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TECHNOLOGY-BASED INTERRUPTIONS IN PARENT-CHILD INTERACTIONS: SYSTEMATIC REVIEW OF CONCEPTUALIZATION AND MEASUREMENT*

Abstract

The aim of this systematic review is to clarify how technology-based interruptions in parent-child interactions resulting from parents' smartphone use are termed, defined, and measured in the literature. For the review, predefined search strings were applied across six databases (APA PsycInfo, Web of Science, Scopus, ScienceDirect, PubMed, and Google Scholar). The review protocol was pre-registered in PROSPERO. Study screening was conducted in ASReview. Study quality was appraised with the MMAT (2018). Following systematic evaluations, 105 studies were included in the review and categorized into three broad groups: smartphone use (n = 27), technoference (n = 40), and phubbing (n = 38). The findings indicate inconsistency in this field,

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with overlapping constructs and measurement approaches that lack consistent definitions. This review, clarifies the definitions of the concepts smartphone use, technoference, and phubbing, and examines their operational definitions and measurement instruments. The results suggest that smartphone use should be conceptualized as a broad behavioral construct, technoference as a brief, externally induced interruption, and phubbing as a longer and intentional act of smartphone use during social interactions. Finally, the main definitions and operationalisations of the constructs on technology-based interruptions due to parents' smartphone use are discussed and proposed for future research.

Keywords: *parent–child interaction, parents' smartphone use, technoference, phubbing, measurement, systematic review*

1. INTRODUCTION

As far back as 2002, Gergen, K. J. described the paradox of "absent presence", referring to people's tendencies to be physically present but mentally absorbed in a technologically mediated world elsewhere (Gergen, 2002). Since then, research consistently pointed to the presence of technological interference in various social and close interactions, i.e., peer relationships, romantic relationships, and parent-child relationships (e.g., McDaniel *et al.*, 2021; McDaniel and Coyne, 2016a, b). However, technology interference is differently operationalized and measured in the literature (e.g., Meeus *et al.*, 2021; Wang *et al.*, 2020), making it hard to conclude its effects on one's well-being and development. This study focuses on technology interference in parent-child interactions because smartphones are inevitably enmeshed in family daily life as one of the most used digital devices today, and their use affects the well-being and development of children.

Parents frequently use smartphones for personal and work-related purposes throughout the day, and sometimes during interactions with their children (e.g., texting while playing with their children; McDaniel, 2020; Beamish *et al.*, 2019). According to McDaniel (2020), the primary reasons for parents' smartphone use include maintaining contact with others, completing work-related tasks, seeking information, and entertainment, distraction from stressful events, coping strategies for unpleasant emotions, seeking support, and escaping stressful parenting situations (e.g., when a child has a tantrum), as well as the habit of constantly checking notifications. According to some research, in situations where parents are distracted by smartphone use while with children, they communicate less frequently with their children and often delay their response to the child's demands for attention (e.g., Ellias *et al.*, 2021; Radesky *et al.*, 2015, 2014). Children attempt to attract parental attention either through verbal efforts or physical touch (e.g., Merkaš *et al.*, 2021; Hiniker *et al.*, 2015; Radesky *et al.*, 2015, 2014). In such situations, children express that they feel neglected, sad, and angry (e.g., Merkaš *et al.*, 2021; Steiner-Adair and Barker, 2013), mostly because they must compete with

smartphones for their parents' attention. Numerous recent studies mainly indicate the presence of negative effects of parents' smartphone use on the quality of their interactions with children, as well as on children's behavior and well-being (e.g., Tammisalo *et al.*, 2022; Braune-Krickau *et al.*, 2021; Merkaš *et al.,* 2021; Knitter and Zemp, 2020; McDaniel, 2019; Kushlev, 2018; Hiniker *et al.*, 2015).

Negative effects of distractions in parent-child interactions due to parents' smartphone use may be explained from various theoretical perspectives by focusing on an individual level - automatic thinking perspective (Chen *et al.*, 2020) and/or an interpersonal level - social exchange theory (Homans, 1958). One of the common explanations is a shift of verbal and nonverbal communication cues from interaction to the device in situations where technology interferes due to smartphone use, which is emphasized within the displacement hypothesis (Valkenburg and Peter, 2007). This is in line with social exchange theory (Homans, 1958), according to which individuals weigh rewards against costs to choose the most beneficial social relationships to engage in. In the context of technology interference, uncomfortable emotions resulting from technology use during face-to-face interactions are perceived as an additional "cost" in relationships, disrupting the balance between gains and investments (Homans, 1958). Additionally, technology interference can be interpreted as a loss of rewards that a particular relationship should provide (e.g., loss of attention), disrupting the balance of social exchange and making one partner dissatisfied. This is a mechanism that may trigger conflict (Homans, 1958). It is important to bear in mind that not all forms of technology use in social interactions will lead to negative outcomes (i.e., taking joint photos). However, there is still no consistent theoretical base for work in this area. Devine and Smith (2023) suggest an integrative theoretical approach that encompasses various theoretical perspectives, emphasizing the importance of context in the study of technology interference in caregiver-child interactions. But, before developing further theoretical frameworks, it seems important to clearly define the point of interest.

Taken together, these theoretical perspectives point to a common process through which parents' smartphone use may affect children's well-being. When caregivers attend to their devices during interactions with the child, attention and time are displaced from the interaction, caregivers' behavioral and emotional responsiveness can be reduced, and negative emotions or conflict may arise in the relationship (Devine and Smith, 2023; Valkenburg and Peter, 2007). Technology-based interruptions disrupt parental responsiveness, shared attention, and co-regulation (Devine and Smith, 2023; McDaniel, 2019). Over time, repeated disruptions may contribute to children's uncomfortable emotions, problem behaviour, and lower children's well-being (Stockdale *et al.*, 2018). Clarifying how these mechanisms are defined and measured is therefore essential for evaluating their links to child developmental outcomes and for advancing theory on technology-based interruptions in family life. In line with this rationale, our

review focuses specifically on the operational definitions to provide a clearer conceptual basis for future empirical work.

1.1. TERMINOLOGY CONFUSION

It's difficult to draw valid and uniform conclusions in this research field because there has been a proliferation of terminology and operationalizations of constructs related to the effects of parents' smartphone use during interactions with children (Frackowiak *et al.*, 2023). For example, some authors refer to "parental mobile use" (Knitter and Zemp, 2020), some to "parent technology use" (Wong *et al.*, 2020), some to "parental smartphone use" (Wolfers *et al.*, 2020), some to "co-present smartphone use" (Oduor *et al.*, 2016), some to "parental screen distraction" (Blackman, 2015). The term "parental technoference" (McDaniel, 2015) is most mentioned in the literature, and its meaning is often confused with the construct of "parental phubbing" (Hong *et al.*, 2019). Although these constructs seemingly represent the same phenomenon, their definitions encompass different aspects of parents' mobile phone use in parent-child interactions. According to Frackowiak *et al.* (2023), co-present smartphone use is conceptually the broadest term, referring to mobile phone use in the presence of others that disrupts the quality of those relationships. While neutral constructs like smartphone use relate to the behavioral measure of usage, terms like technoference, parental screen distraction, and phubbing imply a causal mechanism of association between behavior (smartphone use) and typically negative effects of that behavior (Frackowiak *et al.*, 2023).

In addition to this conceptual diversity, studies rely on a wide range of instruments, often using modified scales that are labelled with different constructs (e.g., Meeus *et al.*, 2021; Wang *et al.*, 2020). Such heterogeneity in both terminology and instruments disables comparisons across studies and makes it difficult to cumulate evidence, highlighting the need for a systematic synthesis of existing definitions and measures of parents' technology-based interruptions during interactions with children.

1.2. TECHNOFERENCE VS. PHUBBING

In a study where the concept of "technoference" was first mentioned, McDaniel (2015, 7) defines technoference as "[…] times when technology devices intrude, interrupt, and/or get in the way of couple and family communication and interactions." On the other hand, the term "phubbing" emerged when the Macquarie Dictionary invited authors, poets, linguists, and lexicologists to devise a term describing the behavior of ignoring live social interactions while using one's mobile phone. The term "phubbing" is defined as the act of rejecting or ignoring a person due to mobile phone use during social interactions. In

other words, it is an "act of snubbing someone in a social setting by concentrating on one's phone instead of talking to the person directly" (Chotpitayasunondh and Douglas, 2016, 1). There are numerous citations in the literature indicating the existence of ambiguities in defining and measuring technoference and phubbing. According to Wang *et al.* (2020): "Previous empirical research measuring parental phubbing (or parental technoference) has relied on parental reports of their own behavior (McDaniel *et al.* 2018; McDaniel and Radesky 2018a, 2018b; McDaniel and Coyne 2016)." Lemish *et al.* (2020) state: "Radesky, Miller, *et al.* (2014) were the first to operationalize parents' level of device use during parent-child interaction as "the extent to which the primary focus of the caregiver's attention and engagement was with the device rather than the child" (845). This behavior has been recently defined as parental screen distraction (PSD) that applies to situations "in which parents or caregivers are distracted from performing behaviors associated with the parent role due to engagement with a screened device" (Blackman, 2015, 6), or simply technoference (i.e., technology interference in parent-child interactions; McDaniel and Radesky, 2017). Technoference can be understood as a version of phubbing that focuses specifically on implications for parental interactions. Such parental use of mobile media was found to have various negative outcomes on the quality of childcare (Lemish *et al.,* 2020, 3; Radesky *et al.,* 2016). Researchers also use measures for phubbing while discussing technoference in their work. For example, Meeus *et al.* (2021) claim: "Technoference. Preadolescents' perceptions of their parents' technoference were assessed using an adapted version of the Roberts and David (2016) partner phubbing scale."

Recently, several scientists have called for caution and more rigorous scientific inquiry to clarify the role of parental smartphone use in children's development (e.g., Frackowiak *et al.,* 2023; McCaleb *et al.,* 2021; Modecki *et al.*, 2021). In line with this, Frackowiak *et al.* (2023) emphasize that when defining the concept of mobile phone use in parent-child interactions, it is important to consider the devices that are used (e.g., smartphone), the cause of use (internal – compulsive behavior or external – pressured by work-related notifications), behavioral mechanisms (distraction vs. interruption), and the consequences of behavior (e.g., the child's emotional response). The authors explain the differences between the constructs of "phubbing", "technoference", and "parental screen distraction" through the harm mechanism, which involves the feelings of being ignored in phubbing, interference in technoference, and distraction in parental screen distraction (Frackowiak *et al.*, 2023). Additionally, Frackowiak *et al.* (2023) emphasize that studies have not paid sufficient attention to studying these mechanisms but rather to perceptions of the effects of the mechanisms, which potentially could lead to erroneous conclusions because then happens that we over-pathologize the use of digital technology (Przybylski and Weinstein, 2017).

Earlier studies have recognized the need for greater clarity regarding constructs related to parental smartphone use in interactions with children (Frackowiak *et al.*, 2023).

Given the significant confusion prevailing in this research area, especially concerning the definition and operationalization of the construct of technology-based interruptions in parent-child interactions due to parents' smartphone use, this systematic review has two main goals: (1) examine the common definitions of technology-based interruptions due to parents' smartphone use in parent-child interactions, and (2) investigate the most used measures for technology-based interruptions due to parents' smartphone use.

2. METHODS

The study has been pre-registered on Prospero (https://www.crd.york.ac.uk/prospero/), an international prospective register of systematic reviews.

2.1. REVIEW QUESTIONS

1. How are technology-based interruptions in parent-child interactions due to parents' smartphone use termed and defined in the literature?

2. How are technology-based interruptions in parent-child interactions due to parents' smartphone use measured in previous research?

2.2. STUDY INCLUSION CRITERIA

Published research is retained for extensive examination if it meets the following inclusion criteria: (a) focuses on technology-based interruptions due to parents' smartphone use during parent-child interaction, defined as any form of spending time together (eating, playing, driving, etc.); (b) uses methods for assessing technology-based interruptions due to parents' smartphone use; and (c) examines technology-based interruptions due to parents' smartphone use.

2.3. STUDY EXCLUSION CRITERIA

Published research that assumes the co-use of smartphones in social interactions is excluded. Technology-based interruptions due to parents' smartphone use do not include smartphone social behaviors that do not interfere with face-to-face interactions or involve temporary interpersonal neglect (e.g., using a smartphone together in an interaction). Distractions from the smartphone outside of social interactions (e.g., taking pictures instead of enjoying the beautiful scenery) are also not related to tech-

nology-based interruptions due to parents' smartphone use. Also, research conducted with infants is excluded as well as studies with children with special needs, since their reactions and development need a specific study focus.

2.4. SEARCH STRATEGY

This systematic review was based on published scientific research papers. Grey and popular literature were excluded. This systematic review considers both qualitative (e.g., observational) and quantitative (e.g., experimental, correlational) study designs on the topic of technology-based interruptions in parent-child interactions. Systematic reviews, meta-analyses, and scoping reviews were also considered, along with conference abstracts and dissertation papers. We note that, despite the primary focus on published scientific papers, conference abstracts and unpublished dissertations were also included to reduce publication bias and provide a more comprehensive synthesis. This review did not require that the included measures meet specific psychometric criteria (e.g., validity, reliability). Studies published in English are included with no specific time limit until March 2024.

Despite the inclusion of meta-analyses (n = 1) and systematic reviews (n = 13), due to the high heterogeneity in definitions and measurement instruments, this systematic review does not provide consistent quantitative indicators of effect size trends.

APA PsycInfo, Web of Science, Scopus, ScienceDirect, PubMed, and Google Scholar were searched using database-specific Boolean combinations (Table 1). In brief, strings combined technology-based interuption terms (e.g., technoference, phubbing, "phone distraction," "absent presence"), parent terms (parent* OR mother* OR father* OR caregiver*), child terms (child* OR adolescent*), digital device terms (phone OR smartphone OR "mobile phone" OR "cell phone"), and relationship terms (interaction* OR relation* OR "parent–child" OR "mother–child" OR "father–child").

Table 1 Keywords used in the systematic review

Terms	**Key words**
Technology-based interruption terms	absent presence, phone distraction, technoference, technology interference, technological technoference, family technoference, parental technoference, parents' technoference, parent's technoference, co-present phone use, phubbing
Parent terms	parental, parent(s), mother(s), maternal, father(s), paternal, caregiver(s)
Child terms	children, childhood, adolescents, adolescence
Digital device terms	phone, smartphone, mobile phone, cell phone (use)
Parent-child relationship terms	interaction(s), relation(s), relationship(s), parent-child, child-parent, mother-child, child-mother, father-child, child-father

2.5. DATA EXTRACTION

After conducting the above literature searches, the retrieved articles were screened by title, abstract, and full text in the ASReview (Active Learning for Systematic Reviews - https://asreview.nl/) application. Studies that did not meet the inclusion criteria for this systematic review were eliminated, and the remaining studies were considered for further analysis. One reviewer extracted the data, and a second one checked the data. The eligibility of the articles was assessed based on the inclusion/exclusion criteria. After the literature screening, data extraction from the selected studies was initiated. Two independent researchers performed the data extraction and collected the extracted information into a data extraction table.

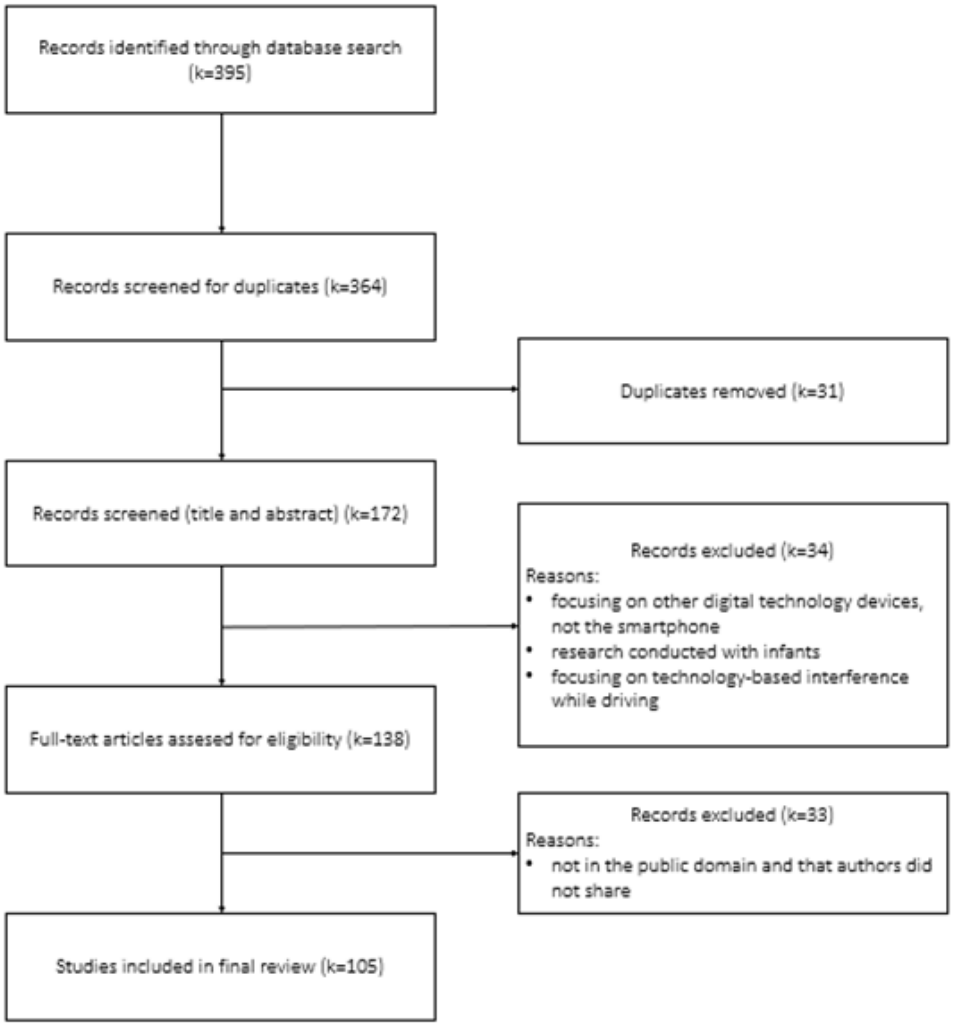
For each included study, bibliographic information (e.g., authors, title, year of publication, definitions, measures, etc.), construct definitions and operationalizations, sample characteristics and design (e.g., sample size, gender, age, demographic group, etc.), instruments and measurement conditions, and key findings relevant to parent–child interaction outcomes were extracted.

If the results of the data extraction did not agree between the two coders, the results were discussed and checked with the third coder. Disagreements most concerned the primary construct category (e.g., whether a study should be classified under technoference or phubbing) and the coding of measurement type or outcome focus. In such cases, coders first revisited the original article and compared their rationale using a predefined set of decision rules (e.g., priority of authors' terminology, focus on mechanisms vs. general use). Only when consensus could not be reached did the third coder adjudicate. This process was intended to enhance the transparency and reliability of construct classification and instrument coding.

The percentage of agreement among researchers regarding the acceptance of studies for further analysis was 91.89 %. The total number of records was n = 364, of which n = 138 were assessed as relevant. The final number of research papers included in the analysis was n = 105. Papers that were not in the public domain and that authors did not share with us upon our request till 20th March 2024, were excluded from further analysis (n = 32).

The entire research process is reported in full in the final version through the Flow Chart of Literature Search, Figure 1, and studies included in the systematic review in Appendix 1.

Figure 1 Flow chart of the literature search



2.6. STUDY QUALITY

The study quality is assessed with the study quality instrument, the Mixed Methods Appraisal Tool (MMAT; Hong *et al.*, 2018). This instrument consists of checklists for assessing the quality of quantitative and qualitative studies (Hong *et al.*, 2018).

2.7. DATA ANALYSIS

Considering different levels of immersion implied by the most used terms in this research area, we divided the papers into three broad categories according to key terms: a) smartphone use, b) technoference, and c) phubbing. In a first step, we grouped studies according to their primary construct (smartphone use, technoference, or phubbing) and the predominant mode of assessment (observational, self-report, experimental, or review-based). Within each construct, we then compared operational definitions and instruments. During the analysis, a particular focus was placed on operational definitions and measures used. Given the high heterogeneity of measures and operational definitions in the field, a method of thematic synthesis was applied for grouping findings based on the prevalent key term (smartphone use, technoference, phubbing).

3. RESULTS

The present systematic review identified a total of 105 published studies that met the inclusion criteria. Of these, 69 studies relied on survey, self-report, or interview data, 15 incorporated observational data, 7 adopted a (quasi-)experimental approach, and 13 were literature reviews and meta-analyses. Sample sizes varied significantly, ranging from N = 4451 to N = 38 participants. Most studies were conducted in China (n = 33), the USA (n = 30), Europe (n = 20), Australia (n = 3), and Canada (n = 3), predominantly in urban or suburban areas. Publication dates of the studies ranged from 2014 to 2023. The reviewed papers were categorized into three categories based on the level of immersion in mobile phone use: smartphone use (n = 27), technoference (n = 40), and phubbing (n = 38).

The category "smartphone use" was included separately because it refers to a simple behavioral measure of the presence, frequency, or duration of use. Unlike technoference and phubbing, smartphone use alone does not necessarily imply the mechanism of interruption or harm, but it serves as a broader foundation for understanding the more complex phenomena of technoference and phubbing. Taken together, the results indicate that research on technology-based interruptions in parent–child interactions is characterised by terminological and methodological fragmentation. Similar or overlapping behaviours are labelled with different constructs and assessed with a wide variety of instruments, while distinct constructs sometimes rely on very similar measurement tools. This heterogeneity helps explain why conclusions about the impact of parents' smartphone use on children's outcomes may be mixed and difficult to compare.

The studies involving caregivers and infants (n = 18) were not included in further analysis for two reasons. The first reason is that infants and older children differ in their reactions to technology-based interruptions, which can mostly be attributed to their

developmental stage and needs. The second reason is methodological, relating to the fact that studies involving infants mostly utilized the still-face paradigm (e.g., Stockdale *et al.*, 2020), which involves instructed and intentional ignoring of the child due to mobile phone use.

3.1. SMARTPHONE USE

Most studies were qualitative (n = 12), followed by systematic reviews and meta-analyses (n = 6), experimental studies (n = 5), and studies using self-report data (n = 3).

3.1.1. Definitions

Through the review, the use of mobile phones in parent-child interactions is commonly defined as using phones while caring for children (Hiniker *et al.*, 2015), device use during playtime at playgrounds (Wolfers *et al.*, 2020), and mobile phone use during a family meal in eateries (Elias *et al.*, 2021a). Within studies focusing on mobile phone use, this construct is often operationalized as the frequency of use and duration of use (e.g., Ochoa *et al.*, 2021; Radesky *et al.*, 2014).

3.1.2. Measurements

In studies investigating the concept of smartphone use during parent-child interactions, observational methods in natural settings were predominantly conducted (e.g., Linder *et al.*, 2022; Elias *et al.*, 2021a, b; Erwin *et al.*, 2021; Bury *et al.*, 2020; Kiefner-Burmeister *et al.*, 2020; Wolfers *et al.*, 2020; Hiniker *et al.*, 2015; Radesky *et al.*, 2014, 2015), and such studies were mostly conducted in America and Australia, with fewer studies in Europe. Observational studies on smartphone use in parent-child interactions often concluded based on detailed field notes, where other behaviors, parental and child characteristics, events, environment, and other relevant details were noted (e.g., Linder *et al.*, 2022; Erwin *et al.*, 2021; Elias *et al.*, 2021a, b; Bury *et al.*, 2020; Kiefner-Burmeister *et al.*, 2020; Wolfers *et al.*, 2020; Hiniker *et al.*, 2015; Radesky *et al.*, 2014). In such research, mobile device use was commonly recorded by timing each instance to the minute using a digital clock to facilitate comparison between behaviors occurring during device use and in its absence (e.g., Erwin *et al.*, 2021; Hiniker *et al.*, 2015; Radesky *et al.*, 2014).

On the other hand, for some observational studies, coding schemes were developed to quantify the observation of mobile phone use behavior more easily (e.g., Ochoa *et al.*, 2021; Radesky *et al.*, 2015). One such example is found in the work of Ochoa *et al.* (2021), who used a dichotomous scale (0 - not observed; 1 - observed) to record wheth-

er caregivers and their child used a device, how they used it (i.e., texting/swiping, taking a picture, looking at the screen), caregiver-child proximity, and whether they displayed a list of specific behaviors in parent-child interactions at least once in each 10-second observational interval.

Some studies employed experimental methodology in which parent and child behavior during structured tasks was observed (e.g., Cosottile and Damashek, 2022; Lederer *et al*., 2022; Kushlev and Dunn, 2019; Reed *et al*., 2017; Radesky *et al*., 2015).

In their research, Wolfers *et al.* (2023) used the experience sampling method in which parents were asked to rate how often they use their smartphones on a scale from 1 (never) to 5 (all the time), and whether they had used their phone during a stressful situation. Mothers indicated if their smartphone use harmed their interaction with their child during the situation on a scale from 1 (do not agree) to 5 (fully agree).

Quaresma (2017) conducted qualitative research with parents using three items to assess the frequency of digital technology use at mealtimes, for the participant, partner, and child. Parents reported on a scale with a forced-choice format. In the beginning, they had to choose the state that describes their own, or their partner's, or child's behavior ("Some people regularly use digital technologies (i.e., iPhone, tablet, laptop, etc.) during family mealtimes at home (e.g., dinnertime)" and "Other people rarely use digital technologies during family mealtimes at home"). After choosing the statement, participants indicated whether the description was really true or sort of true.

The literature review identified five systematic reviews by Kildare and Middlemiss (2017), Opsenica Kostić (2022), Tammisalo and Rotkirch (2022), Beamish et al. (2019), and Knitter and Zemp (2020), as well as one meta-analysis by Courtright and Caplan (2020).

3.2. TECHNOFERENCE

Studies investigating the concept of technoference were mostly quantitative (n = 30), although initially, several observational studies were conducted (n = 2), as well as studies with experimental methodology (n = 2). Technoference as a construct was predominantly studied in America (n = 19), and it was primarily explored by the pioneer of this concept, McDaniel (2015), while later interest expanded to Europe (n = 9).

3.2.1. Definitions

In McDaniel's work (2015), where the term "technoference" was first mentioned, the author defines the concept as follows: "I focus here on the potential for technology in-

terference in couple and family relationships—times when technology devices intrude, interrupt, and/or get in the way of couple and family communication and interactions. I term this 'technoference.'" (McDaniel, 2015, 7). Numerous subsequent studies have used the same definition as McDaniel (e.g., Amaliyah and Agustina, 2023; Dixon, 2023; Szymańska, 2023; Tran, 2023; Dolev-Cohen and Ricon, 2022; Roberts, 2022; Uzundağ *et al.*, 2022; Meeus *et al.*, 2021; Merkaš *et al.*, 2021; Gramm *et al.*, 2020; Sundqvist *et al.*, 2020; Qiao and Liu, 2020; Liu *et al.*, 2020a; Moldecki *et al.*, 2020; Turvill *et al.*, 2019; Stockdale *et al.*, 2018). Initially, this concept was studied within romantic relationships, and it was only later investigated in the context of parent-child relationships. In some studies (most commonly observational studies), the term "technoference" was used, but parents' smartphone use was examined (e.g., Lemish *et al.*, 2020). On the other hand, in some studies (e.g., Kelly *et al.*, 2023; Kelly and Ocular, 2021), the keywords include "technoference," while measures of smartphone use are used, but nowhere else in the text is the term "technoference" referenced.

3.2.2. Measurements

Technoference has been studied in observational research and (quasi-)experimental studies where it was measured from detailed field notes, observation protocols, and coding schemes (e.g., Kelly and Ocular, 2021; Lemish *et al.*, 2020; Boles and Roberts, 2008). In the research by Lemish *et al.* (2020), field notes were used. Technoference due to parents' smartphone use was measured by coding parent mobile device use (e.g., when, for how long, and how they are used and under what circumstances), and parent-environment interaction (e.g., interaction with others; engagement in nonmobile-devices-related activities). In their study, Boles and Roberts (2008) used comparisons of multi-phase conditions, dividing the 45 minutes in the room into three phases: no planned distractions, a planned distraction period, and no planned distractions. Each phase lasted 15 minutes and was monitored by the researcher or a parent using digital stopwatches. Ten parent-child dyads were randomly assigned to one of four conditions: phone distraction, TV distraction, computer distraction, or no distraction. Similarly, Kelly *et al.* (2023) determined smartphone use from the observation protocol if the parent took a photo, looked at the phone alone, or looked at the phone with the child.

The short story methodology for studying technoference in parent-child interactions was used by Browne (2022). In this research methodology, short stories were designed for children, and their task was to continue writing the story along the same theme. The themes in the stories for children in the social device interruption group were some of the common activities with their parents (i.e., a mother and son playing a board game) that are being interrupted by a digital technology device (i.e., a mother receives a phone call).

Regarding self-report measures as assessment tools for technoference in the parent-child relationship, there are several scales - The Technoference Scale (McDaniel and Coyne, 2016a), Technology Device Interference Scale (hereinafter: TDIS; McDaniel and Radesky, 2018a, b), The Technology Interference in Life Examples Scale (hereinafter: TILES; McDaniel and Coyne, 2016a), Technology Interference in Co-parenting Scale (hereinafter: TICS; McDaniel and Coyne, 2016a), Technology Interference in Parenting Scale (hereinafter: TIPS; McDaniel and Coyne, 2016a), Distraction In Social Relations and Use of Parent Technology (hereinafter: DISRUPT; McDaniel, 2021) and Technoference Attitudes and Beliefs (Zurcher *et al.*, 2020) showed in Table 2.

Table 2 Self-report measures as assessment tools for technoference in the parent-child relationship

Name	Operationalization	Scale	Example of items	Study where scale was used
The Technoference Scale (McDaniel and Coyne, 2016)	Frequency of technology interference in parent-child interactions, and it was conducted on parents and children	1 (not at all) to 5 (a great deal)	"My parents ignore me when they are on their tablet/cell phone", "I struggle to get my parents' attention when they are on their tablet/cell phone", and "My parents check their cell phone/ tablet even if I'm right in the middle of a conversation with them."	Liu (2020); Stockdale *et al.* (2018)
The Technology Interference in Life Examples Scale (TILES; McDaniel and Coyne, 2016)	Frequency of experiencing technology interference in life, specifically romantic relationships	1 (less than once a week), 2 (once a week), 3 (once every few days), 4 (once a day), 5 (2 to 5 times a day), 6 (6 to 9 times a day), and 7 (10 or more times a day).	"During a typical mealtime that my partner and I spend together, my partner pulls out and checks his phone or mobile device" and "When my partner's phone or mobile device rings or beeps, he pulls it out even if we are in the middle of a conversation"	Liu (2020); Qiao and Liu (2020); McDaniel *et al.* (2018)
Technology Interference in Co-parenting Scale (TICS; McDaniel and Coyne, 2016)	How frequently cell phones/smartphones, television, computers/laptops, and iPads or other tablets get in the way of or even interrupt interactions that they have when all three family members (mother, father, child) are present	0 (never), 1 (rarely), 2 (sometimes), 3 (often), 4 (very often), 5 (all the time)		McDaniel and Coyne (2016a)
Technology Interference in Parenting Scale (TIPS; McDaniel and Coyne, 2016)	How frequently technology interferes with or interrupts their own and their partner's parenting during 14 domains, such as mealtime, naptime, education activities, discipline/limit setting	0 (never), 1 (rarely), 2 (sometimes), 3 (often), 4 (very often)	"On a typical day, about how many times do the following devices interrupt a conversation or activity you are engaged in with your child?"	Tran (2023); Roberts (2022); Merkaš *et al.* (2021); Newsham *et al.* (2020)

Technology Device Interference Scale (TDIS; McDaniel and Radesky, 2018)	How frequently cell phones/smartphones, TV, computers/laptops, and iPads or other tablets get in the way of or even interrupt interactions that they have with their partners/children	0 (none) to 6 (more than 20 times)	"On a typical day, about how many times do the following devices interrupt a conversation or activity you are engaged in with your child?" The 6 items on the scale included: cellphone/smartphone, television, computer, tablet, iPod, and video game console	Cohen and Ricon (2022); Zhang *et al.* (2022); McDaniel *et al.* (2021); Dolev- Sundqvist et al. (2020); Truvill *et al.* (2019); McDaniel and Radesky (2018a, b)
Technoference Attitudes and Beliefs (Zurcher *et al.*, 2020)	Acceptance of technoference behaviors in general, or how accepting one is of using technology while caring for his or her child theoretically without taking into consideration actual behaviors	1 (strongly disagree) to 4 (strongly agree)	Parents were given the prompt "It is okay for me personally to use media (e.g. cell phone, tablet, television, games, apps)" followed with the following items "When I take my child to the park", "When my child is playing with toys", "When feeding (breast or bottle feeding) my child", "When my child is watching television", and "When my child's attention is occupied by something else."	Zurcher *et al.* (2020)
Distraction In Social Relations and Use of Parent Technology (DISRUPT; McDaniel, 2021)	Parents' problematic phone tendencies while with their children	1 (strongly disagree) to 6 (strongly agree)	"During time I spend with my child I feel like I use my phone or other mobile device too much."	Canale et al. (2023); Szymańska (2023); Browne (2022); La Gioia (2022); McDaniel (2021); Merkaš *et al.* (2021); Zayia *et al.* (2021); Gramm *et al.* (2020)

Since the concept of technoference was initially investigated in romantic relationships, it is necessary to note that some of these scales were developed by modifying and adapting scales primarily used to measure interference in romantic partnerships (e.g., TDIS, McDaniel and Radesky, 2018a, b; TILES, McDaniel and Coyne, 2016a). Some of the mentioned scales have been modified and adapted in further research to obtain more valid results. For example, in their study, Newsham *et al.* (2018) modified the original TIPS scale by including questions about the amount of time spent in each activity and asking participants about the extent to which technology interfered with each activity. Additionally, the activities were adjusted and/or expanded to include other types of activities in which mothers might engage with their child (e.g., joint technology, chores with child, and "shopping trips" from the original TIPS were transformed into "playtime excursions, such as going to the park, library, pool, etc."). Participants reported the number of minutes per day spent on 11 activities, which were scored individually as well as combined into a Time in all activities score. Participants were then asked to rate how often they felt technology interfered with each of the 11 activities on a scale of 1 (never) to 6 (always).

In some studies, technoference was measured using a single item (e.g., Uzundağ *et al.*, 2022). Parents were asked to rate the frequency of interruptions ranging from 0 (never) to 4 (always) on the item: "Notifications and messages that appear on my smartphone interrupt the conversations and activities that I am engaged in with my child". Modecki *et al.* (2020) operationalized technoference as family displacement due to technology use and measured it by parents rating the extent to which their smartphone use displaced family time via two averaged items, 1 (strongly disagree) to 5 (strongly agree).

3.3. PHUBBING

When phubbing is the focus, there are not as many observational studies (n = 1) in the literature compared to smartphone use and technoference. Instead, questionnaire methods and self-report measures were predominantly used in studies, particularly with samples of adolescents and students, while only a small number of studies (2 out of 38 studies) considered parents' perceptions of experiencing phubbing in interactions with children. The construct of phubbing has been predominantly researched in China, comprising 96 % of the searched papers.

3.3.1. Definition

When defining the concept of phubbing in the literature, it is often mentioned that phubbing is a new word composed of "phone" and "snubbing." It indicates an interrup-

tion in social relationships where a person snubs or neglects others when concentrating on their mobile devices (Chotpitayasunondh and Douglas, 2016). However, different researchers define the concept of phubbing differently without considering the level of immersion in the mobile device. For example, some researchers say that parents' phubbing is an interruption in parent-adolescent interactions caused by parents' mobile phone use, leading adolescents to feel ignored (Xie and Xie, 2020) or simply parental phone use during interactions with their children (Zhang *et al.*, 2023). Some authors define phubbing very similarly to technoference, e.g., Dong *et al.* (2023) state that parents' phubbing refers to the extent to which parents use or are distracted by their smartphones when they interact with their children (Wang *et al.*, 2020). Various definitions mention terms such as "social exclusion" (Xie *et al.*, 2019), "ignoring" (e.g., Harianti and Kurniawan, 2022; Pancani *et al.*, 2020; Bai *et al.*, 2020a), "preoccupation" (Jiang *et al.*, 2023), and "neglect" (Wang and Lei, 2022). Taking this into account, it happens in the literature that researchers equate technoference and phubbing and use these two constructs interchangeably. For example, Wang *et al.* (2020, 2) state that "[…] previous empirical research measuring parental phubbing (or parental technoference) has relied on parental reports of their own behavior […]".

3.3.2. Measurement

As mentioned, self-report measures were predominantly used in this research area, with observational methods being slightly less common. Although the word "phubbing" was mentioned in the keywords of the observational study by Abels *et al.* (2018), this study examined caregivers' or parents' smartphone use. Caregivers' smartphone use was coded along with other parental activities (i.e., eating/drinking). However, the behavior coding, while not defined as phubbing, bears similarities to the definition of this concept in the literature. All activities in the study were coded using three levels of absorption into the activity: passive, occasional, and exclusive (coded 1, 2, and 3). Passive phone use referred to moments when participants simply held the smartphone in their hand, occasional use referred to occasionally glancing at the smartphone, while exclusive use was coded in cases where the caregiver appeared completely focused on a non-child-related activity, such as constantly manipulating their smartphone.

When it comes to self-report measures, which are also the most used in studies of the phubbing construct, several scales have been identified: The Parent Phubbing Scale (Roberts and David, 2016), The Generic Scale of Being Phubbed (Chotpitayasunondh and Douglas, 2016), The Generic Scale of Phubbing (Chotpitayasunondh and Douglas, 2016), Parental Phubbing Scale (Pascani *et al.*, 2020) which are showed in Table 3.

Table 3 Self-report measures as assessment tools for phubbing in the parent-child relationship

Name	Operationalization	Scale	Example of items	Study where scale was used
The Parent Phubbing Scale (Roberts and David, 2016)	The extent to which parent uses or is distracted by his/her cell phone while in your company	1 (never) to 5 (always)	"During a typical mealtime that my parents and I spend together, my parents pull out and check their cell phone" "My parent glances at his/her cell phone when talking to me."	Dong and Wang (2023); Jiang *et al.* (2023); Li and Ye (2023); Shen *et al.* (2023); Zhao *et al.* (2023); Mulyaningrum and Kusumaningrum (2022); Xiao (2022); Wang and Lei (2022); Xiao and Zheng (2022); Xie *et al.* (2021); Zhang *et al.* (2021); Wang *et al.* (2022a, c, d); Liu *et al.* (2021a, b); Allerd (2020); Niu *et al.* (2020); Xie and Xie (2020); Hong *et al.* (2019); Liu *et al.* (2019); Xie *et al.* (2019)
The Generic Scale of Phubbing (Chotpitayasunondh and Douglas, 2016)	An individual's perception of others' phubbing behaviors during face-to-face interactions	1 (never) to 7 (always)	"Others seem to check their phones for messages and social media updates." "Others seem like they get rid of boredom by paying attention to their phones instead of me." "I have conflicts with others because they are using their phones."	Li (2023); Li *et al.* (2022); Qu *et al.* (2022); Wang *et al.* (2022b); Geng *et al.* (2021); Bai *et al.* (2020)
The Generic Scale of Phubbing (Chotpitayasunondh and Douglas, 2016)	One's personal phubbing behaviors	1 (never) to 7 (always)	"I feel anxious if my phone is not nearby." "I have conflicts with others because I am using my phone." "I feel content when I am paying attention to my phone instead of others." "I pay attention to my phone for longer than I intend to do so."	Gavcar *et al.* (2023); Salas (2022); Bai *et al.* (2020)
Parental Phubbing Scale (hereinafter: PPS; Pancani *et al.*, 2020)	Adolescents' perceptions of parental phubbing behavior, both fathers, mothers, and overall phubbing behavior from parents	1 (never) to 5 (always/every time)	"Mom/Dad keeps holding her/his mobile phone when he is with me"	Harianti and Kurniawan (2022); Pancani *et al.* (2020)

The development of scales measuring parents' phubbing due to smartphone use has somewhat followed a similar developmental path as the scales for technoference. Specifically, scales for parents' phubbing have emerged through the adaptation and modification of scales originally measuring phubbing in romantic relationships. The modification changed "partner" to "parents", for example, "During a typical mealtime that my parents and I spend together, my parents pull out and check their cell phone" (PPS, Roberts and David, 2016).

4. DISCUSSION

A review of the literature indicates an inconsistency in this field, with overlapping content constructs and measures that are not consistently defined. This makes it challenging to conclude about the effects of the examined constructs in the context of parent-child relationships.

When viewed through the theoretical lenses outlined in the introduction, our findings suggest that the constructs of smartphone use, technoference, and phubbing map onto partially distinct mechanisms of technology interference in parent–child relationships. From the perspective of the displacement hypothesis (Valkenburg and Peter, 2007), both technoference and phubbing represent forms of attentional shift away from the interaction with the child, but they differ in the duration and intentionality of that shift. Social exchange theory (Homans, 1958) further highlights how repeated interruptions or experiences of being ignored may alter children's cost–benefit evaluations of the relationship, potentially undermining feelings of security and closeness. At the same time, the commentary on "absent presence" (Gergen, 2002) aligns most strongly with phubbing, where physical co-presence is accompanied by psychological withdrawal. By clarifying how these theoretical perspectives relate to the different constructs and measures in the literature, the present review provides a more coherent framework for interpreting mixed findings and designing future studies.

4.1. HOW ARE TECHNOLOGY-BASED INTERRUPTIONS IN PARENT-CHILD INTERACTIONS DUE TO PARENTS' SMARTPHONE USE TERMED AND DEFINED IN THE LITERATURE?

In the studied literature, it is not uncommon for all three terms "smartphone use," "technoference," and "phubbing" to be used simultaneously and/or interchangeably (e.g., Damashek, 2022; Meeus *et al.*, 2021), but it is important to consider some differences between the constructs arising from their operationalizations. While these terms share a common foundation – the use of mobile phones in close relationships- these

constructs significantly differ, especially when it comes to the mechanisms of harm as indicated by recent research by Frackowiak *et al.* (2023).

Smartphone use can be understood as a term that denotes the frequency and duration of mobile phone usage based on the methods and approaches used in the literature (e.g., Erwin *et al.*, 2021; Ochoa *et al.*, 2021; Radesky *et al.*, 2014). As such, this construct underlies both technoference and phubbing, and researchers have sometimes defined technoference simply as the use of mobile phones in interactions with children (e.g., Browne, 2022; Lemish *et al.*, 2020; McDaniel and Radesky, 2018). However, it is necessary to distinguish these constructs primarily because technoference refers to technology-based interruptions, not just usage, since smartphone use alone does not necessarily lead to interruption.

Although sometimes used interchangeably (e.g., Meeus *et al.*, 2021; Wang *et al.*, 2019), technoference and phubbing significantly differ. Frackowiak *et al.* (2023) explain the differences between the constructs of "phubbing", "technoference", and "parental screen distraction" through the harm mechanism, which involves the feelings of being ignored in phubbing, interference in technoference, and distraction in parental screen distraction. However, when defining the behaviors to which technoference and phubbing refer, it is important to consider several aspects. Firstly, the digital technology device itself. Although most research focuses on the use of mobile phones and smartphones, it is important to note that technoference also applies to other devices, such as tablets (e.g., McDaniel and Coyne, 2016a), while all conducted studies on phubbing included only mobile phones. Secondly, while defining technoference, the aspect of "interruptions" and "distractions" is emphasized, phubbing emphasizes the concepts of "snubbing" and "ignoring". Given this, it is evident that there is a difference in the locus of control. Namely, technoference implies that something externally interrupts communication (external locus of control), whereas phubbing emphasizes the intention of ignoring (internal locus of control). This is in line with the most frequent reasons for parents' use of digital technology (McDaniel, 2020), according to which there are internalized motivations (habitual checking of notifications) and externalized motivations (performing work-related tasks) for parents' smartphone use. So, it can be assumed that technoference involves only brief interruptions of interactions, while phubbing extends beyond these interruptions since the individual intentionally focuses on their mobile phone (maybe due to an inability to resist the urge to use it). Third, taking these into account, it seems important to consider the duration of behavior when distinguishing between the concepts of technoference and phubbing. Namely, technoference refers to brief interruptions in communication that may not cause harm if infrequent, while phubbing relates more to prolonged behaviors of smartphone use during social interactions, leading to extended periods of ignoring the child with whom a parent is interacting. Taking all the above into consideration, it can be said that the fundamental charac-

teristics of technoference are short, brief externally derived interferences (from digital technology devices like tablets, smartphones) during interactions in close relationships. The basic characteristics of phubbing are longer periods of smartphone use during interactions in close relationships, which are often internally motivated and intentional.

4.2. HOW ARE TECHNOLOGY-BASED INTERRUPTIONS IN PARENT-CHILD INTERACTIONS DUE TO PARENTS' SMARTPHONE USE MEASURED IN PREVIOUS RESEARCH?

Smartphone use is mostly studied using observational methods, where either the usage time or frequency (e.g., Linder *et al.*, 2022; Erwin *et al.*, 2021; Elias *et al.*, 2021a, b; Bury *et al.*, 2020; Kiefner-Burmeister *et al.,* 2020; Wolfers *et al.*, 2020; Hiniker *et al.*, 2015; Radesky *et al.*, 2014, 2015). These studies are useful when it comes to understanding the broader context of the observed behavior, but they do not have sufficient strength in concluding the consequences of the observed behavior because they rely on the observer's capabilities and interpretation of the perceived determinants. Technoference and phubbing are more commonly studied using self-report measures. Both technoference and phubbing measures have originated from modifications of instruments primarily developed to measure technoference or phubbing in romantic relationships (TDIS, McDaniel and Radesky, 2018a, b; PPS, Roberts and David, 2016). This may be a major drawback because parent-child interactions, especially if children are young, significantly differ from romantic interactions or friendship interactions. This opens new opportunities for the development of better measures aimed at parent-child relationships at first.

Additional confusion in this area is due to the unclear content validity of the scales. For example, in the Technoference Scale (McDaniel and Coyne, 2016a), there is an item "My parents ignore me when they are on their tablet/cell phone", which implies more towards phubbing rather than technoference. On the other hand, the PPS (Pancani *et al.*, 2020) contains items that relate more to technoference, or smartphone use, than behaviors characteristic of phubbing, such as "Mom/Dad keeps holding her/his mobile phone when he is with me". Additionally, it is important to note that some scales of phubbing (e.g., The Generic Scale of Phubbing, Chotpitayasunondh and Douglas, 2016) are more multifactorial and include the internal aspect of mobile phone use (e.g., nomophobia), as well as interpersonal conflict and self-isolation experiences, which are more related to one's experiences within the dyadic relationship. This approach is not represented in measurement instruments intended for measuring technoference (DISRUPT, McDaniel, 2021). Some measures used are quite sensitive and depend on an individual's ability to retrospectively respond to questions (e.g., TIPS, McDaniel and Coyne, 2016a). In fact, smartphone use has become so automated that it's difficult to

bring awareness to the details of its use (Oulasvirta *et al.*, 2012). Moreover, it seems important to consider that parents often provide socially desirable responses since it involves a sensitive issue for them.

4.3. LIMITATIONS AND FUTURE DIRECTIONS

Some limitations should be noted. Not all studies used the term "smartphone". Instead, varying terms like "mobile phone" or "mobile device" were used, leading to ambiguity regarding whether they referred to online or offline activities. Hence, we opted to adopt "smartphone" as a comprehensive term, given that presently most adults incorporate smartphones into their daily routines (Eurostat, 2023). Second, in some studies, especially when it comes to observational studies, the age of parents or children is not mentioned, making it difficult to generalize the findings.

Conclusions are contextualized by methodological limitations. Due to the prevalent use of self-report measures (questionnaires), results are susceptible to socially desirable response bias, as parental smartphone use may be considered as a sensitive question. Many measures originate from modified instruments developed for romantic relationships, which questions their content validity in the parent-child interaction context. Furthermore, the geographical concentration of studies, especially the focus on phubbing in China, requires caution in generalizing the findings.

Furthermore, it is important to examine the percentage of shared variance among technoference, phubbing, and problematic mobile phone use, as previous research has shown that problematic use significantly predicts both technoference and phubbing (Newsham *et al.*, 2018; Chotpitayasunondh and Douglas, 2016). One possible way to do so is to apply existing measures at one time and, through appropriate statistical procedures, establish the similarities and differences between these constructs. What is more, suggestions for future research are to verify the constructs and content validity of the constructs of technoference and phubbing to avoid further confusion in this field. According to the results of the review, we highlight possible differentials between smartphone use, technoference, and phubbing to be considered for future research (Table 4).

We suggest that smartphone use should be defined and measured as simply a behavior of use, through the simple presence of parents' smartphone use during interactions with children (Table 4). Maybe only measured as presence, or frequency (e.g., present/not present during interaction, used vs. not used, or frequency of use during interactions) without accounting for the intention of use and harm for interpersonal communication, interaction, and the child's development in the definition. It is the presence of smartphones and their use in interactions.

We further suggest that smartphone use can be passive (like holding a smartphone in hands during conversation with a child, or leaving it on a visible spot, for example, on a table during a family meal) (Table 4). In this way, the use is not primarily harmful but potentially can lead to situations that may provoke harmful behaviors (e.g., long duration of use can lead to neglect of children during interactions) if it becomes active. Smartphone use can also be active in interactions, with occasional active use or constant active use. This active use does not imply joint use by parents and children.

If smartphone use is active and occasionally used during interactions and the use is personally non-intentional, namely externally triggered, it is related to technology interference or technoference in interactions (Table 4). Technoference may be defined as short, brief intrudes, disruptions, or interruptions of communication and conversations caused by the smartphone itself (notification from smartphone, ringing of smartphone) during interactions in parent-child interactions. In this way, technoference is an externally triggered distraction of parent-child interactions. Because it is brief and non-intentional, it does not pose very harmful and long-term effects on communication, interaction, and the child's development itself. But if technoference is present very frequently (like regularly or ordinary) in parent-child interactions, it can become harmful for communication, conversation, and the child's development as well as parent-child relationships. The key spot where technoference starts to cause harm to children is their constant or prolonged feelings of being unseen, unheard, ignored, and neglected by parents who use smartphones during interactions. In this way, the presence of harmful effects of technoference in interactions can only be explored in nature by asking children (the other person in the dyad) how they feel if their parents use their smartphones in interactions with them.

If smartphone use is actively and constantly used during interactions and the use is internally driven by parents, situations of phubbing are present (Table 4). Phubbing can be described as an act of parents' neglecting and ignoring children during interactions because of prolonged and intentional smartphone use by parents (it can be the other way around, with children's smartphone use, not to be taken wrongly). Phubbing is present if parents actively use their smartphones for a period during face-to-face interactions with their children which their ignore their children, causing harm to children's development, conversations, and communication during interactions, as well as the parent-child relationship. The feelings of being ignored by parents who use smartphones are inevitably present during phubbing. These are situations in which parents intentionally and internally motivated, choose smartphones over children during interactions. Therefore, the effects of phubbing are harmful.

A further limitation concerns the characteristics of the samples included in the reviewed studies. Most studies focused on typically developing children in early and middle childhood or adolescence, whereas infants and children with special educational

needs or neurodevelopmental conditions were not represented. As a result, the generalisability of our conclusions to these groups is limited. Future research should therefore include broader and more diverse samples, including infants and children with special needs, to examine whether the mechanisms and consequences of parents' smartphone use in interactions differ across developmental periods and child characteristics.

Finally, the generalisability of our conclusions is constrained by the geographical and sample characteristics of the reviewed studies. Research on phubbing is heavily concentrated in China, while much of the technoference literature originates from North America and Europe, often with relatively homogeneous, urban or suburban, and middle-class samples. Studies rarely include families from low- and middle-income countries or culturally diverse parenting contexts, and infants and children with special needs are frequently excluded. As a result, it remains unclear to what extent existing findings capture universal processes versus culturally specific patterns of technology use and family interaction. Future research should therefore prioritise more diverse samples and contexts to test the robustness of current assumptions and to ensure that emerging guidelines are sensitive to different family realities.

4.4. PRACTICAL IMPLICATIONS

Beyond conceptual clarification, our synthesis also points to several practical implications. For practitioners and policymakers, distinguishing between general smartphone use, brief externally triggered interruptions, and prolonged, intentional phubbing is important when designing guidelines and interventions for families. Rather than pathologising all technology use, efforts could focus on helping parents to minimise frequent, non-essential interruptions during key interaction contexts (e.g., mealtimes, bedtime routines) and to recognise children's feelings of exclusion when interference occurs. Parenting programmes and pediatric counselling might incorporate concrete strategies for managing notifications, setting "device-free" moments, and openly discussing digital habits within the family. For researchers, the findings underscore the need to develop age-appropriate, developmentally sensitive measures that can be used across cultural contexts and that clearly separate behaviour, perceived interference, and child outcomes.

Table 4 Possible differentials between smartphone use, technoference, and phubbing

Variable/ Construct	**Ways of smartphone use during interactions**	**Ways of active smartphone use during interactions**	**Variable/ Construct**	**Potential to be harmful**
Smartphone use presence or frequency (e.g., present/not present during interaction, used vs. not used, or frequency of use during interactions)	Passive use (e.g., holding a smartphone in hands during a conversation with a child, or leaving it on a visible spot, for example, on a table during a family meal)			
	Active use (e.g., texting while in face-to-face interactions, looking at notifications, talking on a smartphone)	Occasional, non-intentional, externally triggered, short use	**Technoference** - Short, brief intrudes, disruptions, or interruptions of communication and conversations caused by the smartphone itself during interactions	- Does not pose harmful effects on communication, interaction, and the child's development itself - If present very frequently, it can become harmful - Cause harm to children when they start to feel unseen, unheard, ignored, and neglected by parents who use smartphones during interactions
		Constant use, intentional, internally triggered, longer use	**Phubbing** - The act of ignoring and neglecting other people in interactions because of the intentional and internally motivated use of a smartphone during interactions	- Poses harmful effects on communication, interaction, and the child's development itself - Feeling of being ignored is present from the start of use

5. CONCLUSION

A review of the literature reveals inconsistency in this area, with overlapping content constructs and inconsistently defined measures, leading to significant overlap in research methods. This complexity makes it difficult to conclude the effects of these constructs on parent-child relationships and child development. The smartphone use can be regarded as an overarching term referring to the smartphone presence or use in interactions. Fundamentally, technoference involves brief external induced interruptions from smartphones during interactions. Phubbing entails an internally motivated and intentional act of ignoring other person in interactions due to attention given to a smartphone. Both constructs elicit similar emotional reactions in the other person in the dyad, resulting in a feeling of neglect, but it seems that the cause of this feeling has a different underlying mechanism for the two constructs. We strongly advise against the introduction of new terminology in the field to describe these smartphone use behaviours in interactions and related consequences until present are not defined.

The literature review reveals inconsistency in this area, with overlapping content constructs and inconsistently defined measures, leading to significant overlap in research methods. Although differentials in harm mechanisms have been identified, it is necessary to emphasize that most measures originated from adaptations of instruments used in romantic relationships. Our review is limited by the methodological heterogeneity of the studied literature, including the lack of consistent quantitative data and the reliance on self-reports. Future research should focus on standardizing measurement instruments specifically aimed at parent-child interactions to advance scientific understanding of technology's impact and provide reliable guidelines for practice.

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TEHNOLOŠKI UVJETOVANI PREKIDI U INTERAKCIJAMA RODITELJ – DIJETE: SUSTAVNI PREGLED KONCEPTUALIZACIJE I MJERENJA

Sažetak

Cilj je ovoga rada objasniti kako se u literaturi nazivaju, definiraju i mjere tehnološki uvjetovani prekidi u interakcijama roditelj – dijete zbog roditeljske upotrebe pametnog telefona, odnosno mobitela. Za potrebe sustavnog pregleda pojmovi za pretraživanje uneseni su u šest baza podataka (APA PsycInfo, Web of Science, Scopus, ScienceDirect, PubMed i Google Scholar), koristeći unaprijed definirane nizove za pretraživanje. Protokol je unaprijed registriran u PROSPERO-u. Probir studija proveden je u alatu ASReview. Kvaliteta studija procijenjena je s pomoću MMAT-a (2018). Nakon sustavne evaluacije, 105 studija svrstano je u tri kategorije i uključeno u pregled: korištenje pametnog telefona (engl. *smartphone use*) (n = 27), ometanje tehnologijom (engl. *technoference*) (n = 40) i *phubbing* (ignoriranje sugovornika zbog korištenja mobitela; n = 38). Pregled ukazuje na nedosljednosti u ovom području, uz preklapajuće konstrukte i mjere koji nisu dosljedno jasno definirani. U ovom se pregledu pojašnjavaju definicije pojmova „korištenje pametnog telefona", „ometanje tehnologijom" i „*phubbing*" te se analiziraju njihove operacionalizacije i mjerni instrumenti. Ključni nalazi upućuju na to da korištenje pametnog telefona označava širi bihevioralni pojam, ometanje tehnologijom kratkotrajni, izvana potaknuti prekid, a *phubbing* dulji, namjeran čin korištenja pametnog telefona za vrijeme socijalnih interakcija. U radu se razmatraju i predlažu jasnije definicije i operacionalizacije konstrukata koji se odnose na tehnološki uvjetovane prekide zbog roditeljskog korištenja pametnih telefona, kao smjernice za buduća istraživanja.

Ključne riječi: *interakcija roditelj – dijete, roditeljsko korištenje pametnog telefona, ometanje tehnologijom,* phubbing*, mjerenje, sustavni pregled*