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Original Article

Developing Attachment-Like Relationships with Smartphones Among Iranian Adolescents: A Grounded Theory Study

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Abstract

Objective: This study aimed to develop a culturally grounded substantive theory explaining how attachment-like relationships with smartphones develop and are negotiated within Iranian adolescents' relational worlds, and to distinguish these relationships from problematic smartphone use and addiction.
Method: This qualitative study used Strauss and Corbin's grounded theory approach. Participants were selected through purposive and theoretical sampling and included 25 individuals: 10 adolescents (13–18 years), 10 parents (36–62 years), and 5 counselors/therapists (30–46 years) with professional experience working with adolescents. Data were collected through semi-structured telephone interviews in Persian and analyzed using open, axial, and selective coding, constant comparison, and theoretical integration.
Results: The core category of "the development of attachment-like relationships with smartphones within adolescents' relational worlds" was identified. Two pathways emerged. The regulated, non-compensatory pathway involved emotional responsiveness, coherent digital guidance, caregiver modeling, self-regulation, and meaningful offline sources of connection and competence, allowing smartphones to remain flexible and purposeful resources. The compensatory-ambivalent pathway occurred when relational support and alternative sources of regulation were limited, increasing reliance on smartphones for connection, privacy, and distress management. This pathway involved a cycle of seeking access, temporary relief, frustration or conflict, and renewed use.
Conclusion: Attachment-like relationships with smartphones are shaped by the emotional and relational functions of the device rather than by use duration alone. Such relationships do not inherently indicate problematic use or addiction; concern emerges when smartphone-based regulation becomes dominant and displaces interpersonal relationships and developmental resources.

Key words*: Adolescent; Emotional Regulationt; Family Relations; Qualitative Research; Smartphones; Social Support*

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Smartphones are now part of adolescents' daily lives, influencing how they communicate, learn, spend their free time, organize their daily activities, and access social and health resources (1-5). In Iran, smartphone usage patterns are influenced by socioeconomic conditions, family interactions and opportunities available to adolescents (4, 6); moreover, international research also shows that purposeful use of mobile media can support learning and life skills (7, 8).

In Iran, adolescent smartphone research has largely approached this phenomenon through problematic use (9), behavioral addiction (10), excessive screen use (6), and nomophobia (11). Although recent studies indicate substantial levels of smartphone engagement among Iranian adolescents, including an average daily use of 6.85 hours among 585 adolescents (12), this body of research has primarily focused on negative outcomes such as impaired self-control (13), sleep (14) and physical health problems (15), poorer academic performance (16), and psychological distress (13). However, these findings do not fully explain how the relationship between an adolescent and the device becomes emotionally meaningful. Research has also shown that mobile devices can act as comforting technologies and become intertwined with individuals' emotional lives (1, 17). This raises another question: How is this emotional and relational meaning created, and what conditions shape this process?

Attachment theory provides a useful sensitizing perspective for examining this question. It explains the human tendency to seek closeness to significant others and to use attachment relationships as a source of security and emotional regulation (18, 19). This does not mean that a smartphone is equivalent to a caregiver or should be considered a human attachment figure. Rather, attachment theory provides a starting point for exploring why a nonhuman object might acquire emotional significance in experiences related to comfort, security, closeness, or distress. Winnicott's concept of the "transitional object" also provides a complementary bridge between attachment relationships and meaningful emotional relationships with objects. Transitional objects, such as blankets or toys, may be associated with comfort and a sense of continuity in a child's experience (20, 21). Subsequent research has shown that meaningful emotional relationships with nonhuman objects can continue beyond childhood and even include technological objects, such as smartphones (22-24). However, the smartphone also differs from a typical transitional object because of its sociotechnical nature. The device is not simply a physical object that can be carried or touched; rather, it provides continuous access to people, messages, memories, personalized content, information, and rapid feedback. Its emotional significance may therefore extend beyond the device itself to a broader "device-content-connection system" system through which adolescents communicate, obtain information, regulate their emotions, maintain their privacy, and sustain connections with others (25-29). Through these functions, the device may acquire an attachment-like relational meaning that overlaps with problematic or addictive patterns of smartphone use. However, these constructs are not synonymous: The relational process examined here concerns the function and emotional meaning of the device within adolescents' relational contexts rather than the frequency of use or impairment alone.

It should be noted that the meaning of such relationships must also be considered in the familial and cultural contexts in which they are formed. Iranian adolescents, as they move toward greater independence and privacy, continue to have close ties to their parents and, in many cases, to their extended family networks. Parental authority, family rules, gender-related expectations, and cultural boundaries around social and emotional relationships can influence both adolescents' smartphone use and parental responses to this use (30-33).

However, Iranian studies have largely focused on problematic smartphone use and its associated consequences (10, 12). To our knowledge, existing research has not yet provided a culturally grounded process model explaining how smartphones acquire emotional and relational centrality in adolescents' everyday lives. Therefore, this study used grounded theory to develop a process-oriented explanation grounded in participants' accounts rather than to test a model derived from attachment theory. Attachment theory and Winnicott's perspective served as sensitizing perspectives rather than predetermined coding frameworks. Accordingly, the study aimed to develop a culturally grounded substantive model explaining how attachment-like relationships with smartphones develop among Iranian adolescents and how their relational meaning is shaped within familial and cultural contexts.

Materials and Methods

Design

This qualitative study was conducted using Strauss and Corbin's grounded theory approach to develop a process-oriented explanation of how Iranian adolescents' attachment-like relationships with smartphones form and evolve within the context of family and culture. Grounded theory was selected because the aim was not to test an existing theoretical explanation, but rather to develop a context-based understanding of the conditions, interactions, strategies, and consequences through which smartphone-related meanings are formed and negotiated (34).

Data collection and analysis were conducted concurrently from April to October 2025. Attachment theory (19, 35) and Winnicott's (36) concept of the "transitional object" were used as sensitizing concepts to enhance theoretical sensitivity and inform broad areas of inquiry rather than serving as predetermined coding frameworks. These perspectives guided attention toward

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issues such as emotional availability, responses to separation, proximity seeking, and meanings assigned to smartphones, while remaining open to concepts emerging from participants' accounts.

Accordingly, participants were not categorized according to attachment styles, and predefined classifications such as secure or insecure attachment were not imposed during analysis. Initial coding remained as close as possible to participants' language and experiences, and theoretical interpretations were developed through constant comparison and the progressive integration of emerging categories. The pathway labels were assigned only after categories and their relationships had been developed through grounded theory procedures.

Participants and Sampling

Participants were recruited through social-media advertisements across several Iranian provinces to facilitate access to geographically dispersed participants and avoid restricting the study to a single urban setting. This recruitment strategy was consistent with purposive and theoretical sampling principles, which aim to obtain analytically meaningful variation rather than statistical representativeness.

Purposive sampling was initially used to obtain three complementary perspectives relevant to the phenomenon: adolescents with direct experience of smartphone use, parents involved in managing smartphone use within the family, and counselors/therapists with professional experience working with adolescents and families. The professional participants were independent informants and were not the treating clinicians of the adolescents included in the study. Adolescents were not recruited based on psychological problems or the receipt of counseling or psychotherapy. Instead, counselor/therapist accounts were used to contextualize, compare, and challenge emerging interpretations regarding adolescent smartphone-related experiences.

The final analytic sample comprised 25 participants: 10 adolescents aged 13–18 years (7 girls and 3 boys), 10 parents (7 mothers and 3 fathers), and 5 female adolescent counselors/therapists. Participants were recruited from nine provinces (Khuzestan, Tehran, Lorestan, Fars, Alborz, Mazandaran, Hormozgan, Isfahan, and Kurdistan), providing geographic variation within the sample (Table 1). Two complete family units and 1 mother–son dyad were included.

Table 1. Demographic, Geographic, and Background Characteristics of the 25 Study Participants Across the Three Participant Groups

Participant group	n	Age range (years)	Gender/role composition	Provinces represented	Relevant characteristics
Adolescents	10	13–18	7 girls; 3 boys	4	All lived with at least 1 parent; both school-aged and late-adolescent experiences were represented.
Parents	10	36–62	7 mothers; 3 fathers	5	Educational backgrounds ranged from high school to PhD; married and single-parent households were included.
Counselors/therapists	5	30–46	5 women	5	Three held master's degrees and two held PhDs; all had adolescent counseling or psychotherapy experience.

Note. Age and gender/role distributions are reported for the 25 analytic participants. The sample included two complete family units and one mother-son dyad.

Eligibility criteria were defined according to participant group. Adolescents were required to own a smartphone, live with at least one parent, and provide assent for an audio-recorded interview; parental consent was additionally obtained for participants younger than 18 years. Parents were required to have a co-residing adolescent child, and counselors/therapists were required to be actively engaged in school-based or clinical work with adolescents. Participants who did not meet these criteria were excluded. Adolescents reporting ongoing psychiatric consultation or medication use were also excluded to maintain a focus on every day, non-clinically defined experiences of smartphone-related emotional regulation.

Among 41 volunteers, 14 were excluded before the interview because they did not meet the eligibility criteria. Twenty-seven individuals completed interviews; two pilot interviews conducted to refine the interview guide and interviewing process were excluded from the final analysis, resulting in 25 analytic cases.

Gender composition reflected participant availability rather than predetermined quotas. Recruitment was open to all genders, and additional efforts were made to recruit adolescent boys and fathers; however, their

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participation remained lower. Gender-related variation was considered during theoretical sampling and constant comparison. Similarly, the exclusively female composition of the counselor/therapist group reflected the eligible professionals who responded to recruitment rather than a predetermined sampling criterion. Their perspectives were included for professional comparison rather than as a representative of gender-specific professional viewpoints.

Theoretical Sampling and Theoretical Saturation

Data collection and analysis proceeded concurrently. After initial interviews, preliminary categories related to emotional availability, family boundaries, privacy, self-regulation, and technology-mediated communication began to emerge. Theoretical sampling was subsequently used to identify participants who could clarify the properties, variations, and relationships of these emerging categories.

Decisions regarding further recruitment were made through continuous comparison of interview data, initial codes, and developing categories. The second, third, and fourth authors, who had expertise in psychology, counseling, and family studies and served as scientific directors of the study, reviewed the transcripts, coding processes, and emerging categories and contributed to sampling decisions.

By analytic case 17, the research team observed preliminary indications of theoretical saturation, as additional interviews were no longer generating new major categories or theoretically consequential relationships among categories. Rather than applying saturation as an automatic stopping criterion, subsequent cases were included to examine variation across participant groups, explore divergent or negative cases, and further refine the category properties.

Cases 18–25 did not generate a new core category or substantially alter the major relationships among existing categories. Instead, these cases were retained to refine category dimensions, examine variations and negative cases, and strengthen the theoretical integration of the emerging model. Therefore, preliminary theoretical saturation was identified at analytic case 17, while the subsequent cases contributed to theoretical refinement and the confirmation of the coherence of the final substantive theory (Table 2).

Table 2. Progression of Theoretical Sampling, Analytic Category Development, and Theoretical Saturation in the Grounded-Theory Study of Iranian Adolescents' Attachment-Like Relationships with Smartphones

Analytic cases	Sampling / analytic phase	Emerging categories and theoretical focus	Purpose / contribution to grounded theory development
1–5	Initial category generation	Initial meanings of smartphone use; emotional functions of smartphones; experiences of connection, comfort, privacy, and regulation	Generated initial concepts and identified preliminary categories across adolescents, parents, and counselors/therapists.
6–9	Category expansion	Emotional availability; family interactions; parental digital guidance peer relationships; smartphone use functions	Expanded category properties and explored variations in the conditions influencing adolescents' relationships with smartphones.
10–13	Category refinement	Relationships among relational conditions, contextual factors, self-regulation, smartphone-mediated regulation, and consequences	Refined categories and examined emerging relationships between conditions, actions/interactions, and outcomes.
14–16	Approaching theoretical saturation	Category dimensions, process linkages, participant-group similarities and differences	Tested emerging theoretical relationships and identified areas requiring further theoretical sampling.
17	Preliminary theoretical saturation	No new core category or theoretically consequential relationship emerged	Indicated preliminary saturation of major categories and relationships within the emerging model.
18–25	Saturation refinement and theoretical integration	Negative cases, participant variation, category density, and coherence of the final process model	Refined category boundaries, explored variations and divergent cases, and strengthened theoretical integration and coherence of the final substantive theory.

Note. Cases after preliminary theoretical saturation were not recruited to identify new descriptive categories; rather, they were used to refine category properties, explore variations and negative cases, and strengthen theoretical integration of the emerging substantive theory.

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Data Collection

The first author, a doctoral student in counseling with training and experience in qualitative interviewing and working with adolescents, conducted all semi-structured interviews in Persian. The interview guide was developed based on the research objectives, previous literature, and consultation with experts in psychology, counseling, and family studies. The main interview domains and illustrative prompts are provided in Table 3.

Table 3. Semi-Structured Interview Domains and Illustrative Questions Exploring Adolescents' Attachment-Like Relationships with Smartphones: Perspectives of Adolescents, Parents, and Counselors / Therapists

Participant group	Domain	Illustrative prompts
Adolescents	Meaning and daily role	How do you feel about your smartphone? What role does it play in your daily life?
Adolescents	Access, separation, and regulation	How do you feel when the phone is unavailable? When do stress, sadness, or anger make you reach for it?
Adolescents	Family and peer context	How do you respond to parental limits? Has phone use replaced or supported any face-to-face relationship?
Parents	Observed meaning and change	What role does the smartphone play in your adolescent's life? What changes have you noticed in mood, routines, or relationships?
Parents	Regulation and family management	How does your adolescent respond when access is limited? What strategies have you used, and with what perceived effects?
Parents	Relational conditions	How do family communication, emotional availability, and parent-adolescent relationships affect use?
Counselors/therapists	Patterns and consequences	What distinguishes regulated use from strong dependency? What positive and negative consequences have you observed?
Counselors/therapists	Developmental and family processes	What family, emotional, social, and developmental conditions appear to shape adolescents' relationships with smartphones?

Note. Prompts were adapted to participant group and followed by iterative probes based on emerging categories.

Attachment-related literature informed broad areas of inquiry; however, the interview process remained open to participants' experiences and concepts emerging from the data. The guide was reviewed by members of the research team, including two professors of psychology and counseling and an associate professor from the Family Research Institute. Two additional faculty members with expertise in psychology and counseling also reviewed the guide and provided feedback regarding question depth and sequencing.

Before the main interviews, two pilot interviews were conducted to examine the clarity of the questions and the interview process. Based on these interviews, minor wording adjustments were made and the order of topics was modified. Sensitive topics, including privacy, family relationships, and emotional experiences related to smartphone use, were therefore introduced after broader questions regarding everyday experiences.

Most participants completed one interview lasting approximately 50 minutes. When clarification or deeper exploration of emerging categories was required, some participants participated in a second interview session lasting approximately 45 minutes. These follow-up sessions focused on elaborating the emerging categories rather than repeating the initial interview.

Because participants were geographically dispersed across several provinces and some participants preferred not to use video-based communication due to confidentiality concerns, interviews were conducted by telephone. The interviewer established rapport, encouraged detailed descriptions, used follow-up questions when clarification was needed, and asked participants to participate from a private and comfortable setting.

All interviews were audio-recorded with permission and transcribed verbatim in Persian. Transcripts were checked against the recordings, identifying information was removed, and pseudonyms were assigned. Selected quotations were translated into English after analysis and reviewed against the Persian transcripts to preserve their conceptual meaning.

Data Analysis

Data analysis followed Strauss and Corbin's grounded theory procedures. Transcripts were imported into MAXQDA 2022 for data organization, retrieval, analytical memoing, comparison, and maintenance of an

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audit trail. The software was used only as a data-management tool and did not generate automated codes or interpretations. All decisions regarding coding, category development, and theoretical integration were made by the research team.

During open coding, transcripts were examined line by line and meaningful units were identified. Initial codes were developed as closely as possible to participants' own words and experiences. These codes remained provisional and were continuously revised as additional interviews introduced new perspectives, variations, or challenges to early interpretations.

Constant comparison was conducted within and across interviews and participant groups. During axial coding, related codes were organized into broader categories and examined according to Strauss and Corbin's paradigmatic model, including causal conditions, contextual conditions, intervening conditions, actions/interactions, and consequences. Selective coding was then used to integrate the central process and establish relationships among the major categories.

Analytical memos were maintained throughout the study to document coding decisions, alternative interpretations, emerging relationships, and inconsistencies. Adolescent narratives were prioritized for understanding first-person experiences of smartphone meaning, separation, and emotional regulation, while parent and counselor perspectives were used to contextualize these experiences and challenge or expand interpretations.

Trustworthiness and Reflexivity

Trustworthiness was enhanced through participant-group triangulation, constant comparison, peer debriefing, negative-case analysis, member review, and maintenance of an audit trail (37-39). Throughout the analytic process, the research team held regular meetings to review codes, category development, and theoretical interpretations. When differences emerged, the researchers returned to the original data and discussed alternative interpretations.

Member reviews were conducted with five participants to examine whether the emerging interpretations adequately represented their experiences and to identify overlooked meanings or alternative explanations. Participant feedback was treated as a source of critical reflection rather than as a simple confirmation of the researchers' interpretations.

The first author's counseling background supported rapport with participants but could also influence the interpretation of relational experiences. Therefore, reflexive notes and team discussions were used throughout the analysis to examine assumptions, consider alternative explanations, and delay theoretical conclusions until the categories were sufficiently developed.

Ethical Considerations

The study was approved by the Ethics Committee of Hormozgan University of Medical Sciences (IR.HUMS.REC.1404.016). Before each interview, participants were informed about the study procedures, confidentiality, audio recording, voluntary participation, and their right to decline questions or withdraw at any time without consequence. Interviews were conducted respectfully in a private setting.

Adults provided verbal informed consent. For adolescents, written consent was obtained from a parent or legal guardian together with the adolescent's verbal assent. Identifying information was removed from the transcripts, and pseudonyms were used in reporting. When interviews raised concerns about emotional distress or family difficulties, participants were provided with information about appropriate professional support services when needed.

Results

The analysis generated an integrated process model explaining how attachment-like relationships with smartphones developed and were negotiated within adolescents' relational environments. The core category identified was "the development of attachment-like relationships with smartphones within adolescents' relational worlds." Through constant comparison and integration of the emerging categories, this core category captured a process in which smartphone-related meanings developed over time through the interaction of emotional availability, family guidance, self-regulation, interpersonal resources, and the functions made accessible through the device.

Two process pathways emerged from this central process: (1) the regulated, non-compensatory pathway and (2) the compensatory-ambivalent pathway (Table 4 and Figures 1 and 2). These pathways did not represent fixed adolescent categories or clinical classifications. Rather, they reflected different configurations of the same relational-developmental process. Within each pathway, the core process described how the conditions surrounding adolescents shaped the meanings assigned to smartphones, the strategies through which access and use were negotiated, and the consequences that followed. Across both pathways, a smartphone acquired meaning through the resources it provided, including connection, privacy, information, entertainment, and emotional regulation, rather than through the physical device alone.

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Table 4. Comparison of the Two Grounded-Theory Pathways of Attachment-Like Relationships with Smartphones Among Iranian Adolescents: Shaping Conditions, Contextual Factors, Regulatory Mechanisms, Strategies, Core Processes, and Outcomes

Analytic dimension	Regulated, non-compensatory pathway	Compensatory-ambivalent pathway
Shaping conditions	Responsive caregiver relationships; coherent boundaries; caregiver modeling; family cohesion; developing autonomy and self-regulation; supportive peers.	Inconsistent emotional availability; conflicting or restrictive parenting; limited parenting literacy; family smartphone saturation; limited self-regulation; compensatory online relationships.
Contextual conditions	Meaningful offline activities; family time; extracurricular participation; part-time work; accessible in-person peer contact.	Restricted offline opportunities; economic and caregiving pressures; need for privacy; social anxiety or negative self-perception; culturally sensitive relationship concerns.
Intervening mechanisms	Interpersonal co-regulation; diversified sources of competence and belonging; purposeful digital guidance.	Digitally mediated privacy, connection, distraction, and short-term soothing; avoidance of difficult interactions.
Actions/strategies	Adolescent routine structuring and content organization; parent-adolescent dialogue; flexible limits; shared activities.	Checking and renewed use; concealment or resistance; surveillance, confiscation, inconsistent limits, or conflict avoidance.
Meaning of smartphone	Accessible tool within a broader relational ecology; supports communication, learning, organization, and leisure.	Comparatively predictable device-content-connection system for proximity, privacy, information, and emotional relief.
Core process	Regulated, non-compensatory attachment-like relationship.	Compensatory-ambivalent attachment-like relationship involving seeking, temporary relief, rustration, separation distress, and renewed use.
Reported outcomes	Purposeful use; maintained offline ties; academic or skill support; ability to disengage when needed.	Possible sleep, concentration, emotional, behavioral, and relational difficulties; secrecy and online vulnerability.

Note. The pathway labels are analytic categories generated from the data and are not clinical classifications of interpersonal attachment or smartphone addiction.

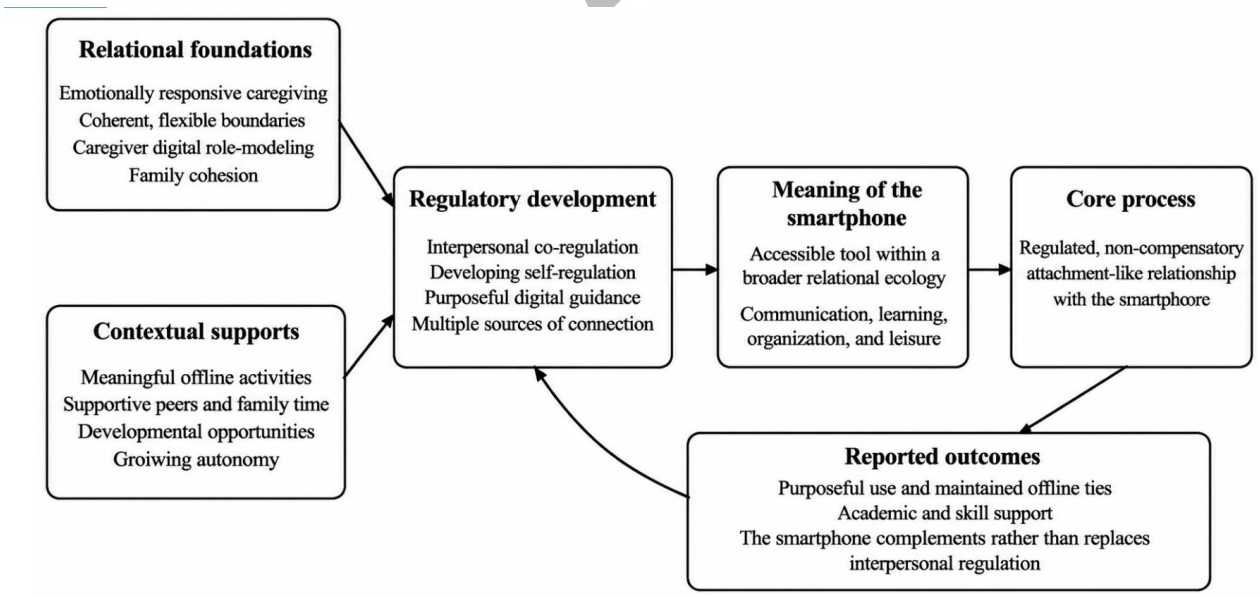


Figure 1. Grounded-Theory Process Model of the Regulated, Non-Compensatory Pathway of Attachment-Like Relationships with Smartphones Among Iranian Adolescents

Note. Arrows indicate perceived process linkages reconstructed from retrospective accounts and do not establish experimental causality

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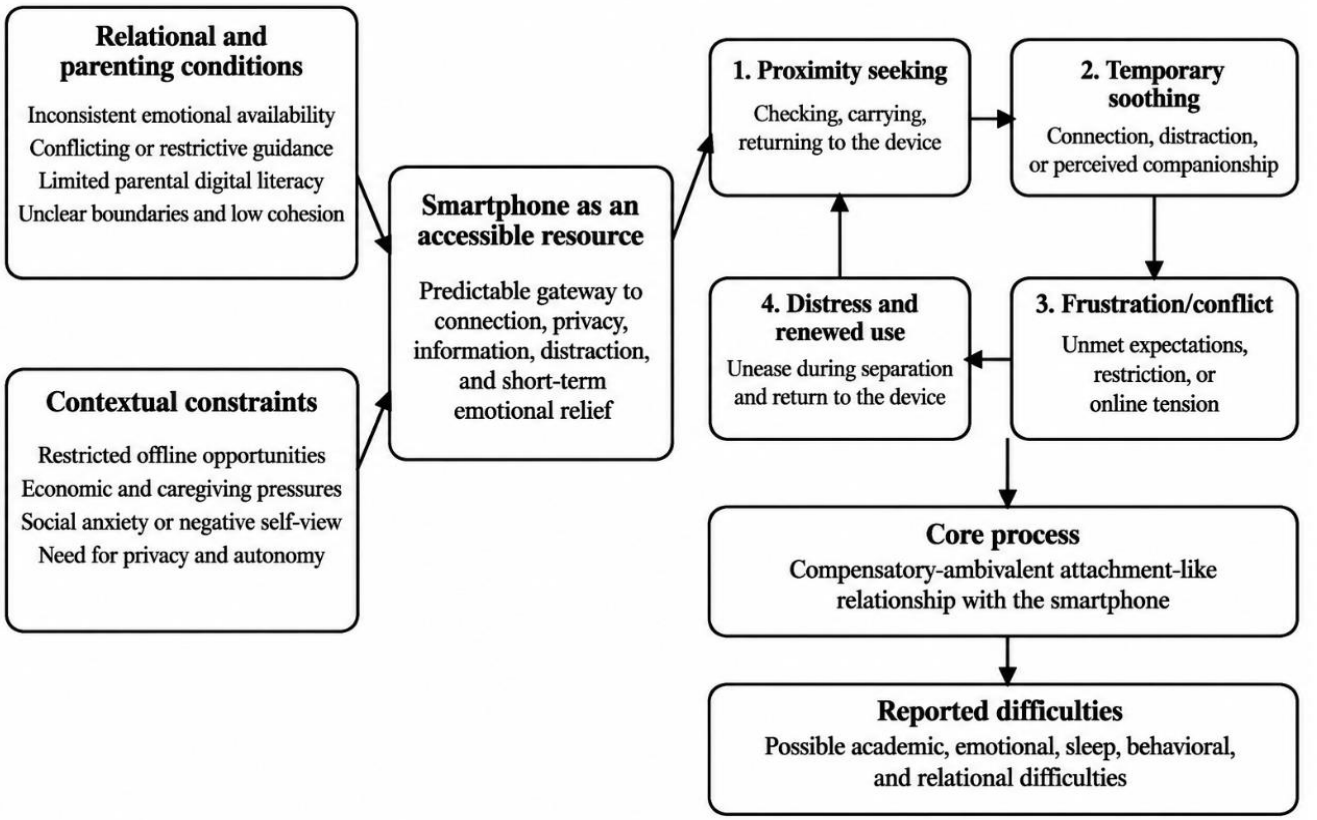


Figure 2. Grounded-Theory Process Model of the Compensatory-Ambivalent Pathway of Attachment-Like Relationships with Smartphones Among Iranian Adolescents

Note. The smartphone is conceptualized as an attachment-relevant socio-technical object that provides access to people, content, privacy, and short-term regulation; it is not treated as a human attachment figure.

The dimensions underlying these pathways varied along continua. Emotional availability ranged from predictable, responsive, and emotionally accessible relationships to inconsistent or limited availability. Family digital guidance ranged from transparent, negotiated, and developmentally adjusted boundaries to conflicting, restrictive, or surveillance-based approaches. Furthermore, adolescents' regulatory resources varied from diversified sources of competence and belonging to greater reliance on digitally mediated experiences when offline alternatives were limited. Within this framework, the same amount of smartphone use could represent different relational meanings depending on what adolescents sought through the device and how access was managed within their social environment.

Regulated, Non-compensatory Attachment-Like Pathway

Relational Foundations and Purposeful Digital Integration

The regulated, non-compensatory pathway emerged within a consistent relational environment in which emotional support, clear and flexible boundaries, caregiver modeling, and family cohesion provided a foundation for developing autonomy and self-regulation. These relational foundations shaped how a smartphone was incorporated into everyday life. Rather than serving as the primary source of reassurance or emotional regulation, the device remained one resource within a broader network of relationships and activities.

Emotional availability was a central dimension of this process, characterized by responsive, readily accessible, and consistent caregiving. In accounts from adolescents and parents, responsive caregivers remained available during moments of distress and provided opportunities for adolescents to express and regulate difficult emotions. Sara, a mother, explained: When she's upset, I understand immediately. I talk to her and ask what happened. Usually, she gets teary and then starts talking after a few minutes. She doesn't let anything stay bottled up inside." Similarly, Rasta described turning to her mother when she encountered difficulties: "My mother is always the first person I turn to when I feel upset or even when I do poorly on an exam."

Rather than directing emotional needs primarily toward smartphones, adolescents in this pathway could move among different sources of support. Consequently, the availability of responsive caregivers therefore provided a relational basis for using the device for communication, entertainment, or information without assigning it a central regulatory role.

A second dimension concerned the coherence and flexibility of family boundaries. In the regulated

pathway, digital guidance was characterized by negotiated, transparent, and developmentally adjusted expectations. Parents explained the reasons for expectations, adjusted responsibility to the adolescent's maturity, and maintained trust. Before allowing broader access to online platforms, Rasta's mother established expectations around responsible use: "Before my mother bought me a phone, she made me promise that the phone should not affect my studies. ... she never did that, but when I wanted to install Instagram and similar apps, she again asked me to promise that I would not follow everyone's requests, ... not post everything."

This account illustrates how digital guidance operated through preparation and shared responsibility. Noura similarly described the absence of intrusive monitoring as an expression of parental trust: "Since I got my phone, they have not interfered with it; they never checked it, and there was no indirect monitoring either."

When caregivers maintained consistent expectations, adolescents encountered a predictable framework for smartphone use. Ramin explained: "Because she knows I stand behind her mother, she no longer tries to break the rules." Across these accounts, coherent boundaries appeared to function not simply as limits on access but as part of a predictable relational environment in which responsibility could gradually be transferred to adolescents.

Caregiver digital role-modeling provided another relational influence. Parents who used digital technologies for learning, problem-solving, or meaningful communication demonstrated ways of incorporating technology into everyday life without making it the center of emotional experience. Sara described how her own use of technology influenced her daughter: "I'm experimenting with AI and I get excited... I see my daughter approaching it to benefit positively from it."

Taken together, these accounts show how these relational foundations converged rather than operating as isolated conditions. Emotional responsiveness provided an accessible interpersonal source of regulation; coherent and flexible boundaries structured smartphone use while supporting growing responsibility; caregiver modeling demonstrated purposeful digital engagement; and family cohesion provided continuity across these interactions. Through this configuration, a smartphone could acquire attachment-like meanings, including familiarity, accessibility, and connection, while remaining embedded within a wider relational ecology rather than becoming an adolescent's primary source of emotional regulation.

Development of Alternative Sources of Connection and Competence

A further dimension of the regulated, non-compensatory pathway was the availability of meaningful sources of connection, competence, and enjoyment beyond smartphones. These sources included sports, educational activities, hobbies, employment, family activities, and peer relationships. What mattered was not simply participation in offline activities, but whether adolescents had personally meaningful opportunities to experience belonging, achievement, learning, and engagement across different areas of everyday life. Within this configuration, smartphones could become part of these experiences without becoming the main setting in which they occurred.

Physical and recreational activities provided opportunities for enjoyment and competence that did not depend on digital engagement. Amirhossein, for example, described the value of physical activity in his everyday life: "Activities like football and volleyball are definitely more enjoyable for me." Such experiences provided an independent source of enjoyment and achievement, allowing the device to remain one activity among several rather than the dominant source of engagement.

Peer relationships also provided opportunities for both social connection and competence, and these relationships could extend across offline and digital settings. Shahla, a mother of a teenager, described how her son and his friends compared their Konkoor rankings and encouraged one another: "My son has a positive sense of competition with his friends; they compare their Konkoor rankings and motivate each other to do better." Similarly, Saboura described how classmates used a WhatsApp group to extend their collaborative learning beyond school: "I have the Konkoor exam this year. We decided at school that whenever anyone finds a good educational video or a useful test-taking tip, they will send it to the WhatsApp group so that everyone can see it and learn." In these accounts, digital communication did not displace peer relationships or meaningful activities; rather, it extended existing collaboration, motivation, and learning into the digital space.

Family activities provided another source of direct interpersonal connection. Shared experiences with relatives created situations in which smartphones became less salient because adolescents were actively engaged with others. Somayeh explained: "When we go to the villa and are with relatives, I'm so engaged that I don't even reach for my phone." Here, reduced smartphone engagement appeared to follow from the availability of meaningful interpersonal involvement rather than from externally imposed restrictions.

Across these accounts, alternative sources of connection and competence formed part of the same relational configuration as responsive caregiving and coherent digital guidance. Their role was not to eliminate smartphone use, but to keep belonging, competence, enjoyment, learning, and interpersonal connection available through more than one part of adolescents' everyday lives. At times, digital communication itself became an extension of these existing relationships and activities rather than a substitute for them. In this configuration, smartphones could therefore serve communication, learning, information, organization, or

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entertainment while remaining embedded within a broader relational and developmental environment rather than becoming an adolescent's principal source of relational or emotional fulfillment.

Strategies and Outcomes

As regulatory capacities developed, adolescents described increasingly purposeful ways of incorporating smartphones into everyday life. Use was directed toward communication, learning, organization, entertainment, and personal interests, while attention could still shift toward schoolwork, family interactions, friendships, and other activities. The device was therefore used flexibly across different contexts rather than occupying a fixed or dominant position in daily life.

Parental involvement in this process gradually shifted from direct management toward support for adolescents' growing autonomy. Rather than relying on continuous monitoring, parents provided expectations and guidance while allowing adolescents to assume greater responsibility for organizing their own time and digital activities. Sepideh described this balance between support and autonomy: "She manages her own schedule; I don't interfere." Such practices reflected a broader process in which responsibility was progressively transferred as adolescents developed a greater capacity for self-management.

Purposeful integration did not mean that smartphone use was unrelated to emotional states. Some adolescents used the device temporarily when upset, primarily to redirect their attention. Somayeh explained: "Most of the time when I'm upset, I go to my phone because I want to take my mind off the subject. When I feel a little better, I go to my mom and talk to her and ask her for help, or I just calm down and forget about the subject." Here, smartphone use functioned as a temporary regulatory strategy rather than the endpoint of the process. A similar pattern appeared in Shahla's account of her son, who sometimes returned from his father's home upset about difficulties in their relationship following his parents' separation and his father's remarriage. At such times, he would briefly turn to his phone to be alone. Shahla explained that after about 10 to 15 minutes, "he seems to recover and comes back and feels better," and she would later find him studying or doing practice questions.

Thus, adolescents could still experience familiarity, enjoyment, accessibility, and connection through their smartphones. What distinguished this pathway was not the absence of emotionally meaningful use, but the position of the device within a broader relational ecology. Interpersonal support, peer relationships, family activities, and opportunities for competence remained available across different areas of everyday life, allowing smartphones to serve particular functions without becoming the sole or primary means of emotional regulation.

The resulting pattern involved purposeful digital engagement alongside continued participation in offline relationships and activities. Smartphones could support educational, social, and recreational pursuits, while adolescents retained the ability to shift between digital and non-digital contexts. The outcome was therefore not simply lower smartphone use, but a flexible pattern in which the device complemented existing sources of connection, competence, and regulation without replacing them.

Compensatory-Ambivalent Attachment-Like Pathway

From Relational Uncertainty to Compensatory Smartphone Use

This cycle could also involve temporary emotional relief followed by renewed reliance on the device. Online interaction could reduce loneliness or anxiety for a short period, but the underlying relational difficulty remained. Furthermore, when expectations were unmet, access was restricted, or tensions developed around digital use, frustration and conflict could emerge.

Subsequently, parental attempts to regain control could lead to concealment, resistance, or renewed efforts to access the smartphone, thereby further reinforcing its emotional significance. In Aref's account, restriction itself became part of this interaction: "On Thursdays and Fridays, I didn't have any lessons, but my mother wouldn't give me the phone." His mother similarly described his repeated efforts to regain access: "During the summer, as soon as he's awake, he splashes water on his face and says 'Mom, phone...' and steals the phone from the table." These accounts show how the device could become entangled with struggles over access and parental control.

Across these accounts, the process was therefore characterized by a repeated movement between seeking proximity to the device, obtaining temporary relief or connection, encountering frustration or relational conflict, and returning to the device. The smartphone did not necessarily replace human relationships altogether. Rather, when interpersonal resources were experienced as unreliable, inaccessible, or difficult to navigate, it became the most immediate and controllable resource for managing distress and relational uncertainty.

As these relational and contextual conditions converged, a smartphone became an increasingly accessible resource for connection, privacy, distraction, and short-term emotional relief. Adolescents described turning toward the device when interpersonal connection was difficult to access, face-to-face interaction felt challenging, or offline sources of support were limited. This use could provide immediate relief; however, this relief was often temporary and did not resolve the underlying relational or emotional difficulties. The resulting pattern was therefore characterized by repeated movement toward the device and a subsequent return to it when distress, frustration, or unmet needs re-emerged.

Ambivalent Regulation and the Cycle of Seeking, Relief, and Renewed Use

Smartphone use often provided immediate relief, but participants described this effect as temporary. When

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adolescents felt lonely, distressed, or uncertain, they sought the device for connection, distraction, or a sense of companionship. This short-term relief could be followed by frustration when expectations were not met, when access was restricted, or when online interactions created new tensions.

The process therefore took the form of a recurring cycle: proximity seeking → temporary soothing → frustration or conflict → distress and renewed use (Figure 2). Proximity seeking included checking, carrying, or returning to the device, particularly when adolescents were seeking connection or relief. Temporary soothing followed when the device provided distraction, perceived companionship, or access to others. However, the relief was often short-lived. Restriction, unmet expectations, or tensions arising from online interactions could then generate frustration or conflict, followed by unease during separation and renewed efforts to return to the device.

Aref captured the ambivalent quality of this experience: "When I have my phone, it feels like I'm dependent on something; when I don't, I feel free. I don't know which one I want more." His account illustrates how the device could be experienced simultaneously as a source of relief and as something from which he wanted to feel free.

Participants also described moments in which smartphones were used to create distance from difficult interactions or to temporarily avoid interpersonal tension. In these situations, seeking the device offered an immediate way to manage discomfort but did not necessarily resolve the relational or emotional circumstances that had prompted its use. The resulting cycle could therefore sustain repeated movement aong seeking, temporary relief, frustration or conflict, and renewed use.

Adolescent and Parental Strategies Within the Compensatory-Ambivalent Pathway

Within the compensatory-ambivalent pathway, adolescents used different strategies to maintain access to their smartphones or to manage situations in which access was restricted. These strategies included withdrawal into digital spaces, avoidance of direct confrontation, resistance to parental restrictions, and repeated attempts to regain access. These responses appeared particularly salient when the device had become an important source of distraction, privacy, or emotional regulation.

For some adolescents, turning to a smartphone provided a way to create distance from emotionally difficult interactions. Adrina described using the device during arguments to control her reactions and avoid further confrontation: "I just keep scrolling through the home page back and forth so I don't look directly at the other person's face and get angry… This way, I avoid continuing the argument, or if it's with my family, I make sure they don't disrespect me further." Here, smartphone use became part of the adolescent's immediate response to interpersonal tension.

Restriction could also elicit resistance, withdrawal, or attempts to regain access. Mahsa, a mother of two, described different reactions among her children when she restricted smartphone access: "My son screams and kicks his sister or bangs the door. With my daughter, it has the opposite effect… she becomes stubborn and studies even less. She doesn't even seem to want to leave her room and just sits there, sometimes staring at the wall for 5 hours." Bita similarly described her daughter's reaction when the phone was taken away because of prolonged use: "She doesn't complain verbally, but she shows it through her actions. She walks angrily, comes and puts it in my room, and leaves angrily, meaning she's unhappy about it. Or she slams the door or comes and gives it to me and says, 'Here, take it. Take it.' Or she goes to her room and shuts the door hard." These accounts show that resistance was not necessarily expressed through direct verbal confrontation; it could also appear through aggression, withdrawal, or nonverbal expressions of dissatisfaction.

Among younger adolescents, particularly around 13 or 14 years of age, responses to threatened restriction could take a more compliant form. When parents threatened to withhold the smartphone because of unmet academic or behavioral expectations, some adolescents appeared to comply with parental demands to avoid losing access. Completing schoolwork where parents could see it could also function as a way of demonstrating compliance. Zohreh described this pattern directly: "I didn't want to give my phone to my mom. But then I go and study and finish my studies, and then I go and get my phone from my mom." In this sense, apparent compliance could itself become a strategy for restoring or preserving access to the device.

Parents, in turn, described difficulties in establishing and maintaining limits. Meysam, Mahsa's husband, summarized this difficulty in relation to managing smartphone use: "This is really our main problem. We always talk about managing mobile phone use. It may have become repetitive for the kids by now, but we always talk about it. On paper, we do very well. On paper, we make a plan, we set a time, we say we should spend less time. But in practice, we have never really succeeded." Parents also differed in how they attempted to manage use, and these approaches could vary even within the same family. However, when the relational, contextual, and intervening conditions described in this pathway were already present, parental efforts to impose or maintain limits were often difficult to sustain in everyday practice.

Across these accounts, adolescent and parental strategies were therefore closely interconnected. Adolescents responded to restriction through resistance, withdrawal, avoidance, or apparent compliance aimed at restoring access, while parents attempted to manage use through rules, negotiation, monitoring, or restriction. These responses could reinforce one another: difficulties in maintaining limits could lead to renewed parental

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control, while adolescents' efforts to preserve access could increase parental concern. Strategies within this pathway thus developed through an ongoing interaction around access, control, autonomy, and emotional reliance on smartphones.

Reported Outcomes

Participants associated the compensatory-ambivalent pathway with a range of difficulties that emerged when smartphone-based regulation became increasingly central in adolescents' daily lives and began to compete with interpersonal, academic, and offline sources of support. These outcomes were not considered defining characteristics of insecure attachment-like relationships with smartphones; rather, they represented downstream consequences of a developmental process in which smartphones gradually acquired a prominent role in managing loneliness, uncertainty, emotional distress, and the need for connection.

One important outcome concerned adolescents' cognitive and academic functioning. Specifically, participants described situations in which smartphone engagement became intertwined with emotional preoccupation and reduced adolescents' ability to regulate attention and maintain daily responsibilities. The difficulty was not related to digital activity itself, but to the increasing challenge of shifting attention away from their devices when other priorities required engagement. For instance, Aref described this conflict between his academic intentions and smartphone involvement: "I picked up my phone at 7 in the morning to see sample questions on Telegram... I lost track of time... At 9, I remembered I was supposed to study."

Consequently, this account illustrates how smartphone use could gradually interfere with self-regulation when digital engagement became difficult to interrupt, even when adolescents were aware of competing goals and responsibilities.

Additionally, sleep disruption and interference with basic daily activities were reported as another consequence of highly salient smartphone involvement. Gohar, a high school counselor and adolescent therapist, described situations in which some adolescents continued using their phones despite their physical needs: "They postpone sleeping, eating, or even going to the bathroom because they are still engaged with the phone."

In these situations, prolonged engagement reflected the increasing priority assigned to maintaining digital involvement, particularly when a smartphone functioned as a source of distraction, emotional relief, or escape from uncomfortable experiences.

Furthermore, emotional responses to interrupted access became particularly evident among adolescents for whom smartphones had acquired a strong regulatory meaning. Mahtab described her reaction when experiencing a problem with her device: "Sometimes, when my phone freezes, I panic… My hands sweat… I get extremely anxious… I keep restarting it over and over. It's really overwhelming."

Thus, this account illustrates how disruption of smartphone access could trigger intense distress when the device had become integrated into everyday strategies for managing emotions and maintaining a sense of security.

Moreover, the compensatory role of smartphones influenced family relationships. Participants described how increasing engagement with digital spaces could gradually alter patterns of direct interaction with caregivers. Some adolescents used smartphones as private spaces for withdrawal or emotional regulation, while parents sometimes interpreted this reduced participation as decreased interest or emotional distance. Zohreh described how her relationship with her father changed after obtaining a smartphone: "My relationship with my father was much closer before I got a phone. We spent a lot of time together. We would go out and talk with each other, but after I got a mobile phone, it felt like our relationship gradually became less close."

Therefore, this account illustrates how smartphone use could become embedded within changing family interaction patterns by redirecting time and attention away from previously meaningful face-to-face experiences. Importantly, smartphones were not described as the sole cause of relational distance; rather, they became part of a gradual process through which digital engagement increasingly occupied emotional and relational space.

Finally, online experiences represented another domain in which the compensatory function of smartphones became visible. Participants described situations in which digital interactions gained heightened personal significance because they provided privacy, acceptance, and opportunities for self-expression that felt difficult to achieve in offline relationships. Mansoureh, a high school counselor and adolescent therapist, described how some adolescents used online spaces as a safer environment for expressing themselves: "I have a student who's very shy… she told me she talks to someone online. Another student wears a mask because she doesn't like her face… but she writes beautifully in chats. The phone acts as a shield, reducing her anxiety, like she's not being directly judged."

Other participants described distress related to emotionally intense online relationships, difficulty maintaining interpersonal boundaries, and continued attention to digital contact even after relationships had changed. These accounts suggested that online vulnerability was not merely a consequence of exposure to digital content, but was connected to the relational functions that smartphones had come to provide, including acceptance, emotional support, and temporary relief from distress.

Importantly, high smartphone use alone did not define this pathway. Some adolescents reported extensive smartphone use for education, creativity, work, or

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maintaining social connections while preserving emotional flexibility and meaningful offline relationships. Conversely, even shorter periods of use could carry compensatory significance when smartphones became the primary response to loneliness, interpersonal uncertainty, conflict, or emotional distress.

Discussion

This grounded theory study generated the substantive theory of "the development of attachment-like relationships with smartphones within adolescents' relational worlds," explaining how smartphone-related meanings emerge and are negotiated within adolescents' relational and regulatory systems. The 2 pathways identified in this study, the regulated, non-compensatory pathway and the compensatory-ambivalent pathway, do not represent fixed adolescent categories or simply different levels of smartphone use; rather, they reflect different configurations of the same relational-developmental process. When emotional responsiveness, coherent parental guidance, caregiver modeling, self-regulation, and alternative sources of connection and competence were available, smartphones generally remained flexible and purposeful resources embedded within adolescents' broader relational environments. In contrast, when these relational and developmental resources were inconsistent or insufficient, smartphones were more likely to acquire a compensatory role in managing distress, relational uncertainty, privacy needs, and emotional regulation. Therefore, the central distinction proposed by this theory is not the amount of smartphone use itself, but the relational and regulatory functions that smartphones serve within adolescents' broader relational worlds.

The present model extends existing explanations of problematic digital engagement. Compensatory Internet Use Theory proposes that individuals may turn to digital environments to cope with psychological distress (40), while the I-PACE model explains problematic digital behavior through interactions among predispositions, affective and cognitive processes, coping, reinforcement, and executive control (41). However, these models have generally focused more on individual-level vulnerability and behavioral regulation. The current theory adds a relational-developmental perspective by demonstrating why similar levels of smartphone engagement may have different meanings. High involvement may remain adaptive when adolescents retain emotional flexibility, meaningful offline relationships, and multiple sources of regulation, whereas problematic involvement may emerge when smartphones increasingly replace unavailable relational or developmental resources.

A central mechanism underlying the regulated pathway was emotional availability. Consistent with attachment theory (18, 19), responsive caregiving provided adolescents with a reliable source of reassurance and emotional regulation, allowing smartphones to remain meaningful without becoming the primary regulatory resource. In the present study, this pattern was particularly evident in relation to maternal responsiveness. Importantly, the regulated pathway did not require the continuous physical presence of both parents. In some cases, fathers were temporarily absent, yet adolescents remained within the regulated pathway when their mothers provided consistent emotional availability, reassurance, and a secure relational base. Thus, within the boundaries of this sample, a reliably responsive maternal relationship appeared more important than physical family structure alone in reducing the likelihood that smartphones would become a compensatory regulator.

This interpretation is consistent with evidence showing the protective role of maternal attachment security for adolescent adjustment, particularly in contexts where family structures differ (42), and with findings indicating that parental attachment security is associated with lower problematic internet use through emotion regulation processes (43). However, this does not suggest that paternal relationships are irrelevant. Recent longitudinal evidence indicates that different maternal–paternal attachment configurations may show distinct associations with problematic mobile phone use, with secure attachment networks generally associated with lower risk (44). Given the limited representation of fathers in the present study, future work should further clarify how maternal and paternal attachment processes jointly influence smartphone-related regulation.

Beyond emotional availability, family digital practices shaped whether smartphones became integrated or compensatory. Predictable boundaries, trust, gradual transfer of responsibility, and caregiver modeling supported purposeful use, whereas inconsistent rules, intrusive monitoring, and reactive restriction could intensify conflict and concealment. These findings align with research linking parenting practices, communication, monitoring, and self-regulation with adolescent smartphone behavior (2, 45, 46). They also support evidence that parental mediation is not uniformly protective but depends on the form and relational context in which it occurs (47, 48).

Importantly, the present findings contribute to ongoing debates regarding whether parental smartphone use is inherently harmful. Previous research has shown that smartphone use alone does not necessarily predict poorer parenting outcomes; rather, negative effects are more strongly associated with technological interference and displacement of family interaction (49). Similarly, systematic evidence suggests that parental smartphone use may have both negative and positive implications depending on the quality and context of parent–child interaction (50). At the same time, observational research indicates that when parental phone use results in disengagement from children, it may reduce opportunities for emotional and social interaction (51). Taken together, these findings support the present model: the relevant question is not whether smartphones

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are present in family life, but whether they interrupt, replace, or coexist with meaningful relationships.

The findings regarding parental education further illustrate why smartphone function should be considered beyond frequency of use. Moradi *et al* (6) reported that adolescents with more highly educated mothers and higher parental education backgrounds showed greater screen and mobile-phone/tablet use. In contrast, adolescents in the present study whose mothers had higher educational attainment or were continuing their education more often described purposeful and constructive smartphone use, particularly for learning and other beneficial activities. This difference may indicate that parental education influences not only digital exposure but also the ways technology is modeled, guided, and incorporated into family routines. Thus, higher use does not necessarily represent greater risk when accompanied by appropriate guidance and meaningful digital engagement. Because socioeconomic effects were not quantitatively examined in this study, this interpretation remains exploratory.

The regulated pathway was also supported by adolescents' access to alternative sources of belonging, competence, identity, and enjoyment. Sports, hobbies, education, employment, family activities, and face-to-face relationships distributed emotional and developmental needs across multiple domains. Therefore, self-regulation appeared not simply as an individual ability to control technology use, but as a developmental capacity supported by relationships, autonomy, meaningful activities, and consistent guidance. This perspective is consistent with evidence showing that purposeful digital engagement may support learning and psychosocial development (5, 7), and that temporary increases in use do not necessarily indicate problematic involvement when smartphone use remains one flexible resource among several (49, 52).

In contrast, the compensatory-ambivalent pathway emerged when relational and developmental resources were less reliable. Relational uncertainty, limited interpersonal access, unmet needs for privacy or autonomy, and fewer alternative sources of support increased the device's value as an immediate and controllable source of emotional regulation. This finding is consistent with compensatory accounts of digital engagement (40) and research describing smartphones as tools for short-term emotional regulation and connection (1, 17). However, the current theory extends these explanations by identifying a relational feedback cycle: distress or uncertainty increased smartphone seeking; access provided temporary relief; conflict, restriction, or unmet expectations renewed distress; and renewed seeking restored access. Although, this resembles proximity-seeking processes described in attachment theory (18), it does not suggest that smartphones become human attachment figures or clinical transitional objects (36).

Within this pathway, adolescent and parental responses could reinforce each other. Parental concern could lead to increased monitoring or restriction, while adolescents could respond through resistance, concealment, withdrawal, or strategic compliance, thereby further increasing parental concern. The resulting consequences, including difficulties with attention, academic responsibilities, sleep, daily routines, interrupted access, and family interaction, overlap with findings from research on problematic smartphone use and nomophobia (12, 53-55). However, the present theory distinguishes attachment-like meaning from problematic involvement. Feelings of familiarity, reassurance, proximity seeking, or discomfort during separation do not necessarily indicate addiction. Problematic use becomes more likely when smartphone-based regulation becomes dominant and begins to displace interpersonal relationships, academic responsibilities, bodily routines, or meaningful offline experiences.

The Iranian sociocultural context provides an important interpretive layer. Family involvement, parental authority, and adolescents' negotiation of autonomy and privacy influence digital practices within Iranian families (30-32). Moreover, for some Iranian adolescents, particularly girls, digital environments may provide opportunities for social participation and self-expression that can be constrained in offline contexts. Research on Iranian women has highlighted how cultural norms, limited leisure opportunities, and gender-related restrictions may reduce access to social participation and recreational spaces (56, 57). Similarly, gendered differences in social and relational opportunities among Iranian youth have been emphasized in broader youth research (58). Therefore, smartphones may sometimes function not only as communication tools but also as accessible spaces for connection, identity expression, and autonomy.

The findings have practical implications for assessment and intervention. Reducing screen time alone may overlook the relational function of smartphone use. When emotional availability is limited, strengthening interpersonal sources of support may be more relevant; when boundaries are inconsistent or surveillance-based, negotiated and developmentally appropriate guidance may be preferable to stricter restriction. Interventions should also address caregiver digital modeling and expand adolescents' opportunities for meaningful social participation, recreation, learning, and competence so that a single device does not become responsible for multiple unmet relational functions.

The findings should also be interpreted considering sample composition. Girls and mothers were more strongly represented than boys and fathers, and all participating counselors/therapists were women. Therefore, the prominence of maternal and female perspectives may partly reflect sample composition rather than gender-specific processes. Future studies

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should examine these pathways with a more balanced representation of adolescents, parents, and professionals. Overall, this substantive theory conceptualizes "the development of attachment-like relationships with smartphones within adolescents' relational worlds" as a dynamic relational-regulatory process. Within the regulated, non-compensatory pathway, smartphones remain embedded within a broader ecology of responsive relationships, coherent guidance, meaningful alternatives, and developing self-regulation. Within the compensatory-ambivalent pathway, relational uncertainty and limited developmental resources increase the smartphone's regulatory centrality, contributing to cycles of seeking, temporary relief, frustration, and renewed use. The contribution of this theory lies in distinguishing flexible digital integration from compensatory displacement, rather than equating frequent smartphone use with problematic use or addiction, or interpreting attachment-like relational meanings toward smartphones as inherently problematic.

Limitation

This study has several limitations. Social media recruitment may have favored participants with greater digital access or willingness to discuss smartphone-related experiences, potentially limiting the diversity of perspectives. Although participants were recruited from 9 provinces, this geographic variation does not necessarily represent the full range of urban, rural, socioeconomic, and cultural contexts, as experiences in provincial centers may differ from those in smaller or less-connected communities. Telephone interviews facilitated access across dispersed regions and increased privacy for discussing sensitive topics; however, they limited the observation of nonverbal and contextual cues. The sample also included more girls than boys, more mothers than fathers, and only female counselors/therapists, which may have increased the prominence of maternal and female perspectives. Finally, as a cross-sectional grounded theory study, the proposed model represents theoretically derived relationships rather than causal pathways; future longitudinal and mixed-method research using approaches such as ecological momentary assessment or digital diaries is needed to further examine and refine these processes.

Conclusion

This grounded theory study generated the substantive theory of "the development of attachment-like relationships with smartphones within adolescents' relational worlds," explaining how smartphone-related meanings emerge and are negotiated through adolescents' relational and developmental contexts. The findings show that attachment-like relationships with smartphones are not determined by frequency of use alone, but by the emotional, interpersonal, and regulatory functions that the device provides. Two pathways emerged from this core process: a regulated, non-compensatory pathway, in which responsive relationships, coherent family guidance, self-regulation, and meaningful offline resources supported flexible and purposeful smartphone integration; and a compensatory-ambivalent pathway, in which limited relational resources and unmet needs increased reliance on smartphones for connection, privacy, and emotional regulation. Importantly, attachment-like meanings toward smartphones should not be interpreted as problematic use or addiction by themselves; greater concern arises when smartphone-based regulation contributes to relational displacement, reducing engagement with interpersonal relationships and other developmental resources. Given that this theory was developed through a qualitative, context-specific grounded theory approach, future studies should test and refine the proposed pathways using longitudinal mixed-method designs, combining quantitative assessments of smartphone use, attachment, emotion regulation, and family processes with in-depth interviews, ecological momentary assessment, or digital diary methods. Such research should be conducted across diverse Iranian contexts, including national, provincial, and urban–rural populations, to examine the transferability and broader applicability of the proposed theory.

Data Availability

De-identified data supporting the findings are available from the corresponding author on reasonable request, subject to ethical and privacy restrictions.

Declaration of Generative AI and AI-assisted Technologies in the Manuscript Preparation Process

During the preparation of this work, the authors used AI tools solely for language editing and translation support, as well as for assistance in formatting the presentation of figures and tables. AI was not used for data analysis, coding, category generation, or theoretical interpretation. All categories, concepts, and theoretical interpretations were developed by the research team through grounded theory procedures, including open, axial, and selective coding, constant comparison, and analytical memoing. After using these tools, the authors reviewed and edited the content as needed and they take full responsibility for the content of the published article.

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Conflict of Interest

The authors declare that they have no conflicts of interest related to this study.

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Authors' Contribution

Sepideh Amani: Methodology, Data curation, Writing-Original draft

Seyyed Reza Fallahchai: Supervision, Methodology, Formal analysis, Writing – Review & Editing.

Farideh Khalajabadi Farahani: Supervision, Methodology, Formal analysis, Writing – Review & Editing.

Seyyed Abdul Wahab Samavi: Supervision, Methodology, Formal analysis, Writing – Review & Editing.

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