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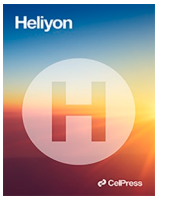

Research article

The effects of parent-child separation on the digital literacy of children and adolescents: A bidirectional perspective study

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ABSTRACT

From a bidirectional perspective, the present cross-sectional study explored the impacts of parent-child separation on the digital literacy of children and adolescents. Drawing upon data from 1894 students (12–18 years, 49.33 % females) in Nanling county, China, we found that parent-child separation can negatively affect the digital literacy of children and adolescents, but effects differ between children experiencing parental migration or parental divorce. Parental mediation can act as a mediator in this process while children's digital feedback to parents may be considered as an auxiliary promoter. To further promote the digital literacy of children and adolescents experiencing parent-child separation, assigned tasks from adults in which children can practice knowledge and skills related to digital devices and the Internet are recommended.

1. Introduction

In this modern age of technology, human beings are inundated with a myriad of easily portable digital devices that have seamlessly woven into the very fabric of our daily lives; utilized for studying, working, entertaining, and engaging in social interactions. A troublesome truth is that a growing number of individuals are becoming reliant on and even addicted to these digital devices to fulfill their needs, often due to the convenience they provide [1]. However, it is neither practical nor realistic to forbid the use of digital devices in children and adolescents in this digital age. In recent years, the protective effect of digital literacy on digital addiction among children and adolescents has garnered increasing attention [2].

1.1. Digital literacy

It is widely recognized that digital literacy holds immense importance in this digital age [3]. It has been touted as a crucial 21st-century skill [4] and deemed an important transversal competence [5]. The concept of digital literacy can be relatively multidimensional, encompassing foundational knowledge about computers and the Internet, along with the abilities and capacity needed to use digital

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devices and the Internet as tools for learning, production, communication, and recreation [6]. While school remains the primary institution where children can acquire knowledge, family also plays a significant role in shaping that knowledge. In fact, it is often the case that children gain access to digital devices prior to their school-aged years [7]. As such, parents should act as the most influential people carrying the primary responsibility for guiding children and adolescents' digital-related behavior [8]. In recent years, studies have been conducted to explore how digital literacy promote children and adolescents' academic performance, physical health, and well-being [9,10], while little understanding exists of how parents and children can learn together to promote digital literacy. This oversight could have significant consequences for the future development and success of our society's youth. Therefore, it is essential to investigate methods of enhancing digital literacy in family settings.

Family is the primary setting that can influence digital literacy of children and adolescents [11], with parents playing a crucial role as the most influential individuals tasked with guiding their children and adolescents' digital-related behavior [8]. Parents often play a crucial role in introducing and guiding their children in the use of digital devices and the internet. When parents are actively involved in their children's learning, they provide support, guidance, and resources that help them acquire knowledge and skills. Without this parental guidance and support, children may have limited access to digital resources, lack the knowledge and skills necessary to use technology effectively, or engage in unsafe or unhealthy online behaviors [12]. However, when there is a parent-child separation, this support system may be disrupted. Thus, among various family factors that may influence digital literacy of children and adolescents, the present study specifically focuses on parent-child separation.

1.2. Parent-child separation

In China, parental migration for work and parental divorce are two major reasons causing parent-child separation. According to the 7th National Census, there were more than 370 million migrants in 2020 [13], the majority of whom will leave their children behind due to the Hukou system which institutionally excluded their children from accessing state-sponsored social welfare programs such as public primary education [14]. Consequently, this large-scale migration created a large population of left-behind children (LBC). In China, LBC refers to children whose parents migrate to another city outside their original residence area, as recorded on the Hukou system, for at least 6 months [15]. In 2015, there were 68.8 million LBC, accounting for 25 % of the total youth population in China [16]. The divorce rate has been continuously rising since 2000 with up to 4.7 million couples divorced in 2019 [17].

Parental divorce is an important predictor of children's well-being. One previous study noted that compared to the parent-child separation due to parental migration for work, the parent-child separation due to parental divorce showed stronger negative effects on the mental health of children [18]. Thus, it is intriguing to know how parental migration for work and parental divorce influences digital literacy of children and adolescents.

1.3. Bidirectional influences

Parent-child relationship is regarded as the most fundamental and principal relationship in the family [19], which is a key factor that can influence children and adolescents development [20]. One recent study pointed out that Chinese adolescents with insecure parent-child relationship exhibited higher risks of psychological and behavioral problems and were more vulnerable to smartphone addiction [21]. Adolescents with negative parent-child relationship are prone to excessive use of smartphones to fulfill their unmet needs within the family [22]. And smartphone addiction among adolescents can be weakened through the improvement of parent-child relationships [23]. Another study further found that Internet use empower Chinese parents to maintain better parent-child relationships which can contribute to their subjective well-being [24]. These bidirectional influences in the parent-child relationship can help identify situations where the beliefs, values, attitudes, motives, and skills of parents and children are constantly changing. Therefore, both parent-to-children digital mediation and children-to-parent digital feedback should be important components of family digital life. In the present study, we adopted a bidirectional perspective to explore how parent-to-children mediation and children-to-parent feedback influence children's digital literacy.

1.3.1. Parent-to-children digital mediation

Parents' strategies for managing their children and adolescents' digital-related behavior are called parent-to-children digital mediation. This involves control, regulations, and restrictions over their digital-related behavior [25]. As noted, parent-to-children digital mediation is crucial for ensuring the online well-being of children and adolescents [26] by mitigating the potential negative impact of digital media use [27] and fostering healthy media use habits [28]. As noted, restrictive mediation was more effective than active mediation in decreasing the amount of time children spent on media, whereas the effects of active mediation and co-using were greater than those of restrictive mediation on reducing the incidence of media-related risks [29]. By playing an active and supportive role in their children and adolescents' digital lives, parents can guide them to behave appropriately online [30] and to effectively navigate online risks [31].

1.3.2. Children-to-parent digital feedback

Recent studies on socialization and parent-child interaction have demonstrated that children are active agents who intentionally and unintentionally influence their parents [32]. According to the dialectical model of bidirectional causality in parent-child relationships, children are not only passive recipients but also active participants in their own socialization [33]. Thus, in addition to parent-to-children digital mediation, children-to-parent digital feedback may also be a predictor of digital literacy among children and adolescents. Children-to-parent digital feedback refers to children's responses to their parents' confusion about digital media usage

[34], such as computers, mobile phones, and the Internet [35]. Good children-to-parent digital feedback may not only solve parents' confusion, but in this process, children are delighted to help their parents find a solution and consequently promote their digital literacy [11]. When exploring possible family predictors of digital literacy among children and adolescents, it provides a more comprehensive picture by incorporating parent-to-children digital mediation and children-to-parent digital feedback simultaneously.

1.4. Research goals and hypotheses

The present study aims to explore the effects of parent-child separation on digital literacy of children and adolescents. Previous research in this area is limited as we are still in the early stage of understanding the acquisition of digital literacy among children and adolescents outside of school in China. To gain a more comprehensive understanding, this study takes parent-to-children mediation and children-to-parent feedback as potential mediators. Based on the aforementioned literature, the study has two hypotheses.

Hypothesis 1(H1). Both parental migration for work and parental divorce can negatively affect digital literacy of children and adolescents.

Hypothesis 2(H2). Parent-to-children digital mediation and children-to-parent digital feedback can act as mediators in the H1 process.

2. Methods

2.1. Data collection

This is a cross-sectional study focusing on digital literacy of children and adolescents conducted in Nanling county, Anhui Province in August 2022. The Nanling county government initiated the Students' Digital Literacy Promotion Program from July to August 2022. This survey was incorporated into this program.

First, a notice was issued by the county education department to principals of all 34 primary schools, 27 middle schools, and 4 high schools, to introduce this survey at the end of July 2022. Second, this notice together with informed consent was disseminated to all students in 65 schools mentioned above from their headteachers. All students living in Nanling county were welcomed to participate in this competition. Third, only students with written consent from their parents or guardians can participate in this survey. These students could participate in this survey by scanning the QR code attached to the notice mentioned above to complete the electronic questionnaire on *Sojump,* a professional online survey platform. Students were told that they can complete this survey anywhere and at any time they feel comfortable. On *Sojump*, we restricted that each digital equipment can only respond to this survey once which means that students can only submit the questionnaire once. Students aged 11 or younger at the time of this survey were recommended to finish the questionnaire with parental assistance, and students aged 12 or older were required to finish the questionnaire by themselves. Thus, the present study only included students aged 12 or older. Among 4680 responses, 1894 students aged 12 or older were included in the present study (49.33 % females).

2.2. Measurements

2.2.1. Outcome variable

The measurement of digital literacy was based on a test comprised of 10 True or False questions and 25 multiple-choice questions. Items were generated to represent the dimensions proposed by A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2 developed by UNESCO [36]. After integrating the item pool, each item was reevaluated by three experts in information education for content relevance and representativeness. A total of 15 True or False questions and 45 multiple-choice questions were identified. Then, a pilot test was conducted with 100 students from one middle school in Nanling county. The items were reviewed and modified based on student feedback. And a total of 10 True or False questions and 50 multiple-choice questions were identified to assess students' knowledge about computers and the Internet, skills, and capacity to use digital devices and the Internet for learning, production, communication, and recreation, and digital security awareness. Digital literacy was scored by summing the total number of correct answers, with a higher score indicating better digital literacy.

2.2.2. Exposure variable

Parent-child separation was assessed with the following questions: "Are your parents divorced?" and "Did your father/mother ever migrate to another place ever since you were born?" Children of parents divorced were classified as DC regardless of parental migration status. Children whose parents were not divorced but with at least one parent migrating at the time of this survey were classified as LBC. Other children were classified as RC (regular children). Among 1894 students included, there were 612 LBC (left-behind children), 307 DC (children of parents divorced), and 975 RC.

The 20 five-point Likert response questions assessing parent-to-children digital mediation were adapted from Livingstone and Helsper's study of parental mediation of children's Internet use [37] along with Valkenburg et al. [38], and van der Voort et al. [39] studies on television viewing. Parent-to-children digital mediation was scored by summing the total 20 questions, with a higher score indicating a more involved parent-to-children digital mediation status. The revised scale was characterized by good reliability, construct and validity for both its individual items and the whole scale in this study [Cronbach's $\alpha = 0.922$, KMO $= 0.935$, Bartlett spherical test $\chi^2 = 22767.26$ ($p < 0.001$)].

The three five-point Likert response questions assessing children-to-parent digital feedback were adapted from the instrumental aid subscale of the Network Relationships-Social Provisions Version [40] concerning media in general [41]. Children-to-parent digital feedback was scored by summing the total three questions, with a higher score indicating more feedback behaviors. The revised scale was characterized by good reliability, construct and validity for both its individual items and the whole scale in this study [Cronbach's $\alpha = 0.897$, KMO $= 0.747$, Bartlett spherical test $\chi^2 = 4111.21$ ($p < 0.001$)].

2.2.3. Social-demographic variable

Socio-demographic characteristics collected for the present study included gender, age, family economic status (poor/fair/wealthy), and paternal and maternal education level (primary school or below/middle school/high school or above).

2.3. Data analysis

Since all data was collected via electronic questionnaires, there was no missing data.

Social demographic characteristics, digital literacy, parent-to-children digital mediation, and children-to-parent digital feedback of the sample students were described as frequencies and percentages for categorical variables and means with standard deviations for continuous variables among RC, LBC, and DC (Table 1).

The association between independent variables (X), mediators (M), and dependent variables (Y) was estimated by multiple linear regression because the dependent variables were linear. The crude model presented a bivariate relationship between independent variables and dependent variables. Then, as informed by previous studies, gender, age, family economic status, and paternal and maternal education level were included as covariates in the adjusted models. We analyzed all data using the SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) and assumed a statistical significance level of $p < 0.05$.

MPlus 8.3 was employed to complete the mediation analysis, using the bootstrapping procedure (5000 times), providing 95 % confidence intervals (CI). The present study examined parent-to-children digital mediation (M1) and children-to-parent digital feedback (M2) as mediators in the association between parent-child separation (X) and digital literacy (Y). The total effect, total indirect effect, and direct effect were reported with bootstrap standard error, two-tailed p-value, and a 95 % confidence interval. Multiple indices were used to assess the model fit, including: 1) insignificant chi-square coefficient (χ^2) or significant results when accompanied by other acceptable fit statistics for sample sizes of over 200; 2) the Comparative Fit Index (CFI) with values of above 0.90; and 3) the Root Mean Square Error of Approximation (RMSEA) with values of less than 0.08. The mediation model presented in Fig. 1 can help to decompose the total effect of left-behind status or parental divorce in children and adolescents on digital literacy into indirect effects through different mediation analysis.

3. Results

The descriptive statistics of socio-demographic characteristics, digital literacy, parent-to-children digital mediation, and children-to-parent digital feedback stratified by parent-child separation are illustrated in Table 1. Compared with RC, LBC reported significantly lower paternal and maternal education levels, lower digital literacy, and lower parent-to-children digital mediation. Compared with RC, DC were older and reported significantly poorer family economic status, lower digital literacy, and parent-to-children digital mediation. There were no differences in children-to-parent digital feedback among groups.

As shown in Table 2, LBC reported significantly lower digital literacy compared with RC ($\beta = -1.55$, 95%CI $= -2.98, -0.13$, $p <$

Table 1
Descriptive statistics for participants stratified by parent-child separation.

	RC N(%) (1)	LBC N(%) (2)	DC N(%) (3)	χ^2 or F	p-value
Gender				1.084	0.582
Male	494(50.67)	322(52.61)	151(49.19)		
Female	481(49.33)	290(47.39)	156(50.81)		
Age Mean (SD)	13.91(1.55)	14.03(1.52)	14.30(1.56)	7.382	0.001
Family economic status				27.949	<0.001
Poor	141(14.46)	87(14.22)	81(26.38)		
Fair	721(73.95)	446(72.88)	196(63.84)		
Wealthy	113(11.59)	79(12.91)	30(9.77)		
Paternal education level				17.980	<0.001
Primary school or below	167(17.13)	133(21.73)	69(22.48)		
Middle school	553(56.72)	368(60.13)	175(57.00)		
High school or above	255(26.15)	111(18.14)	63(20.52)		
Maternal education level				12.876	0.012
Primary school or below	246(25.23)	160(26.14)	95(30.94)		
Middle school	516(52.92)	355(58.01)	153(49.84)		
High school or above	213(21.85)	97(15.85)	59(19.22)		
Digital literacy Mean (SD)	76.34(13.14)	74.78(14.80)	71.80(15.57)	12.323	<0.001
Parent-to-children digital mediation Mean (SD)	61.21(16.76)	58.29(16.39)	52.80(18.02)	29.656	<0.001
Children-to-parent digital feedback Mean (SD)	9.88(3.47)	9.83(3.46)	9.83(3.54)	0.049	0.953

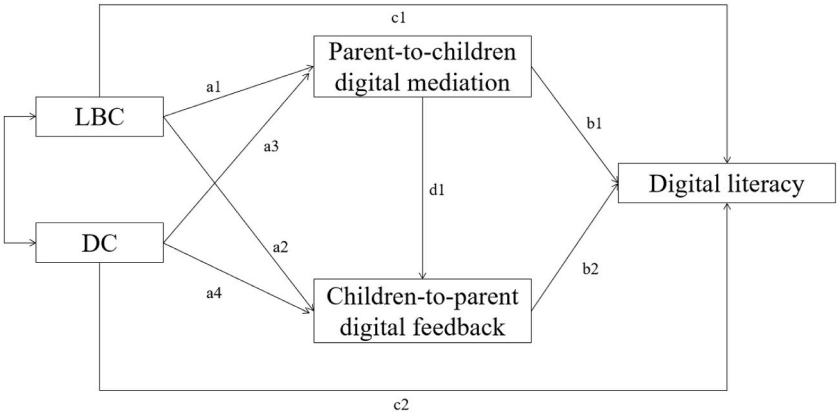

Fig. 1. Visual representation of the hypotheses in this study.

0.05) in the crude model, but this difference was no longer significant when parent-to-children digital mediation and children-to-parent digital feedback were introduced in the crude model or with socio-demographic characteristics controlled in the adjusted model. DC reported significantly lower digital literacy compared with RC ($\beta = -2.99$, 95%CI $= -4.92, -2.06$, $p < 0.01$) in the crude model, and this difference was still significant when parent-to-children digital mediation and children-to-parent digital feedback were introduced into the model with socio-demographic characteristics controlled.

The results of the mediation model including parent-child separation (X: X1 = LBC, X2 = DC, and RC as the reference group), parent-to-children digital mediation (M1), children-to-parent digital feedback (M2), and digital literacy (Y) are displayed in Fig. 1 and Table 3. The total effects of LBC on digital literacy were significant ($\beta = -1.55$, 95%CI $= -2.74, -0.35$, $p < 0.05$). The direct effects of LBC on digital literacy were not significant ($\beta = -1.07$, 95%CI $= -2.23, 0.09$, $p > 0.05$). The total indirect effects of LBC on digital literacy were significant ($\beta = -0.48$, 95%CI $= -0.78, -0.22$, $p < 0.01$). The total effects of DC on digital literacy were significant ($\beta = -4.54$, 95%CI $= -6.29, -3.00$, $p < 0.001$). The direct effects of DC on digital literacy were significant ($\beta = -3.17$, 95%CI $= -4.87, -1.67$, $p < 0.01$). The total indirect effects of DC on digital literacy were significant ($\beta = -1.37$, 95%CI $= -1.86, -0.95$, $p < 0.001$). Overall, the proposed model fitted the data well (CFI $= 0.999$, RMSEA $= 0.001$, $\chi^2 = 390.654$, $p < 0.001$). The standardized coefficients are presented in Fig. 1.

Table 2
Regression coefficients for digital literacy, parent-to-children digital mediation, children-to-parent digital feedback, and parent-child separation.

Crude model				
	Parent-to-children digital mediation (M1)	Children-to-parent digital feedback (M2)	Digital Literacy (Y)	
	β(95%CI)	β(95%CI)	β(95%CI)	β(95%CI)
LBC (X1)	−2.92(-4.62,-1.22)[b]	−0.05(-0.40,0.30)	−1.55(-2.98,-0.13)[a]	−1.07(-2.47,0.33)
DC (X2)	−5.49(-7.80,-3.18)[c]	−0.01(-0.48,0.47)	−2.99(-4.92,-1.06)[b]	−2.10(-4.00,-0.20)[a]
Parent-to-children digital mediation (M1)	/		/	0.16(0.12,0.20)[c]
Children-to-parent digital feedback (M2)		/	/	0.24(0.05,0.43)[a]
Adjusted model				
	Parent-to-children digital mediation (M1)	Children-to-parent digital feedback (M2)	Digital Literacy (Y)	
	β(95%CI)	β(95%CI)	β(95%CI)	β(95%CI)
LBC (X1)	−2.33(-4.01,-0.65)[b]	−0.15(-0.50,0.20)	−0.85(-2.24,0.55)	−0.51(-1.88,0.86)
DC (X2)	−5.49(-7.78,-3.20)[c]	−0.06(-0.54,0.41)	−3.55(-5.44,-1.65)[c]	−2.89(-4.75,-1.02)[b]
Parent-to-children digital mediation (M1)	/		/	0.12(0.08,0.16)[c]
Children-to-parent digital feedback (M2)		/	/	0.43(0.23,0.62)[c]

Note. Gender, Age, family economic status, paternal & maternal education level were covariates in the adjusted models.
[a] $p < 0.05$.
[b] $p < 0.01$.
[c] $p < 0.001$.

Table 3
Mediation effects of group on digital literacy through parent-to-children digital mediation and children-to-parent digital feedback.

Effects	Coefficient	S.E	*p*-value	Confidence Interval	
				Lower 2.5 %	Upper 2.5 %
Total Effects of LBC on Digital literacy (c1+a1*b1+a2*b2+a1*d1*b2)	−1.55	0.72	0.032	−2.74	−0.35
Direct Effects of LBC on Digital literacy (c1)	−1.07	0.70	0.126	−2.23	0.09
Total Indirect Effects of LBC on Digital literacy (a1*b1+a2*b2+a1*d1*b2)	−0.48	0.17	0.005	−0.78	−0.22
LBC→ Parent-to-children digital mediation → Digital literacy (a1*b1)	−0.47	0.16	0.002	−0.74	−0.24
LBC→ Children-to-parent digital feedback → Digital literacy (a2*b2)	0.04	0.04	0.421	−0.02	0.14
LBC→ Parent-to-children digital mediation→ Children-to-parent digital feedback→ Digital literacy (a1*d1*b2)	−0.05	0.03	0.056	−0.10	−0.02
Total Effects of DC on Digital literacy (c2+a3*b1+a4*b2+a3*d1*b2)	−4.54	0.99	<0.001	−6.29	−3.00
Direct Effects of DC on Digital literacy (c2)	−3.17	0.98	0.001	−4.87	−1.67
Total Indirect Effects of DC on Digital literacy (a3*b1+a4*b2+a3*d1*b2)	−1.37	0.28	<0.001	−1.86	−0.95
DC→ Parent-to-children digital mediation → Digital literacy (a3*b1)	−1.36	0.26	<0.001	−1.83	−0.97
DC→ Children-to-parent digital feedback → Digital literacy (a4*b2)	0.12	0.07	0.093	0.03	0.29
DC→ Parent-to-children digital mediation→ Children-to-parent digital feedback→ Digital literacy (a3*d1*b2)	−0.14	0.06	0.024	−0.25	−0.05

4. Discussion

This study offers new insights into an important part of research on parent-child separation regarding children and adolescents' digital literacy through a bidirectional perspective. This approach allowed us to highlight previously under-explored but important components, such as parent-to-children digital mediation and children-to-parent digital feedback, and to investigate their relationships with children and adolescents' digital literacy. The results support our hypotheses raised in the introduction section: 1) Both parental migration for work and parental divorce can negatively affect digital literacy of children and adolescents, but these effects differ between LBC and DC. 2) Parent-to-children digital mediation can act as a mediator in this process while children-to-parent digital feedback may be considered an auxiliary promoter.

Based on our findings, we propose that, for LBC, migrant parents should guide and encourage their children to avail themselves of the full range of apps on smartphones to facilitate their development. Moreover, in addition to parent-to-children mediation, extra support from the extended family and school-based and court-connected programs can help minimize the negative effects of parental divorce on children and adolescents. To further promote digital literacy of children experiencing parent-child separation, assigned tasks from adults in which children can practice knowledge and skills of digital devices and the Internet will also be helpful. Given the common top-down single way of digital-related knowledge transmission in most Chinese families, we suggest that while parent-to-children digital mediation should be especially enhanced for children experiencing parent-child separation, children-to-parent digital feedback should be widely encouraged for all children.

The finding of a negative correlation between parental migration and digital literacy among children and adolescents may be attributed to detrimental impact of social-economic disadvantages and reduced parental supervision. As noted, being from an economically advantaged family is a key determinant of better digital literacy among children and adolescents [42,43]. In the case of LBC, the poor family economic status may be the primary reason for parents migrating out for work, but it does not necessarily follow that parents migrating back corresponds to an improvement in family economic status. The high prevalence of smartphone possession among LBC can be attributed to the fact that they can communicate with their migrating parents through instant messaging apps, such as WeChat and QQ, at a low cost via smartphones [44]. Migrating parents should utilize the Youth Mode on their children's smartphones to manage online time and usage, thus remedying the decreased parental supervision resulting from the time-space distance created by parent-child separation.

The separation of parents and children caused by parental divorce is different from that resulting from parental migration. While parental migration for work generally increases family income and decreases parental supervision, parental divorce often leads to a decrease in family income and a simultaneous decrease in parental supervision [45]. A study of 19839 adolescents suggested that a shortage of parental financial resources was indeed associated with poor academic performance of adolescents from disrupted families [46]. Unlike parental migration for work, which is usually a shared family decision for a better future, parental divorce is usually a protracted process accompanied by conflicts and disputes among family members, which can negatively influence children and adolescents' development both before and after divorce [25]. Previous studies confirmed that children and adolescents who experienced parental divorce were more likely to report poorer academic performance [47], lower chances of graduating from high school or attending college [48], and a lower level of educational attainment by adulthood [49], which are consistent with the present study.

Family life should be characterized by a lively and interactive give-and-take between children and parents. High levels of dyadic mutuality in parent-child interaction play a vital role in supporting children's development [50]. Previous studies found that parent-to-children mediation practice can reduce youth sexting behaviors [51] and buffer the influence of TV viewing on adolescents' drinking intentions, compared with traditional instructive or restrictive communication strategies [52]. Children-to-parent feedback, such as when children offer solutions to parents' questions about digital use, enables children to seek information from knowledgeable participants [53]. Therefore, joint engagement in the context of family digital life provides opportunities for children and adolescents to actively interact with digital media within the framework of warm and close relationships [54]. In the present study, it is noteworthy

to find that while LBC and DC reported significantly lower parent-to-children digital mediation than RC, the status of children-to-parent digital feedback did not vary between RC, LBC, and DC. This similarity may indicate a one-way transmission of digital-related knowledge in most Chinese families.

The present study has several limitations. Firstly, due to the cross-sectional study design, the current study can only establish correlations, rather than causal relationships. Additionally, it must be noted that this study only collected data from 1894 students living in Nanling county. Therefore, the generalizability of our results may be limited. Secondly, parent-to-children digital mediation was reported by children. Children and their parents usually differ in the amount of mediation, as parents may exaggerate their interventions to comply with social desirability, whilst children may minimize parent-to-children digital mediation for reasons of peer status [55], which might attenuate our results. Thirdly, the current study failed to differentiate DC without parental migration from those with parental migration, which may exert additive effects. However, this limitation might have weak effects as one previous study suggested parental divorce exerted greater influence on children's development compared with parental migration [23]. Well-designed qualitative studies and longitudinal studies can be useful to fill this gap in the future.

5. Conclusion

Parent-child separation can negatively affect children and adolescents' digital literacy, but effects differ between children suffering from parental migration or parental divorce. Parental mediation can act as mediator in this process while children to parents' digital feedback may be considered as an auxiliary promoter. We suggest that while parent-to-children digital mediation should be especially enhanced for children suffering from parent-child separation, children-to-parent digital feedback should be widely encouraged for all children.

Data availability statement

Data will be made available on request.

Ethic statement

This study was reviewed and approved by the Ethics Committee of Zhejiang University (Project Number ZJU ZGL202108-1).

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CRediT authorship contribution statement

Shi Guo: Writing – review & editing, Validation, Conceptualization. **Jiayao Xu:** Writing – review & editing, Investigation, Data curation. **Menmen Wang:** Writing – review & editing, Investigation, Data curation. **Hailati Akezhuoli:** Writing – review & editing, Investigation, Data curation. **Xudong Zhou:** Supervision. **Jingjing Lu:** Writing – original draft, Software, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e31113.

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