Data collection

All study procedures and measures received approval from the IRC's Institutional Review Board (IRB) and senior staff of the departments of research and early childhood education of Jordan's MoE. IRC hired and managed enumerators and supervisors ($n = 107$ enumerators; 20 supervisors), and, in collaboration with the NYU team, trained enumerators on administering measures and consent for each stage of data collection (1–3 weeks duration each). Training included consent processes, phone-based caregiver survey and child assessment administration, child safeguarding, referral procedures for child protection, school logistics, and research ethics. Enumerators also provided feedback on Arabic language dialect translations of measures and suggestions to enhance participant understanding of items/tasks.

Caregiver survey

Enumerators administered 30–45 min phone surveys to caregivers before and after the intervention. The baseline survey included child and family demographics, household characteristics, and media exposure. The endline survey verified a small portion of demographics and household characteristics, reassessed media exposure, and included items on children's use of emotion words and key *Ahlan Simsim* phrases at home.

Teacher survey

Enumerators collected teacher-reported data on years of teaching experience, education level, number of students in the class, and daily class attendance.

Endline child measures

Assessments of children's emotion recognition, situation knowledge and regulation, and familiarity with *Ahlan Simsim* characters took place in all sample schools (35–45 min per child), and only at endline due to COVID-19 restrictions on in-person data collection at baseline. Adapted from the Affect Knowledge task (Denham, 1986; Heinze et al., 2015) and Challenging Situation Task (Denham et al., 2014), the assessment includes qualitative and quantitative items administered through two tasks, showing stimuli of facial expression drawings on cards, and reading 11 illustrated vignettes of social situations featuring characters (1 boy and 1 girl), each written to focus on a single targeted emotion (see Appendix B). The 95 enumerators recorded open-ended responses on tablets.

Prior to this impact evaluation, the child direct assessment underwent extensive development through three rounds of pilot studies, and ongoing feedback from program partners. Through this process, we modified child assessment stories, illustrations, and items to ensure they were (1) culturally appropriate and relevant, (2) sufficiently engaging for KG2 children, and (3) logistically feasible for administering in public school settings in Jordan.

Measures

Implementation measures

Ahlan Simsim characters

At endline, we assessed children's ability to recognize and name each of the seven main characters from *Ahlan Simsim* (printed on cards) and whether they liked the character as three separate items. We coded children's answers as yes or no and averaged (i.e., range between 0% and 100% for each child) each of the three questions. We also asked children where they knew each of the *Ahlan Simsim* characters from; enumerators categorized their responses into three groups, "*Ahlan Simsim*," "TV/Mobile/YouTube," or "other sources," and we calculated the proportion of children choosing "*Ahlan Simsim*." We treated these character knowledge items as individual outcomes (i.e., recognized all seven characters, correctly named all seven characters, liked all seven characters, knew Basma from *Ahlan Simsim*, knew Jad from *Ahlan Simsim* (Basma and Jad are the two main characters), and knew the rest of the characters from *Ahlan Simsim*).

Frequency of Ahlan Simsim phrases and viewing at home

We asked caregivers to report children's use of emotion words and phrases related to *Ahlan Simsim* at endline. These questions used a four-point frequency scale over the course of the past two weeks for frequency of *talking about their emotions*, using the emotion words *happy, sad,* and *angry* at home, "*power pose*," "*me love cookies*," "*Ma'zooza*" (the main animal character in the show), "*squeeze your brain*," and "*let's ask how they feel*." We treated these nine items as individual outcomes. Caregivers also reported frequency of watching *Ahlan Simsim* at home at both baseline and endline, using a four-point scale (from don't watch to daily watching).

Children's emotion recognition

Children's expressive and receptive emotion recognition

This measure was adapted from the Affect Knowledge task (Denham, 1986; Heinze et al., 2015) to focus on emotions drawn from the *Ahlan Simsim* curriculum. Enumerators used male or female facial expression illustrations, to correspond with each child's gender. In the expressive emotion recognition measure, enumerators asked, "*how is he/she feeling in the picture*?" in relation to six different pictures shown one at a time: *happy, sad* (shown twice), *angry, scared,* and *frustrated*. We calculated children's overall expressive emotion recognition (i.e., between 0% and 100%, $\alpha = 0.7$) using the proportion of correct answers out of the five emotions shown once during the six tasks, and the

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average proportion of correct answers on *sad*. We also conducted exploratory analyses treating these expressive emotions as five separate outcomes (again averaging scores for *sad*).

For receptive emotion recognition, enumerators showed all six faces in a grid and asked children to identify *happy, frustrated, angry, afraid,* and *sad* faces ("can you point to the face you think is showing the emotion I am telling you?"). We coded each task as correct or incorrect. We used the proportion of correct answers ($\alpha = 0.3$) to reflect children's overall receptive emotion recognition, and also conducted exploratory analyses with the emotions as separate outcomes.

Children's emotion vocabulary, situation knowledge, and regulation

Vignette tasks

We presented children with 11 vignettes containing mainly challenging or stressful situations and one positive situation, designed to elicit a range of emotions, with six target emotions primarily drawn from the *Ahlan Simsim* curriculum (see Appendix B). The vignettes depicted two characters, a girl, Farida and a boy, Zaid, each depicted as roughly 5 or 6 years old. For each vignette, we asked children four questions: *(1) How does Farida/Zaid feel now?*; *(2) What is the reason that makes her/him feel this way?*; *(3) What can Farida/Zaid do to calm herself/himself and release the stress?*; and *(4) What would you do if you felt that way?* Enumerators recorded children's responses to each of these questions.

Qualitative coding of vignette task responses

A team of 10 Arabic-speaking analysts from the Levant region conducted qualitative coding of children's responses to these vignettes, using a grounded theory approach (Strauss & Corbin, 1994). Through open coding on a sample of 50 transcripts, the team generated a codebook and subsequently revised it to reach reliability standards (inter-rater reliability kappa >0.8 (80%) for all codes). In addition to codes that emerged in open coding, we included codes for the predetermined vignette target emotions (see Appendix C). Each code was applicable across all vignettes and items (i.e., not exclusive to a particular vignette/item). Children's responses were rated present or absent for each code; these dichotomous variables were then combined into the outcome measures described below.

Use of emotion vocabulary

This measure builds upon the Challenging Situation Task (Denham et al., 2014). The qualitative analysis team identified the emotion words children mentioned across 11 vignettes: *anger, caring, fear, frustration, nervousness, hope/determination, jealousy, loneliness, sadness,* and *happiness*. We summed up the total number of times children mentioned each of these 10 emotions across all 11 of the vignette-based responses.

Emotion situation knowledge

Adapting the Challenging Situation Task (Denham et al., 2014), we assessed children's emotion situation knowledge using the same 11 vignettes. There are six emotion target words across vignettes: *jealousy, caring, hope/determination, nervousness, loneliness,* and *frustration*. Apart from *frustration*, the remaining five target emotion words were each repeated twice. In contrast to the Challenging Situation Task, we did not use a forced-choice design; children were interviewed, which allowed more detailed responses.

Children's responses could include identification of the exact target word, description of the target word, or, in some cases, mention of the target word in subsequent responses within the same vignette (after they were unable to correctly answer Question 1, which directly asks them to identify the emotion word of that vignette). We also evaluated whether children gave a response that was the correct valence of the target word (e.g., negative for *frustration* and positive for *caring*). We coded responses as correct or incorrect valence according to the positive or negative connotation in each vignette. Therefore, we extracted three measures of children's emotion situation knowledge: (1) correct mention of target emotion when directly asked ($\alpha = 0.64$); (2) correct mention of target emotion to a later question ($\alpha = 0.64$); and (3) correct valence of the target emotion word ($\alpha = 0.90$). We coded each measure dichotomously (1 correct, 0 incorrect) for each of the vignettes and calculated four average scores across 11 vignettes (thus representing the proportion across all vignettes). We also conducted exploratory analyses for each of these four measures by specific emotion word as six separate outcomes (we averaged the five targeted emotions repeated across vignettes).

Emotion regulation strategies

After each of the 11 vignettes, questions 3 and 4 above solicited children's emotion regulation strategies for themselves and the characters. The strategies children gave (19 in total) fell into three predetermined categories: prosocial, passive, and aggressive/hostile (Blair et al., 2004). Prosocial strategies included four that map onto those targeted in the curated *Ahlan Simsim* content (of a total of six directly targeted by the show; the other two did not emerge in the data): *asking for help, finding an alternative/making a plan, breathing,* and *taking a break*. Other prosocial strategies that emerged were *singing, dancing, determined behavior, playing/continuing to play, sharing,* and *expressing kind words.* Passive regulation strategies included *no reaction or nothing, avoidance,* and *acceptance*. One passive strategy emerged only with reference to self: *reverse emotional reaction*. Aggressive/hostile strategies included *hitting, yelling, stealing, ignoring safety instructions or rules,* and *other aggressive behaviors* (see Appendix C for definitions of each). We calculated the total number of times children mentioned each of these emotion regulation strategies across the 11 vignettes. Emotion regulation strategies for self and for character each had Cronbach's alpha of 0.58.

Concurrent validity of emotional development measures

We assessed concurrent validity of child emotion recognition, vocabulary, situation knowledge, and regulation measures by conducting Fisher's z-transformation (suggested for datasets with multiple imputation) of correlations with child age and caregiver education level (Appendix I; Harel, 2009).

Covariates

We included the following covariates in analyses: child gender, age at endline (months), nationality (Syrian vs. not Syrian), at-home viewing of the *Ahlan Simsim* TV show (at baseline), and general health (four-point scale) (WHO, 2018); school governorate (Irbid, Balqa, and Karak); caregiver gender, age (years), education level (coded on a five-point ordinal scale from basic education and below to university degree and above), and general health (coded on a four-point scale) (WHO, 2018); household size (total number, separate totals of adults and children in household); and two indicators of socio-economic status from (a) perceived refugee environment index (McEwen et al., 2023) pertaining to household resources

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(access to clean water, food, heating, transportation, health services electricity, income, and housing; $a = 0.86$, 12 items) and (b) caregiver social support for family resources (food and money, care for child, and personal problems; three separate dichotomous items (Moser et al., 2012); see Appendix D). We also controlled for parental stimulation at home as an average score across five items on play and learning material use ($a = 0.52$) (Kariger et al., 2012) and assessed parenting stress using the parental stress scale as an average score on nine items ($a = 0.8$) (Berry & Jones, 1995). Teacher-reported covariates included teachers' years of experience; number of students in the classroom and teacher education level (coded on a five-point ordinal scale from basic education and below to university degree and above; see Appendix D).

Missing data

From our full baseline sample of 4,369 children (2,257 control and 2,112 treatment), we identified that 56 either had ID issues (after cross-checking with their school attendance) or may have copied each other's answers in the child assessments (after analyzing transcripts). We removed these records, for a total analytic sample of 4,313 participants (2,237 control and 2,076 treatment). Additionally, 3.59% of our sample did not participate in the endline caregiver survey, and 12.8% did not participate in the child assessment. There was minimal item-level missingness (<4%) on outcomes and covariates, except *Ahlan Simsim* character knowledge (20% missing cases). The amount of overall missingness did not differ significantly between treatment and control. In addition, through regression analysis, we found that there was no statistically significant differential attrition by treatment status, measured by missingness between baseline and each of the endline data sources (teacher survey, child assessment, and caregiver survey). We used Multiple Imputation chained in Stata 17 to generate 100 complete and imputed datasets with the total analytic sample of $n = 4{,}313$ for all analyses. We omitted endline and treatment status assignment variables when imputing baseline outcomes so that we are not predicting pretreatment values by anything that might have been affected by treatment. We ran the same analyses on the pre-imputed datasets, and results were essentially identical. Here we report the imputed results (see Appendix E for non-imputed impact results).

Analytic approach

We used mixed models to account for both fixed and random effects. In our case, children are nested within school, so fixed effects give rise to the average treatment effects while the random effects account for differences between schools that could induce correlations among outcome levels of children from the same school. We used individual- and school-level (teacher-reported) covariates and children's treatment/control status:

$$Y_{ij} = \beta_0 + \beta_1 \left(T_x\right)_j + \alpha\left(\textit{individual covariates}\right)_{ij} + \gamma\left(\textit{school covariates}\right)_j + e_{ij} + u_{0j}$$

$$e_{ij} \sim N\left(0, \sigma_e^2\right)$$

$$u_{0j} \sim N\left(0, \sigma_u^2\right)$$

Where Y_{ij} is the outcome variable tested on child i in school j, β_0 is the mean outcome level for children in the control groups, β_1 is the main treatment effect (i.e., the average difference in the mean outcome between children in treatment and control groups), α refers to the coefficients of a range of child-level covariates controlled in the mixed-effects models, γ refers to the coefficients of a range of school-level covariates controlled in the mixed-effects models, e_{ij} is the random error associated with child i in school j, and u_{0j} is the random error associated with school j.

Using false discovery rate methods, adjustment of p-values for multiple hypothesis testing was used to minimize the type I errors (Benjamini & Yekutieli, 2001). The outcomes were grouped into conceptual families as indicated in Tables 1 and 2 with family-wise adjustment, as recommended by the Institute for Educational Sciences (Schochet, 2008).

Cost estimation methods

We apply the ingredients method in a cost-effectiveness framework to estimate the cost of this intervention, causally identifying resources delivered through the treatment relative to a control condition (Levin et al., 2017). Following cost-effectiveness standards, we apply the economic principle of opportunity cost to reflect the value of all resources related to the treatment's effectiveness. We measure the ingredients, or resources, for treatment and control classrooms to estimate the cost per child of delivering the treatment relative to the cost per child of the business-as-usual KG2 national curriculum provided to control classrooms.

Ingredients of the *Ahlan Simsim* intervention included facilities, materials, and personnel. Facilities consisted of the classroom to provide space for the TV. Materials were the TVs and flash drives with episodes. Personnel consisted of supervisors/enumerators who supported and monitored implementation and provided technical support and IRC personnel who procured the TVs and flash drives, managed flash drives and TV installation, and created guidelines for teachers. We also include teacher time in the personnel category in a second estimate to account for this potential cost in future iterations of delivering this intervention. However, our primary cost estimate of this implementation of the intervention excludes teacher time, as teachers in the treatment group did not extend their work hours to support the delivery of the intervention.

We assessed these ingredients during program implementation to reflect what was delivered through the intervention in practice. We collected data from teachers in treatment and control schools about their time and classroom practices with surveys. For the calculation including teachers' time, we used the average monthly salary for KG2 teachers in Jordan and estimated an hourly rate based on a 30-hour work week over 4 weeks. To estimate the costs of the materials and program staff, we collected data from IRC's implementation records, expenditure records, and interviews with staff. We collected information on program personnel and related salaries, descriptions and quantities of TVs, and the market rate for bulk TV purchases. To examine the sensitivity of our results to this choice, we estimated costs using available market rates for TVs matching the description of the ones used to deliver the *Ahlan Simsim* intervention. We find no difference related to which price value is used.

We estimated costs in 2022 U.S. Dollars, as this was the currency used by IRC to deliver the intervention. Finally, we adjusted the purchase prices for equipment (e.g., TVs) to reflect the length of

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time these materials were used for the intervention, using a 3.5% discount rate.

Results

Descriptive results

Of the 4,313 children in the baseline sample, 51% were female. The mean child age at endline was 66.9 months (SD = 14.7 months). Only 3% of children were Syrian ($N = 130$). Children based in Irbid comprised 57.5% of the sample ($N = 2,481$), with 29% in Balqa, and 13.5% in Karak. More than 91% of children had fair to good general health. Prior to the intervention, 86% of children had never watched *Ahlan Simsim* and 4% watched it a few times a week or more.

Caregivers had a mean age of 34.8 years (SD 6.4 years) and 92% were females. 30% held at least a bachelor's degree, 37% held a high school degree, and 6% received basic education or below. Around 92% of caregivers reported fair to good general health. Households averaged 2.24 adults (SD = 1.18) and 2.61 children (SD = 1.38). With regard to stimulation activities at home, 50%–60% of caregivers reported that they have toys made by adults and toys that make music. Around 80% of families reported having household objects, materials from outside the house, toys for building things, things for moving a lot, and toys for playing pretend, and 94% had things for drawing and writing. In terms of parenting stress, 42% of caregivers reported that they always feel worried that they have not done enough for their children, and around 20%–25% always feel that their child has been a major stress in their lives both financially and emotionally. Between 30% and 50% of caregivers reported that they never or seldom have enough income or resources to pay for basic needs (e.g., food and housing).

For teachers in the sample, 97% had completed at least a bachelor's degree, with 3% holding at least a diploma degree. On average, they had 10.3 years of teaching experience (SD = 0.1). Classroom size averaged 23.6 students (SD = 0.14).

The attendance rate during the intervention was 73% in treatment schools and 82% in control schools, possibly due to differences in data collection: Enumerators' caseloads consisted of 4–5 schools in the treatment group, compared to 16–19 schools in the control group. Variation in time or relationships with teachers due to these different caseloads may have led to differences in teacher-reported attendance across groups.

Validity analyses on the child emotion outcomes showed positive correlations of parental education with expressive and receptive emotion recognition, 4 of the 10 emotion vocabulary words used in the facial expression stimuli, proportion correct valence of the target emotion in the vignettes, and 7 of the emotion regulation strategies (roughly half). All were in expected directions, though small in magnitude (see Appendix I). There were fewer correlations with child age; however, this was a variable with a very restricted range as the study focused on one grade.

Impact analysis

Tables 1 and 2 show control and treatment group means, effect size (ES), unadjusted *p*-value, and *p*-value adjusted for family-wise multiple hypothesis testing, for each outcome. We describe here statistically significant results when they withstand corrections for multiple hypothesis testing and report the adjusted *p*-values. For the main effects (research questions 1– 3), we used four groups for multiple hypothesis testing: (A) *Ahlan Simsim* character recognition, liking, and knowing the source, and frequency of watching *Ahlan Simsim* at home; (B) Frequency of using emotion words and phrases from *Ahlan Simsim* at home; (C) Expressive and receptive emotion recognition, emotion vocabulary, and emotion situation knowledge; and (D) Emotion regulation strategies. The maximum intraclass correlation coefficient among all outcomes was a relatively low 0.094.

Research questions 1 and 2: effects on implementation outcomes and home viewing

Table 1 shows that children in the treatment group were more likely to recognize the seven characters (B = 0.20, ES = 0.53, t = 7.79, adj. $p = .001$), correctly name (B = 0.28, ES = 0.83, t = 12.88, adj. $p = .001$) and like them (B = 0.05, ES = 0.24, t = 5.49, adj. $p = .001$). They were also more likely to identify *Ahlan Simsim* as how they know Basma (B = 0.36, ES = 0.77, t = 13.04, adj. $p = .001$), Jad (B = 0.37, ES = 0.79, t = 13.10, adj. $p = .001$), and the rest of the characters (B = 0.38, ES = 0.93, t = 13.36, adj. $p = .001$).

There were no significant differences between treatment and control in caregiver-reported use of emotion words such as happy, sad, angry, and mad at home, or in using the phrases "power pose," "me love cookies," "squeeze your brain," and "let's ask how they feel." Children in the treatment group were more likely to mention "Ma'zooza" (B = 0.26, ES = 0.27, t = 3.72, adj. $p = .001$) and more frequently watch *Ahlan Simsim* at home (B = 0.13, ES = 0.17, t = 2.48, adj. $p = .007$).

Research question 3: effects on primary outcomes (Table 2)

Effects on emotion recognition

Children in the treatment group showed significantly higher expressive emotion recognition (B = 0.05, ES = 0.17, t = 2.62, adj. $p = .017$). In exploratory analyses on individual emotions (see Appendix F), children in the treatment group were more likely to name *angry* (B = 0.05, ES = 0.11, t = 2.15, adj. $p = .046$), *frustrated* (B = 0.04, ES = 0.15, t = 2.79, adj. $p = .015$), and *scared* (B = 0.09, ES = 0.21, t = 3.08, adj. $p = .011$) correctly. There were no significant differences in children's abilities to name *happy* and *sad*. For receptive emotion recognition, there were no significant differences overall or for individual emotions.

Effects on the use of emotion vocabulary

Children in the treatment group more frequently mentioned *fear* (B = 0.17, ES = 0.19, t = 2.76, adj. $p = .014$), *frustration* (B = 0.43, ES = 0.34, t = 6.05, adj. $p = .001$), *nervousness* (B = 0.13, ES = 0.24, t = 3.60, adj. $p = .001$), and *loneliness* (B = 0.12, ES = .30, t = 2.87, adj. $p = .014$). There were no significant differences between treatment and control groups in frequency of mentioning other emotion words, *anger*, *happiness*, *sadness, caring*, *jealousy*, and *hope/determination*.

Effects on emotion situation knowledge

Children in the treatment group were more likely to correctly name the target emotion of the vignettes when asked (B = 0.04, ES = 0.36, t = 3.02, adj. $p = .011$) and to use the word in a later question on the

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Table 1 Intent-to-treat (ITT) estimates research questions 1 and 2: effects on implementation outcomes and home viewing ($n = 4{,}313$).

Outcome (hypoth. direction)	Control μ (pooled SD) ($n = 2{,}237$)	Treatment μ (pooled SD) ($n = 2{,}076$)	ITT effect	Effect size	t(df)	*p*-value	Adj. *p*-value
Outcomes Group A							
***Ahlan Simsim* (*AS*) character recognition/knowledge and frequency of watching *AS* at home: child direct assessment**							
Recognize characters (+)	0.57 (0.40)	0.78 (0.35)	0.20***	0.53**	7.79	<.001	.001
Name characters (+)	0.21 (0.33)	0.50 (0.34)	0.28***	0.83**	12.88	<.001	.001
Like characters (+)	0.89 (0.19)	0.95 (0.22)	0.05***	0.24**	5.49	<.001	.001
Learned Basma from *AS* (+)	0.20 (0.44)	0.57 (0.49)	0.36***	0.77**	13.04	<.001	.001
Learned Jad from *AS* (+)	0.20 (0.44)	0.58 (0.49)	0.37***	0.79**	13.10	<.001	.001
Learned both from *AS* (+)	0.18 (0.43)	0.58 (0.49)	0.38***	0.83**	13.36	<.001	.001
Watching *AS* at home (+)	0.35 (0.79)	0.48 (0.79)	0.13**	0.17**	2.48	.013	.007
Outcomes Group B							
Frequency of using key words/phrases from *AS* at home: caregiver report							
Talk about emotions (+)	1.73 (1.04)	1.73 (1.05)	0.01	0.01	0.09	.925	.819
Use the word "sad" (+)	0.81 (0.90)	0.87 (0.93)	0.07	0.08	1.27	.203	.667
Use the word "angry/mad" (+)	1.26 (1.03)	1.30 (1.06)	0.06	0.06	1.10	.271	.667
Use the word "happy" (+)	1.69 (1.09)	1.74 (1.10)	0.06	0.05	0.87	.384	.783
Say "power pose" (+)	1.60 (1.30)	1.66 (1.32)	0.08	0.06	1.04	.300	.667
Say "me love cookies" (+)	1.81 (1.55)	1.74 (1.53)	−0.04	−0.02	−0.32	.752	.819
Say "Ma'zooza" (+)	0.40 (0.90)	0.62 (1.01)	0.26**	0.27**	3.72	<.001	.001
Say "squeeze your brain" (+)	0.42 (0.88)	0.49 (0.91)	0.08	0.09	1.28	.201	.667
Say "let's ask how they feel" (+)	0.50 (0.90)	0.58 (0.93)	0.09	0.10	1.49	.137	.667

Note. Two-tailed tests. *$p < .05$, **$p < .01$, ***$p < .001$.

vignette (B = 0.003, ES = 0.14, t = 2.74, adj. $p = .015$), but there was no statistically significant difference in describing the target word without naming it. They were also more likely to respond with an emotion word that was the same valence as the target word (B = 0.06, ES = 0.16, t = 2.80, adj. $p = .014$).

In exploratory analyses on specific emotions (see Appendix F), the treatment group was more likely to correctly mention the valence of (B = 0.07, ES = 0.16, t = 2.70, adj. $p = .017$) and describe *jealousy* (B = 0.002, ES = 0.08, t = 2.57, adj. $p = .018$), but not more likely to give the exact word *jealousy*. For *caring,* there were no significant differences between the treatment and control group in naming the exact target word or giving a response with the correct valence. The treatment group was more likely to correctly describe it (B = 0.01, ES = 0.13, t = 2.50, adj. $p = .020$). For *hope/determination*, there were no significant differences in naming, describing, or identifying valence. For *nervousness*, the treatment group was more likely to name the exact word when asked (B = 0.01, ES = 0.10, t = 2.85, adj. $p = .014$), give the exact word in a later question (B = 0.05, ES = 0.27, t = 3.14, adj. $p = .011$), and identify its valence (B = 0.05, ES = 0.20, t = 3.88, adj. $p = .001$), but there were no significant differences in describing it. For *loneliness*, the treatment group was more likely to mention the exact word in a later question (B = 0.06, ES = 0.30, t = 2.88, adj. $p = .014$) and to give its correct valence (B = 0.09, ES = 0.21, t = 3.56, adj. $p = .001$), but there were no significant differences in describing it or naming the exact word when asked. For *frustration*, the treatment group was more likely to name the word when asked (B = 0.01, ES = 0.11, t = 3.06, adj. $p = .011$), mention it in a later question (B = 0.06, ES = 0.31, t = 5.54, adj. $p = .001$) and give its valence (B = 0.08, ES = 0.17, t = 2.82, adj. $p = .014$), but not to describe it.

Effects on emotion regulation strategies

We found no significant differences between the treatment group and control group in mentioning any of the prosocial strategies when choosing for either character in the vignettes or themselves (what they would do if they felt that way), apart from *breathing*. Children in the treatment group were more likely to mention *breathing* both as a strategy the characters in the vignette could or should use (B = 0.20, ES = 0.21, t = 3.88, adj. $p = .001$) and as a strategy for themselves (B = 0.16, ES = 0.18, t = 3.44, adj. $p = .018$). We also found no significant differences between the treatment group and control group in mentioning any of the passive or aggressive strategies, either when choosing for the character in the vignettes or for themselves.

Research question 4: moderation effects

We found no significant moderation effects of child gender or age on any outcomes.

Research question 5: program costs

Showing the collection of selected *Ahlan Simsim* episodes to 108 treatment classrooms (2,120 students) in KG2 classrooms in Jordan cost $6,360 in total or $3 per child. These costs do not reflect the costs of creating the mass media content itself. The staff required to procure equipment and oversee implementation was the main driver of costs. Equipment was the second largest category. IRC purchased 112 TVs ($52,113) and 128 flash drives ($624).

While the treatment did not include extending teachers' work hours, teachers did report watching the *Ahlan Simsim* episodes,

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Table 2 Intent-to-treat (ITT) estimates research question 2: effects on children's social-emotional skills ($n = 4{,}313$).

Outcome (hypoth. direction)	Control μ (pooled SD) ($n = 2{,}237$)	Treatment μ (pooled SD) ($n = 2{,}076$)	ITT effect	Effect size	t(df)	*p*-value	Adj. *p*-value
Outcomes Group C							
Emotion Recognition							
Expressive (+)	0.52 (0.26)	0.58 (0.27)	0.05*	0.17*	2.62	.009	.017
Receptive (+)	0.38 (0.16)	0.38 (0.15)	0.001	0.01	0.20	.840	.331
Emotion Vocabulary (in italics if targeted by *Ahlan Simsim* curated curriculum)							
Anger (+)	0.29 (0.93)	0.24 (0.85)	−0.03	−0.004	−1.02	.307	.217
Caring (+)	0.00 (0.11)	0.02 (0.7)	0.03	0.19	1.41	.159	.127
Fear (+)	0.30 (0.82)	0.49 (0.99)	0.17*	0.19*	2.76	.005	.014
Frustration (+)	0.07 (0.96)	0.54 (1.57)	0.43***	0.34**	6.05	<.001	.001
Nervousness (+)	0.05 (0.44)	0.19 (0.64)	0.13**	0.24**	3.60	<.001	.001
Hope/Determination (+)	0.02 (0.21)	0.06 (0.28)	0.04	0.17	1.40	.160	.127
Jealousy (+)	0.08 (0.40)	0.17 (0.45)	0.08	0.19	1.98	.048	.065
Loneliness (+)	0.06 (0.36)	0.19 (0.47)	0.12*	0.30*	2.87	.004	.014
Sadness (+)	4.13 (3.59)	4.27 (3.52)	−0.05	−0.02	−0.20	.838	.331
Happiness (+)	0.81 (0.95)	0.82 (0.96)	−0.01	−0.01	−0.14	.892	.333
Emotion Situation Knowledge (across all target emotion words)							
Exact word when asked (+)	0.02 (0.08)	0.06 (0.12)	0.04*	0.36*	3.02	.002	.011
Correct description (+)	0.02 (0.05)	0.02 (0.06)	0.003	0.05	0.70	.485	.277
Exact word later (+)	0.00 (0.02)	0.01 (0.02)	0.003*	0.14*	2.74	.006	.015
Correct valence (+)	0.52 (0.38)	0.60 (0.36)	0.06*	0.16*	2.80	.005	.014
Outcomes Group D							
Emotion Regulation Strategies—Character (in italics if targeted by *Ahlan Simsim* curated curriculum)							
Ask for help (+)	1.11 (1.40)	1.04 (1.49)	0.10	0.06	1.00	.318	.400
Find alternative/make plan (+)	1.61 (1.65)	1.46 (1.75)	−0.27*	−0.16	−2.21	.027	.117
Breathing (+)	0.01 (0.29)	0.21 (1.32)	0.20**	0.21*	3.88	<.001	.001
Sing (+)	0.10 (0.34)	0.09 (0.31)	−0.01	−0.02	−0.46	.649	.644
Dance (+)	0.00 (0.05)	0.00 (0.06)	0.002	0.03	1.19	.235	.368
Determined behavior (+)	0.74 (1.11)	0.77 (1.07)	−0.01	−0.01	−0.24	.812	.644
Play/continue to play (+)	1.06 (1.29)	0.97 (1.25)	−0.16*	−0.12	−2.01	.044	.135
Sharing (+)	0.06 (0.25)	0.05 (0.24)	−0.01	−0.03	−1.39	.164	.356
Expressing kind words (+)	0.03 (0.21)	0.06 (0.26)	0.03**	0.14	2.69	.007	.084
No reaction (−)	0.21 (0.92)	0.21 (0.92)	0.02	0.02	0.25	.801	.644
Avoidant (−)	0.30 (0.67)	0.26 (0.62)	−0.04	−0.05	−1.22	.223	.368
Acceptance (−)	0.59 (0.85)	0.49 (0.82)	−0.11*	−0.13	−2.42	.016	.108
Hitting (−)	0.03 (0.22)	0.02 (0.18)	−0.01	−0.07	−1.52	.128	.297
Yelling (−)	0.01 (0.14)	0.01 (0.11)	−0.004	−0.02	−1.19	.233	.368
Stealing (−)	0.07 (0.27)	0.05 (0.25)	−0.02	−0.07	−1.77	.077	.213
Ignore safety instruction/rule (−)	0.07 (0.27)	0.09 (0.28)	0.01	0.06	1.15	.250	.373
Other aggressive behaviors (−)	0.04 (0.25)	0.04 (0.26)	−0.002	−0.01	−0.27	.789	.644
Emotion Regulation Strategies—Self (in italics if targeted by *Ahlan Simsim* curated curriculum)							
Ask for help (+)	1.16 (1.56)	1.29 (1.65)	0.06	0.04	0.51	.611	.644
Find alternative/make plan (+)	1.66 (1.73)	1.49 (1.66)	−0.27*	−0.16	−2.30	.022	.108
Breathing (+)	0.01 (0.19)	0.18 (1.26)	0.16**	0.18*	3.44	.001	.018
Sing (+)	0.20 (0.42)	0.17 (0.40)	−0.02	−0.06	−1.26	.207	.368
Dance (+)	0.00 (0.06)	0.00 (0.06)	0.001	0.01	0.31	.760	.644
Determined behavior (+)	0.85 (1.13)	0.83 (1.14)	−0.06	−0.06	−1.04	.300	.400
Play/continue to play (+)	1.28 (1.41)	1.16 (1.36)	−0.20*	−0.15	−2.34	.019	.108

(*Continued*)

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Table 2 (*Continued*)

Outcome (hypoth. direction)	Control μ (pooled SD) ($n = 2,237$)	Treatment μ (pooled SD) ($n = 2,076$)	ITT effect	Effect size	t(df)	*p*-value	Adj. *p*-value
Sharing (+)	0.06 (0.25)	0.05 (0.25)	−0.01	−0.02	−0.62	.532	.644
Expressing kind words (+)	0.03 (0.22)	0.06 (0.24)	0.02	0.08	1.62	.106	.257
No reaction (−)	0.38 (1.28)	0.27 (1.05)	−0.09	−0.08	−1.29	.197	.368
Avoidant (−)	0.28 (0.64)	0.24 (0.60)	−0.05	−0.08	−1.68	.093	.241
Acceptance (−)	0.60 (0.85)	0.50 (0.82)	−0.11*	−0.14	−2.59	.010	.089
Reverse emotional reaction (−)	0.06 (0.34)	0.07 (0.37)	0.01	0.03	0.46	.649	.644
Hitting (−)	0.03 (0.19)	0.02 (0.17)	−0.01	−0.04	−1.02	.306	.400
Yelling (−)	0.01 (0.10)	0.00 (0.08)	−0.004	−0.04	−1.19	.233	.368
Stealing (−)	0.05 (0.23)	0.04 (0.21)	−0.02	−0.08	−2.15	.031	.120
Ignore safety instruction/rule (−)	0.12 (0.33)	0.13 (0.33)	0.002	0.01	0.17	.866	.644
Other aggressive behaviors (−)	0.04 (0.24)	0.04 (0.24)	−0.004	−0.02	−0.38	.704	.644

Note. Two-tailed tests. *$p < .05$, **$p < .01$, ***$p < .001$.

which were 25 min long and shown daily over 52 class days. Including this teacher time raises our cost estimates to around $14,270 or $7 per child.

Discussion

This study is the first causal impact evaluation of a mass media program designed for the Middle East and with a focus on preschool children's emotional development. In finding positive impacts on expressive emotion recognition and on emotion situation knowledge, our evaluation supports the *Ahlan Simsim* theory of change. We found limited support for improvements in emotion regulation strategies (specifically breathing, which was prominent in the curated episodes), and no impacts on receptive emotion recognition or other emotion regulation strategies. Our effect sizes (0.11–0.36) are overall weaker, but at the high end comparable, to the average 0.33 effect size of in-person preschools' on emotion outcomes in a recent meta-analysis (Luo et al., 2022), and the average 0.34 effect size on a wider range of social-emotional outcomes from universal (not targeted) preschool interventions in another (Murano et al., 2020). Notably, our effects were from a mass media program, rather than a teacher-implemented one.

Our results suggest successful implementation of and positive response to the program. In partnership with the Jordan Ministry of Education, the intervention of daily *Ahlan Simsim* episode viewing was implemented in 108 KG2 preprimary classrooms for 12 weeks in the Jordan Valley region. Children in schools randomly assigned to show *Ahlan Simsim* in classrooms were more likely to identify and like characters from the show. Teachers do not report a reduction in time teaching the national KG2 curriculum (Appendix G), implying the program is feasible to implement in the context of a preprimary national curriculum in public schools (though this finding is limited as it uses teachers' perception of time allocation, not direct observation). It also does not appear to negatively affect teaching, as an ancillary analysis on a subset of schools shows no effects on an observed measure of classroom teacher-child interaction quality (Appendix H).

The program positively affected expressive, but not receptive, emotion recognition. Children's ability to produce emotion words is typically *more* challenging than identifying the associated facial expression when given the words (Raver, 2002). The program introduced multiple Arabic words for emotions associated with discomfort that go beyond basic emotions like anger and sadness, including words for *frustration*, *nervousness*, *fear*, and *jealousy*. Our data suggest that children learned the general negative valence of these new emotion words, but may not have absorbed the subtleties of the meaning of each negative word. Because the stimuli were more targeted in the expressive task than in the receptive one (responding to just one facial expression, rather than a set of four), children may have been able to show their increased knowledge of general negative emotion words more readily in the expressive task.

In response to a series of vignettes of social situations involving conflict or distress, children exposed to the show were more likely to use new advanced emotion words that were prominent in its curriculum. Many of these were used interchangeably with other advanced emotion words of the same valence (e.g., mentioning fear for a vignette written to be about jealousy, substituting one negative emotion word for another). Children in the treatment group were also more likely to mention the correct exact target emotion word for specific vignettes. Though these findings suggest that the intervention is effective at both introducing emotion vocabulary and facilitating children's ability to link these terms with a certain social situation or conflict, these impacts were driven by a relatively small proportion of children. For example, a range of 1%–9.5% of children in the treatment group correctly identified each target emotion word in response to the vignettes, compared to 0%–3% of children in the control group.

There are a couple possible explanations for the interchangeable use of new negative emotion words. Literature on language development posits that the first stages of word learning often include overextension of new words as they are added to children's vocabulary (Rescorla, 1980). Thus, the interchangeability of new words in our data may reflect such overextension and comprise initial steps toward knowledge and application of specific emotion words. It also may reflect the difficulty of translation across languages and cultures. Studies comparing emotion categorization in Arabic vs. English indicate sociolinguistic differences in subcategories within overall domains of negative and positive emotions (El-Dakhs & Altarriba, 2019; Elasri, 2018). Recent studies have also challenged the assumed universality of emotions across cultures (Gendron, 2017) and

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demonstrated that many English language emotion words do not have exact counterparts in Arabic (Kayyal & Russell, 2013). For example, the Arabic word for *frustration* used in the show and coded in our outcome measures—*al'ihbat*—differs in important ways in its meaning (in a way that more closely translates to despair) from the American English definition of frustration. Discrepancies between use in the show, intended meaning in the direct child assessments, and the meaning of words in Jordanian Arabic could lead to more generalized learning of the valence of new emotion words, rather than specific word-level definitions.

Positive impacts were found for the emotion regulation strategy of *breathing*, which was suggested by children for both themselves and for the vignette character's use in response to the social-situation vignettes. This finding, of only one treatment effect among six emotion regulation strategies targeted in the episodes (and 19 different emotion regulation strategies emerging from open-ended responses in total), suggests to us that, while exposure to the show improved use of emotion vocabulary both generally and in vignettes of social situations, the next step of applying this emotion knowledge to enacting a range of regulation strategies occurred in only a limited way. The strategy that did show a positive impact, *breathing,* is quite prominent in *Ahlan Simsim* (e.g., advising the use of belly breathing when experiencing strong emotions). It could be that a physiological response is more visible and memorable in a TV show and therefore more likely to be applied in other situations (like the ones we measured), or alternatively that it is more consonant with local, culturally relevant emotion coping responses. For broader effects on emotion regulation strategies, it may be useful to pair teacher-implemented support for these skills with mass media programming.

The impact of exposure to the show in school on children's at-home viewing of *Ahlan Simsim* suggests that inclusion of educational children's media content in school contexts may also increase exposure to such content at home. This finding is further supported by, and may explain, effects on children's vignette-based use of emotion words that were not covered in the *Ahlan Simsim* curated content delivered in classrooms, but were included in other episodes in the broadcast. These findings do not extend to the use of emotional vocabulary by children at home, however: there were no significant treatment effects on caregiver reports of children using emotion words at home. More explicit supplementation of mass media with caregiver-directed support may be a next step for expanding effects on children's emotional development.

We found no evidence for moderation by our two pre-registered moderators of child gender or age. However, the evaluation, focused only on KG2 classrooms, limited child age to roughly a one-year span. A wider age range of children may reveal differences in impacts. In non-pre-registered analyses, we investigated further the possibility of moderation by parenting stress or economic worry; however, no moderated impacts were found.

Our best estimate of what it cost to deliver this intervention in 108 KG2 classrooms in Jordan is $3 per child. This estimate does not, however, value teacher time. Teacher time in this evaluation was challenging to quantify. Our data do not indicate that treatment teachers, on average, extended work hours or took away time from the curriculum (Appendix G). Indeed, some reported using the time that children were watching episodes for other tasks. Some did report engaging more actively with the show, a practice that could enhance the intervention's effects and would (if done more consistently) cost teacher time. In this way, the cost of teacher time is implementation-dependent. For cases in which they play a more active role, which may also yield greater impacts, the $7 per child estimate would likely be more accurate.

Limitations

There were several limitations to this study that should be acknowledged and considered when interpreting these findings. First, due to a low proportion of Syrian students in the targeted areas of the Jordan Valley and in government preschools across Jordan, we could not examine impacts on Syrian children specifically or how they differed from impacts on Jordanian children. The results may nevertheless be meaningful and actionable in a region affected by displacement. Syrian children have relatively low access to preprimary education in Jordan. While about 40% of Jordanian children attend preschool under 20% of Syrian children did in the 2017–2018 school year (UNICEF, 2020). Second, we were unable to collect child assessment data at baseline due to COVID-19 school closures, and therefore moderation of impacts by baseline child skills was not possible to examine. Baseline child assessments may also have improved the precision of our estimates (Bloom et al., 2007). That said, our baseline checks showed balance across treatment and control on observed baseline characteristics.

Third, our data on teacher time use and practices around this intervention are based on teachers' reports and one observational measure of teacher-child interaction quality (Appendix H). As such, it may not capture all possible unintended consequences of the intervention, such as detracting time from other instructional activities, or all ways in which teachers did or did not contribute their time to the implementation of the program. Given the complex, varying ways in which teachers interacted with the show, more direct measures are needed in the future to understand the effects on instruction of daily TV episode provision.

While we took several steps to adapt our emotion-based outcome measures for use in Jordan, more rigorous evaluation of the predictive validity of this tool in this context is needed (e.g., to understand how tools that rely on child verbal ability such as these are associated with parent- or teacher-reported emotional development). We did assess concurrent validity of each emotional development outcome with child age and caregiver education, and found generally expected directions of associations with caregiver education, though not with child age (however, child age had a very restricted range in this sample).

Our final limitation centers around the emotion terms used to assess children's emotional development. We heard from Arabic-speakers from Jordan and the Levant (both internal and external to the project) that two of the specific terms used in the child assessment measures (i.e., *frustration*, *caring for*) were departures from how they are typically used in Arabic and did not reflect their English meanings. Translation of English emotion words to Arabic is extremely complex. Future work may benefit from a more extensive approach to understanding how to support and measure children's early emotion vocabulary in the Levant region.

Implications for practice and future research

Given continued threats to and uncertainty around children's stability and wellbeing worldwide, the development of effective SEL supports in modalities that reach large numbers of children in accessible, cost-effective ways is urgently needed.

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This study describes the implementation, impacts, and cost of an educational mass media program designed for and produced in the Middle East. *Ahlan Simsim* was implemented in government preschools within Jordan alongside the standard curriculum and found to improve children's emotional knowledge and recognition skills. Delivering the intervention in 108 KG2 classrooms cost an average of $3–7 per child, further supporting its feasibility and scalability. These findings are also meaningful given that *Ahlan Simsim* has reached 23 million children in the MENA region. Two out of three children who watch *Ahlan Simsim* are reported to do so four times per week, a similar dosage to the intervention (Sesame Workshop, 2023). This suggests that our findings may be generalizable to a much larger number of children who watch the show at home.

IRC reports of follow-up discussions with teachers and principals who participated in the intervention reflect overall positive experiences delivering it—in some cases building upon the episodes or applying their themes to other parts of the curriculum—suggesting that the program was a resource for teachers. These anecdotal reports, combined with our findings, show the promise of supplementing existing school curricula with targeted educational media content (in this case, focused on emotional development). They also highlight the potential for integrating such programming with the national preschool curriculum. Building in additional activities to support this integration could potentially extend the gains we have observed thus far from *Ahlan Simsim* to a wider range of emotion regulation strategies and use of emotion words at home.

Future research should address the study limitations and opportunities, we outline above. Unique effects on children in families that directly experienced displacement, for instance, must be understood. To better understand the social-emotional needs of displaced children, and address the challenges to reaching them in research, studies should employ methodological strategies like oversampling of schools serving refugee families.

Additional research to understand emotion socialization in the Levant region could also benefit culturally grounded educational media. While Sesame Workshop engaged extensively with a language advisory to select emotion terms, additional steps to deepen our understanding of the emotion concepts most meaningful to children and families in this context could address some of the translation limitations identified in the interpretation of our study's results. And as mentioned previously, teacher-implemented or caregiver-directed programs may usefully supplement mass media programs like *Ahlan Simsim* to strengthen and broaden impacts on emotional development.

Overall, this study finds that an educational media intervention for preprimary children in Jordan facilitates foundational aspects of their emotional development and thus that the *Ahlan Simsim* TV show as a whole likely contributes to efforts to support children's SEL in the Levant, a region currently affected by poverty, migration, and displacement. While questions remain regarding additional strategies needed to support the full spectrum of children's emotional development needs, this evaluation is an important first step in demonstrating how children's media interventions can effectively target specific social-emotional skills in this context.

Supplementary material

Supplementary material is available at *Child Development* online.

Data availability

The data, analytic code, and study materials supporting the findings of this study are publicly available at the Harvard Dataverse repository (see https://doi.org/10.7910/DVN/YTLX91). All shared data have been de-identified in accordance with institutional and ethical guidelines. This study was reviewed and approved by the NYU IRB, which determined that the sharing of de-identified data in a public repository is permissible. All procedures performed in this study were in accordance with relevant guidelines and regulations.

Author contributions

Casey Moran (Formal analysis, Writing—original draft, Writing—review & editing [equal]), Hirokazu Yoshikawa (Conceptualization, Formal analysis, Methodology, Project administration, Writing—original draft, Writing—review & editing [equal], Funding acquisition, Supervision [lead]), Dennis Hilgendorf (Formal analysis, Methodology [equal]), Yiran Vicky Zhao (Formal analysis, Methodology [equal]), Dalia Al-Ogaily (Formal analysis, Writing—original draft, Writing—review & editing [equal]), Kate Schwartz (Formal analysis, Methodology, Writing—original draft [equal]), Joyce Rafla (Formal analysis, Writing—original draft, Writing—review & editing [equal]), Andres Molano (Conceptualization, Methodology, Supervision, Writing—original draft [equal], Formal analysis [lead]), Kendra Strouf (Formal analysis, Methodology, Writing—review & editing [equal]), Mohammad Khanji (Conceptualization, Data curation, Formal analysis, Methodology, Writing—review & editing [equal]), Rawan Abu Seriah (Conceptualization, Data curation, Formal analysis, Methodology, Writing—review & editing [equal]), Mohammad Al-A'abed (Conceptualization, Data curation, Formal analysis, Methodology, Writing—review & editing [equal]), Ragheb Fityan (Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Writing—review & editing [equal]), Phoebe Sloane (Conceptualization, Data curation, Methodology, Project administration, Supervision, Writing—review & editing [equal]), Laila Hussein (Conceptualization, Methodology, Writing—review & editing [equal]), Da'ad Hidayah (Conceptualization, Methodology, Writing—review & editing [equal]), Manar Shukri (Conceptualization, Methodology, Writing—review & editing [equal]), Tareq Sharawi (Conceptualization, Formal analysis, Methodology, Supervision, Writing—review & editing [equal]), Kim Foulds (Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Writing—review & editing [equal]), A. Brooks Bowden (Conceptualization, Formal analysis, Methodology, Writing—original draft, Writing—review & editing [equal]), Sangyoo Lee (Conceptualization, Formal analysis, Methodology, Writing—original draft [equal]), Priyamvada Tiwari (Data curation, Formal analysis, Writing—review & editing [equal]), and Jere R. Behrman (Conceptualization, Formal analysis, Methodology, Writing—review & editing [equal])

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https://www.socialscienceregistry.org/trials/8579 and https://sreereg.icpsr.umich.edu/sreereg (#8961.1v1).

Conflicts of interest

None declared.

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