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Navigating Digital Waters: The Role of Parental Behaviours and Parent-Child Relationships in Shaping Adolescents' Digital Maturity

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NAVIGATING DIGITAL WATERS: THE ROLE OF PARENTAL BEHAVIOURS AND PARENT-CHILD RELATIONSHIPS IN SHAPING ADOLESCENTS' DIGITAL MATURITY

Research full-length paper

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Abstract

Previous research on the intersection of internet usage and parent-child attachment has often been unidimensional, focusing largely on negative aspects such as internet addiction or maladaptive behaviour. Our study utilizes the recently introduced concept of 'digital maturity'—a multidimensional framework that emphasizes self-directed use of digital technology for psychological growth and risk avoidance and hence to explore its relationship with parenting behaviours. This study contrasts earlier work by including an analysis of parental risk management and its effects on parent-child dynamics among adolescents. In a cross-sectional study with 285 parent-child dyads including adolescents aged 12 to 18, we evaluated parenting behaviours, parent-child relationships, and digital maturity, specifically analysing how parent-child relationships mediate the influence of parenting behaviours on digital maturity. Our findings indicate that both rationalization and unstructured time within parental behaviours significantly affect digital maturity. This impact is further mediated by factors such as perceived identity, and varying degrees of parental support in parent-child relationships. Our study expands the understanding of how digital interactions are shaped by family dynamics, providing new insights into the development of digital maturity.

Keywords: Parenting Behaviours, Parent-Child attachment relationships, Digital Maturity.

1 Introduction

In contemporary society, the use of digital technologies among adolescents has reached unprecedented levels, fundamentally altering their daily lives and social interactions. Studies consistently report that young individuals, particularly those between the ages of 9 and 18, are at the forefront of Information and Communication Technologies (ICT) usage. This demographic not only constitutes a substantial portion of internet users, with 96% engaging daily compared to 84% of the broader European population (Eurostat, 2023), but also exhibits a profound emotional attachment to their digital devices (Walsh et al., 2008). Such attachment signifies the integral role of ICTs in their daily routines and social behaviours, a trend further emphasized by their universal presence across various facets of life (Szymkowiak et al., 2021; Bucksch et al., 2016; Crone & Konijn, 2018; Odgers & Jensen, 2020).

The interaction with digital technologies provides adolescents with numerous developmental opportunities. These technologies facilitate access to a vast array of resources that enhance learning, skill acquisition, and self-expression (Haddon & Livingstone, 2017; Livingstone & Helsper, 2010; Nebel et al., 2017; Huang, Kumar, & Hu, 2021). They also offer platforms for social interaction and emotional

support, which are crucial during the formative years of adolescence (Chen et al., 2019; Vossen & Valkenburg, 2016; Younas et al., 2020). However, alongside these benefits, there are significant risks such as digital addiction, excessive screen time, and an overall decline in mental well-being, which have been documented extensively in recent literature (Hawi et al., 2019; Kwon et al., 2013; Orben, 2020; Przybylski & Weinstein, 2017; Seema et al., 2022; Twenge & Campbell, 2018).

The digital divide represents a critical issue, where access to technology can both ameliorate and exacerbate existing socio-economic disparities (Ren, et al. 2022). While digital technologies hold the promise of democratizing access to educational resources, making them more affordable and widely accessible (Moore & Blackmon, 2022), there is considerable evidence suggesting that the benefits are not uniformly distributed across all socio-economic strata. Research indicates that individuals from lower socio-economic backgrounds are more susceptible to the adverse effects of digital engagement, such as heightened risk of device addiction and lower levels of digital literacy (Faltýnková et al., 2020; Sun et al., 2021; Ren et al., 2022).

This dichotomy between the potential benefits and risks of digital technology use underscores the need for a more nuanced understanding of digital engagement among young people. The recently introduced concept of digital maturity offers a valuable framework for assessing the efficacy of digital interactions in promoting personal and societal development. Defined by Laaber et al. (2023) as the capabilities and attitudes that enable autonomous, problem-solving, and socially beneficial use of digital technologies, digital maturity encapsulates the essence of what it means to utilize digital tools effectively and ethically.

Digital maturity is predicated on the foundational principles of psychosocial maturation and self-determination theory, emphasizing the importance of autonomy, competence, and relatedness in the digital sphere. Accordingly, a digitally mature individual is characterized by the capacity to use technology autonomously, navigate digital challenges proficiently, and engage in constructive social interactions online (Laaber et al., 2023, Arenas and Yazdi., 2022),. This conceptual framework suggests that digital maturity can function as a mediator and anchor, connecting various factors such as screen time, parental influence, and educational outcomes, with broader implications for mental and social well-being.

Amidst this complex backdrop, the role of parenting in shaping digital behaviours becomes crucial. Research highlights that key parenting behaviours, such as parental control (PC), monitoring (M), unstructured time (UT), dissuasion (D) and rationalization (R), significantly influence children's engagement with digital technologies (Venkatesh et al., 2019). Furthermore, the quality of the parent-child attachment relationship (PCR), as theorized by Bowlby (1969, 1973, 1980, 2005) and documented by Hair et al (2003), plays a pivotal role in mediating the effects of these parenting behaviours on children's digital disciplines.

Our research utilizes quantitative data collected from 285 parent-child pairs to investigate the influence of parenting behaviours on children's Digital Maturity Index (DIMI). Given the high attrition rates common in child development studies, meticulous study design is crucial. This study uniquely gathers data from both children and parents in a manner that prevents parental influence on children's responses. Informed by extensive literature, including Xu et al. (2012), which examines the role of significant influencers—parents, teachers, and peers—in youth technology usage and addiction, our study delves into the nuanced interactions between parenting styles and parent-child relationship dynamics. Our objective is to offer deeper insights into how effective parenting can either promote or impede the development of digital maturity. By applying a quantitatively determined multidimensional digital maturity construct (DIMI), this study adopts a pioneering method to assess how parental behaviours impact adolescent lifestyles. Ultimately, this research adds to the broader dialogue on the effects of digital technology on youth, providing a thorough analysis of how parenting and parent-child relationships contribute to achieving digital maturity—an essential factor for successful and healthy engagement with the digital world

2 Theoretical background

2.1 Mature use of digital devices

The widespread use of digital devices among youth necessitates an examination of their engagement in terms of maturity and responsibility (Escobar-Viera et al., 2018; Thorisdottir et al., 2019; Matook et al., 2015). Digital maturity, as a concept, provides a holistic lens through which young people's interactions with digital technologies are viewed. It encompasses not only the risks but also the significant opportunities these technologies present. Defined by Laaber et al. (2023) as a blend of "capabilities and attitudes which enable individuals to use digital technologies in ways that support personal development and societal integration," digital maturity extends beyond mere technical proficiency.

This broad capability for mature use is expected to manifest across different devices, functionalities, and situations (Buksch et al., 2016; Faltýnková et al., 2020). Digital maturity not only relates to but also expands upon the concept of a mature personality in non-digital contexts, predicting positive behavioural outcomes in the digital sphere. This includes capabilities specific to the digital context, allowing young individuals to adeptly navigate both its challenges and opportunities (Arenas & Yazdi, 2022; Christensen et al., 2023; Laaber et al., 2023, 2024). Furthermore, digital maturity encompasses—and extends beyond—digital literacy by emphasizing people skills and personal growth alongside technical skills. It underscores the necessity of technical knowledge while highlighting that it alone is insufficient for psychological growth through technology. A mature user views digital technologies as tools for personal development, actively seeking content that aids in achieving specific goals, enhancing social connections, and overcoming challenges through mutual support.

Current research often views passive use of social media as detrimental, associating it with declines in well-being, whereas active use is generally seen as beneficial, though the evidence is more mixed (Escobar-Viera et al., 2018; Matook et al., 2015; Roberts & David, 2023; Thorisdottir et al., 2019; Verduyn et al., 2017). For example, Verduyn et al. (2017) describe how passive social media use can lead to negative social comparisons and feelings of envy, while active use may foster social capital and enhance feelings of connectedness. This dichotomy is further evidenced by studies showing that increased online activity can reduce feelings of loneliness (Deters & Mehl, 2013) and that the impacts of social media use vary significantly with the user's level of engagement (Roberts & David, 2023).

The role of parental involvement is also critical in nurturing digital maturity. Active parental monitoring has been shown to enhance digital skills and understanding of the digital world, better preparing youth to manage online content and risks (Cricchio et al., 2022). Historical research supports this, finding that strong parent-family connections can mitigate emotional distress and reduce suicidality among adolescents (Resnick et al., 1997). Furthermore, shared enjoyable activities between parents and children and parental presence during key times of the day correlate with protective effects against emotional distress across adolescent age groups. Longitudinal studies have similarly highlighted that high levels of parental support are associated with various positive outcomes, including emotional attachment to parents, satisfaction with life, and psychological well-being (Amato & Booth, 1997; Mahony & Stattin, 2002).

2.2 Effect of Parenting Behaviours on children digital maturity

The well-established parenting styles—authoritative, authoritarian, permissive, and neglectful—each predispose different parenting behaviours, influencing various aspects of child rearing from rule enforcement to communication and guidance (Baumrind, 2005; Heath, 2005). These behaviours significantly impact how children interact with digital technologies, potentially affecting their susceptibility to Internet addiction and shaping their overall digital maturity.

Guided by the foundational work of Viswanath et al. (2019), we rely on five key parenting behaviours that are critical in influencing children's digital engagement: (1) Parental Control (PC) involves setting

explicit rules that the child is expected to follow and is crucial for establishing boundaries within which children can safely explore digital spaces (2) Monitoring (M) is defined as the surveillance and oversight of the child's adherence to established rules, and ensures that children remain within safe boundaries while online. (3) Unstructured Time (UT) refers to the provision of freedom and opportunities for the child to engage in responsible behaviour independently. Allowing unstructured time encourages self-regulation and fosters skills necessary for digital literacy and safe internet use (4) Dissuasion (D) involves advising against certain actions through various means such as exhortation or coercion, helping children understand the consequences of unsafe digital practices. (5) Rationalization (R) educating children to think critically and make informed decisions, rationalization aims to reduce problematic behaviours by enhancing the child's understanding of the digital environment.

Each parenting style incorporates these behaviours to varying degrees (Venkatesh et al, 2019). Based on previous research regarding more responsible and advantageous use behaviour, we expect the following relations

H1a: Higher parental control (PC) leads to higher digital maturity (DIMI)

H1b: Higher parental monitoring (M) leads to higher digital maturity (DIMI)

H1c: Higher unstructured time in parenting (UT) leads to lower digital maturity (DIMI)

H1d: Higher dissuasion in parenting (D) leads to higher digital maturity (DIMI)

H1e: Higher rationalization in parenting (R) leads to higher digital maturity (DIMI)

2.3 Parent-Child attachment relationships (PCRs) with respect to the use of digital devices

The quality of parent-child attachment relationships (PCR) plays a pivotal role in shaping the impact of parenting behaviours on children's internet behaviour, particularly regarding susceptibility to internet addiction. Positive perceptions of PCRs are likely to foster adherence to parental expectations around acceptable internet use, thereby reducing the likelihood of addiction. Conversely, negative PCRs may prompt children to rebel against parental guidelines as a means of seeking attention, potentially leading to excessive internet use and addiction (Baumrind, 1966, 1967; Ward, 2006).

In the context of negative parent-child relationships, children may perceive parental control as overbearing or punitive. Such a perception can lead children to view any established rules or boundaries as oppressive, increasing the likelihood of rule-breaking as both a form of rebellion and a cry for attention (Heath, 2005; Kaye, 2005; Marsh et al., 2003). When parent-child relationships are positive, children typically perceive monitoring as a constructive form of communication, fostering a robust dialogue between parent and child (Armsden and Greenberg, 1987). Positive attachments encourage openness and honesty, enhancing the effectiveness of parental monitoring and the likelihood of voluntary disclosure by the child (Ginott and Goddard, 2003). Positive PCRs allow unstructured time to be seen as a demonstration of trust in the child's decision-making capabilities, suggesting that the parent views the child as mature and responsible (Maccoby and Martin, 1983; Zimmer-Gernbeck and Collins, 2003). Conversely, in the backdrop of negative PCRs, such freedom might be misused, with the child potentially engaging in excessive internet use as a form of retaliation against perceived parental neglect. The success of dissuasion largely depends on the quality of the PCR. A strong, positive attachment fosters effective communication and mutual respect, making parental advice more likely to be heeded, even if not thoroughly justified. In stark contrast, a poor PCR characterized by weak communication and lack of mutual respect renders dissuasive efforts less effective and can exacerbate the child's inclination toward excessive internet use. Similar to dissuasion, rationalization involves educating the child about the risks of excessive internet use, aiming to foster critical thinking and informed decision-making (Xu et al., 2012). Positive PCRs create an ideal environment for such educational efforts, enhancing the likelihood that the child will internalize and adhere to parental guidance. Conversely, in negative PCRs, the lack of communication and respect may undermine these educa-

tional efforts, reducing their effectiveness and potentially leading to digital indiscipline. Guided by the principles set by Hair et al (2003) as established in the longitudinal studies we grouped the questions into following categories: (1) perceived identity (PI), (2) strong parental support (PS), and (3) weak parental support (PW). Our research can provide relevant insights into nature of interactions between PBs, PCRs and DIMI. We expect the following relations

H2a: Higher perceived identity (PI) relates to higher digital maturity (DIMI)

H2b: Higher strong parental support (PS) relates to higher digital maturity (DIMI)

H2c: Higher weak parental support (PW) relates to higher digital maturity (DIMI)

H3: Parent-Child attachment relations (PCRs) mediate the relationship between parenting behaviours (PBs) and digital maturity (DIMI)

2.4 Present study

The central aim of this research was to dissect the relationships between parenting behaviours (PBs), parent-child relationships (PCRs), and Digital Maturity Index (DIMI), as illustrated in Figure 1. This investigation was structured to enhance understanding of how these variables interact to influence the digital maturity of adolescents. The initial objective was to independently assess the impact of PBs and PCRs on the digital maturity levels of young individuals. This analysis aims to uncover how PBs and PCRs contribute to the development of a beneficial and responsible engagement with digital devices among youth. The second objective sought to explore whether the effect of PBs on DIMI is mediated by PCRs. This part of the study examines if stronger, more positive parent-child relationships enhance the ability of Parenting Behaviours to foster digital maturity, suggesting that PCRs could play a crucial role in facilitating the development of these essential digital competencies. Additionally, the study considered the age of the adolescents and the age of the parents as control variables. These factors were included to account for the potential variability in digital maturity that could be attributed to different stages of adolescent development and parental influence. The inclusion of these variables helps in isolating the specific effects of PBs and PCRs on digital maturity. To address these objectives, we conducted empirical research involving parent-child dyads. Measurements were taken for PBs, PCRs, and DIMI. The study population comprised adolescents aged 12–18 years—a critical developmental phase where individuals increasingly engage in independent device use. This age range is particularly pertinent as it represents a transition period where parental influence and the maturation of device use behaviours become particularly impactful.

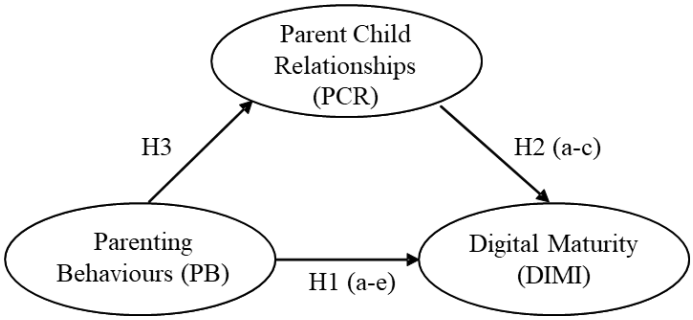

Figure 1. Conceptual Model

3 Method

3.1 Participants

This data was collected as part of a large multi-scale study for a research project. Participants from Spain were recruited via the Bilendi online panel, which recruited parents with children aged 12–18

from their available participant pool. The aim was to collect data from children aged 12–18 years and their parents, living in Spain. Using a Qualtrics (www.qualtrics.com) cross-sectional online survey, answers from both a parent and their child regarding the relevant constructs investigated in the study were collected. Overall, 400 parent-child dyads completed the study[1] , of which 115 responses were excluded, as they indicated the child to be younger than 12 years of age, which falls outside the inclusion criteria of the study. Further, 1 response were excluded as participants failed both attention checks. Of the resulting 284 responses, 51.23 % (146) of the children were male, 48.77 % (138) were female. The average age was 14.38 years (SD = 1.85), ranging from 12 to 18 years. Regarding the parent, 45.61% (130) were male, 54.39 % (154) were female. Equivalently, 57.54 % (164) of parents were the child's father, 42.46% (130) were the mothers. Parents' average age was 44.13years (SD = 11.56). The study was approved by the Ethics Committee of the IE University and University of Vienna (reference number 00615).

3.2 Materials and Procedure

3.2.1 Measures completed by Parents

To measure Parenting Behaviours, we used fifteen items from Venkatesh et al. (2019; e.g., "I check the web sites visited and/or apps used by my child?") with a 5-point Likert scale (strongly disagree (1); strongly agree (2); neutral (3); agree (4); Strongly agree (5); (Steinfeld, 2021). The items were grouped in their respective behavioural and were averaged into a custom score (Venkatesh et al 2019).

3.2.2 Measures completed by Children

To measure children's digital maturity, the Digital Maturity Inventory (DIMI; Laaber et al., 2023) was used. The DIMI comprises 32 items which measure digital maturity on 10 dimensions (e.g., "When using a mobile device, I learn new skills", "When using a mobile device, I choose the content I want to see", "When using a mobile device, I care about the feelings of others"). All dimensions were measured on 5-point scales (not at all (1) to completely (5) for the digital literacy dimension; never (1) to always (5) for all other dimensions; The final digital maturity score was created according to Laaber et al. (2023). To measure parent child relationships, we used an 8-item scale by Hair et al (2003), asking the children about how they view their relationship with their parent (e.g., "I aspire to be like my parent/guardian"). Again 5-point Likert scale (strongly disagree (1); strongly agree (2); neutral (3); agree (4); Strongly agree (5); Steinfeld, 2021) was made use of and the items were grouped in their respective parent-child relationship style and were averaged into a custom score (Hair et al 2003). Further, children reported their average use hours of mobile devices for leisure activities on an average weekday, on a scale from 0 to 24 h. They also reported their age when they first received their own mobile phone, on a scale of bi-yearly intervals up to the age of 12, with the option older than 12 years, or I do not own a mobile phone.

3.3 Methodology

First, correlations were used to examine the associations between Parenting Behaviours, parent-child relationships, and digital maturity using Microsoft Excel 365[2]. Second, we applied ordinary least

[1] The survey study was conducted in accordance with the regulations set by Digymatex Institutional Review Board (IRB) and European Union (EU) as part of Horizon 2020 project

[2] Analysis ToolPak extension

square (OLS) regression modelling[3] to test the proposed model. To assess model fit, we applied the R^2 fit values. We relied on common p-value recommendations of regression coefficients below 0.05, suggesting a significant fit (Hu & Bentler, 1999). Additionally, we used the Python 3.0[4] (Hayes, 2017) to test indirect effects. We also used Python 3.0 to set 1000 bootstrap samples[5] for 95 % percentile bootstrap confidence intervals for all models.

4 Results

The hypotheses were tested using ordinary least squares (OLS) regression. To increase readability, we present the results in separate tables.

The correlation matrix (Table 1) reveals that parental control and monitoring are highly correlated with each other, suggesting that in environments where one is high, the other tends to be high as well. Whereas the other variables show specific patterns of correlations with various parenting measures highlighting complex relationships that could influence behavioural outcomes in children.

Correlation matrix (N = 285)

	Mean (μ)	Standard Deviation (SD)	Age of child (c)	Age of parent (p)	Parental control (PC) (p)	Monitoring (M) (p)	Unstructured time (UT) (p)	Dissuasion (D) (p)	Rationalization (R) (p)	Perceived identity (PI) (c)	Strong parental support (PS) (c)	Weak parental support (PW) (c)	DIMI score
Age of child (c)	14.382	1.846	1										
Age of parent (p)	44.130	11.564	0.079	1									
Parental control (PC) (p)	3.732	0.960	0.414	0.010	1								
Monitoring (M) (p)	3.568	0.953	0.402	0.072	0.735	1							
Unstructured time (UT) (p)	2.745	0.976	0.037	0.021	0.004	0.049	1						
Dissuasion (D) (p)	4.034	0.636	0.171	0.141	0.564	0.422	0.009	1					

[3] Regression package in Analysis ToolPak extension

[4] Statsmodels package, Python 3.0

[5] Sci-kit learn package, Python 3.0

Rationalization (R) (p)	3.706	0.732	0.139	0.056	0.521	0.467	0.120	0.588	1				
Perceived identity (PI) (c)	4.115	0.677	0.072	0.055	0.289	0.294	0.050	0.241	0.313	1			
Strong parental support (PS) (c)	4.312	0.740	9.945 13E-05	0.059	0.218	0.201	0.068	0.328	0.326	0.529	1		
Weak parental support (PW) (c)	2.154	0.973	0.032	0.110	0.027	0.048	0.327	0.059	0.003	0.277	0.366	1	
DIMI score	1.78	10.71	0.115	0.013	0.131	0.174	0.339	0.191	0.371	0.306	0.254	0.323	1

Table 1. Correlations between contributing factors and DIMI score. (p) – parent reported, (c) – child reported.

Table 2 presents the results of the models predicting the DIMI score (Laaber et al 2023). Model 1 includes only the Parenting Behaviours as dependent variables. Model 2 includes only the perceived parent-child relationships as dependent variables. Model 3 combines both Parenting Behaviours and perceived parent-child relationships into a first order linear equation model. Model 4 develops and Model 3 and further includes the two-way interactions between parental monitoring (PM) behaviours and each of the perceived parent-child relationships.

We found that in the Parenting Behaviour model (Model 1), the age of the child, unstructured time, and rationalization variables to be the significant contributors with a positive slope. In the parent-child relationship model (Model 2), we found that the age of the child, perceived identity, strong parental support, and weak parental support to be significant with a positive slope. Upon combining all the contributing factors into a single model (Model 3), we found that only age of the child, unstructured time, rationalisation factors to be significant along with all the other factors from the parent-child relationship model. Accounting for the strong positive correlation between parental control and parental monitoring, we eliminated multicollinearity between these two variables and recalculated to include any interaction effect between the Parenting Behaviours and parent child relationships (Model 4). Accordingly, we found that the final model (Model 4) with second order variables had the best explained variance of all the models (45%). The results indicated that 2 parenting behaviours and all three parent-child relationships had significant contributions

Predicting DIMI (N=285)

	Model 1		**Model 2**		**Model 3**		**Model 4**	
Dependent Variable	*DIMI score*		*DIMI score*		*DIMI score*		*DIMI score*	
	R^2 = .256		*R^2 = .350*		*R^2 = .427*		*R^2 = .453*	
	b	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*
Intercept	1.785**	.554	1.784**	.516	1.785***	.489	1.305*	.508
Age of child (c)	1.879**	.624	1.649**	.521	1.728**	.553	1.560**	.548

Age of parent (p)	-.364	.568	-.015	.522	-.142	.504	-.146	.496
Parenting Behaviours								
Parental control (PC) (p)	-.661	.929			-.445	.824	-.442	.810
Monitoring (M) (p)	1.190	.846			.169	.757	.104	.750
Unstructured time (UT) (p)	3.072***	.562			1.823***	.529	1.669**	.547
Dissuasion (D) (p)	.155	.752			-.178	.674	-.192	.667
Rationalization (R) (p)	3.588***	.734			2.674***	.661	2.693***	.649
Parent-Child Relationships								
Perceived identity (PI) (c)			3.350***	.615	2.577***	.609	2.612***	.599
Strong parental support (PS) (c)			2.974***	.633	2.369***	.628	2.015**	.644
Weak parental support (PW) (c)			5.521***	.561	4.439***	.574	3.494**	.638
Interactions								
M * PI							.071	.699
M * PS							1.874*	.777
M * PW							1.746**	.618

Table 2. Different OLS models predicting DIMI. (p) – parent reported, (c) – child reported

Given the limited OLS fit, we suspected that there could be nonlinear distribution of the data. Hence, we plotted Model 4 residuals with its corresponding line fit (Figure 2a). From the figure we could confirm the presence of influential observations affecting the regression line and the spread of residuals also appears to increase with the fitted values, indicating slight heteroscedasticity. To assess the normality of residuals we plotted the Normal Q-Q plot. Residual points in this plot largely were on the diagonal line indicating a healthy approximation.

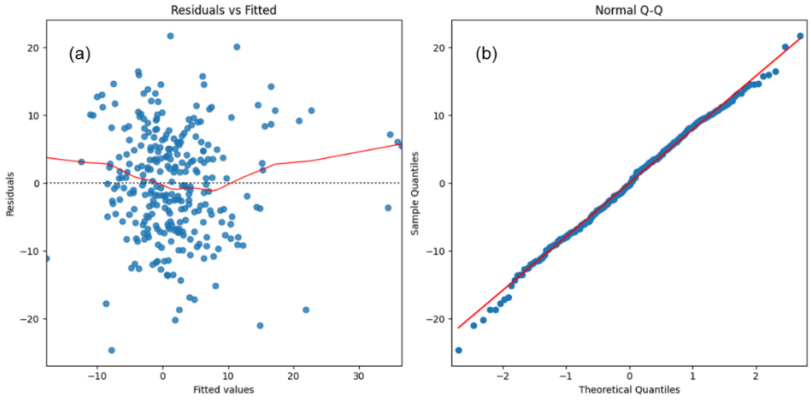

Figure 2. (a) Model Residuals vs Fit plot. Red – Lowess fit curve. (b) Normal Q-Q plot

Previously, studies have shown that parents with higher socioeconomic status (SES) are more likely to engage in active mediation (Alkan et al., 2021; Bako & Tokes, 2018). Venkatesh et al (2019) have shown that effects of parenting behaviours on children's internet addiction is moderated by the children's views of parent–child attachment. Whereas Laaber et al, (2024) have previously shown the relation of SES to digital maturity was fully mediated by active parental mediation which is in turn mod-

erated by personality traits such as agreeableness, conscientiousness, and negative emotionality. Based on this we tried to examine if parental-child relationships in fact mediates the relationships between Parenting Behaviours and digital maturity (DIMI). We independently examined the mediating role of perceived identity (PI), strong parental support (PS), and weak parental support (PW) on DIMI.

Mediating effects of parent-child relationships on Parenting Behaviours

	Perceived identity (PI) (c)				Strong parental support (PS) (c)				Weak parental support (PW) (c)			
	Direct	Indirect	Total	95% CI	Direct	Indirect	Total	95% CI	Direct	Indirect	Total	95% CI
Age of child (c)	1.752	.120	1.879	(-.161, .500)	1.710	.168	1.879	(-.049, .468)	1.998	-.119	1.879	(-.485, .204)
Age of parent (p)	-.478	.114	-.363	(-.133, .405)	-.393	.029	-.363	(-.176, .265)	-.123	-.239	-.363	(-.654, .076)
Parenting Behaviours												
Parental control (PC) (p)	-.863	.202	-.661	(-.219, .722)	-.615	-.045	-.661	(-.438, .345)	-.420	-.240	-.661	(-.741, .276)
Monitoring (M) (p)	.829	.360	1.190	(-.039, .889)	1.039	.150	1.190	(-.212, .544)	.927	.262	1.190	(-.242, .824)
Unstructured time (UT) (p)	3.029	.042	3.072	(-.229, .273)	3.268	-.196	3.071	(-.471, .013)	2.182	.889	3.071	(.323, 1.639)
Dissuasion (D) (p)	.118	.036	.155	(-.296, .423)	-.230	.385	.155	(.065, .777)	.266	-.112	.155	(-.533, .295)
Rationalization (R) (p)	3.169	.418	3.588	(.049, .946)	3.186	.402	3.588	(.099, .881)	3.622	-.034	3.588	(-.474, .405)

Table 3. Mediation effects of each on the parent-child relationships on Parenting Behaviours while predicting DIMI score (p) – parent reported, (c) – child reported

Further developing on the results from table 3, we found that PI adds to the direct effect of R on predicting DIMI ($\beta = 3.169$, $p<0.001$) whereas PW adds to the direct effect of UT ($\beta = 2.182$, $p<0.001$). Interestingly, we observed that PS while adding to the direct effect of R ($\beta = 3.186$, $p<0.001$) and slightly reducing the total effect of UT ($\beta = 3.268$, $p<0.001$), it also reverses the impact of D ($\beta = -0.230$, $p>0.05$). While the best fit OLS model does not suggest this D variable to be included, it poses a significant question to wonder if in the future studies one needs to ascertain appropriate weights to these variables.

Results of Hypothesis Testing

Hypothesis	Supported
1. Higher parental control (PC) leads to higher DIMI	
2. Higher monitoring leads (M) to higher DIMI	
3. Higher unstructured time (UT) leads to lower DIMI	YES
4. Higher dissuasion (D) leads to higher DIMI	
5. Higher rationalization (R) leads to higher DIMI	YES

6. Higher perceived identity (PI) leads to higher DIMI	YES
7. Higher strong parental support (PS) leads to higher DIMI	YES
8. Higher weak parental support (PW) leads to higher DIMI	YES
9. Parent-Child relationships (PCRs) mediate the relationship between parenting behaviours (PBs) and DIMI	YES[a]

Note. (a) subject to conditions.

5 Discussion

The pervasive use of digital technologies among young individuals presents both significant opportunities and risks, shaping their developmental trajectories in profound ways (Odgers & Jensen, 2020; Twenge & Campbell, 2018; Younas et al., 2020). Our study aimed to unpack how various dimensions of parental influence—specifically Parenting Behaviours and the quality of parent-child relationships—mediate the effects of these technologies on adolescents' digital maturity.

Consistent with prior research, our findings reaffirm that not all digital engagement is detrimental. Opportunities such as enhanced access to information and skill development can serve as significant equalizers in educational and social terms (Livingstone & Helsper, 2010). However, the risks, particularly digital addiction, remain a pressing concern (Sun et al., 2021; Urbanova et al., 2019). Our study extends this discourse by demonstrating that specific Parenting Behaviours, notably unstructured time (UT) and rationalisation (R), directly influence digital maturity (DIMI). This suggests that providing adolescents with measured autonomy and reasoned guidance fosters an environment where digital technologies are used more judiciously and constructively.

The significant role of R highlights the importance of educating young individuals about the potential pitfalls and responsible use of digital technologies. By encouraging critical thinking about digital consumption, parents can equip their children with the skills to navigate the digital world more effectively, potentially mitigating the risks associated with excessive or inappropriate use.

Our analysis reveals that the quality of PCRs plays a crucial role in mediating the impact of PBs on digital maturity. This finding aligns with attachment theory, which posits that secure attachments foster greater openness to parental influence and guidance (Bowlby, 1969). When PCRs are characterized by mutual understanding and trust, parental interventions such as monitoring and guidance are more likely to be accepted and internalized by the adolescents, thereby promoting healthier digital habits.

Interestingly, our results indicate that even when certain PBs like dissuasion (D) are not included in the best-fit model, strong parental support (PS) can modify the impact of these behaviours. This interaction suggests that the context in which parental strategies are employed—whether perceived as supportive or coercive—can dramatically alter their effectiveness. Therefore, parental support not only strengthens the direct effects of rational behaviours but can also counteract the potentially negative impacts of more authoritarian measures.

The concept of digital maturity, as explored in this study, encompasses more than just the avoidance of excessive use—it involves using digital technology in a way that actively supports personal development and societal integration (Laaber et al., 2023; Laaber et al., 2024). Our findings suggest that digital maturity is best achieved in environments where PBs are mediated through positive parent-child relationships, allowing for active and adaptive mediation strategies that reflect the evolving digital landscape.

6 Limitations and future directions

One of the primary strengths of this study lies in its dyadic approach, capturing insights from both parents and children to provide a more holistic view of the familial dynamics influencing digital maturity

(Cricchio et al., 2022). This method allows for a more nuanced understanding of how perceptions and behaviours on both sides contribute to outcomes.

However, the study is not without limitations. The cross-sectional design limits our ability to draw causal inferences. Longitudinal studies would be beneficial in further elucidating the directionality of these relationships and how they evolve over time. Additionally, exploring the impact of cultural factors could enhance the generalizability of the findings, as parenting styles and the role of digital technology in children's lives can vary significantly across different socio-cultural contexts.

Future research should also consider the role of digital content, which was beyond the scope of this study. As digital maturity involves not only the quantity but also the quality of digital engagement, understanding the types of digital content that adolescents are exposed to and how they interact with this content could provide further insights into how digital maturity develops.

In conclusion, this study provides compelling evidence that the path to fostering beneficial digital engagement among young people lies not only in the strategies employed by parents but also in the strength and quality of the underlying parent-child relationships. By further refining our understanding of these dynamics, we can better support adolescents in navigating the complexities of the digital world, ensuring they reap its benefits while avoiding its pitfalls. This research thus marks a significant step forward in our understanding of digital maturity, offering a foundation for both future academic inquiry and practical application in parenting strategies for the digital age.

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Appendix:

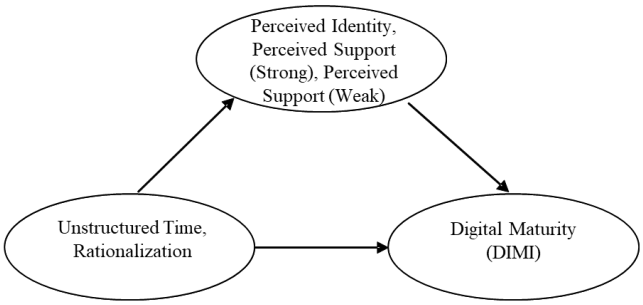

Figure 1. Final model with significant mediators

Questions answered by children on Parent-Child Relationship (PCRs)

Perceived Identity (PI)	1. I think highly of my parent/guardian
	2. I aspire to be like my parent/guardian.
	3. I really enjoy spending time with my parent/guardian.
Perceived Support (Strong) (PS)	4. My parent/guardian praises me when I perform well.
	5. My parent/guardian helps me do things that are important to me
Perceived Support (Weak) (PW)	6. My parent/guardian criticizes me or my ideas.
	7. My parent/guardian blames me for her/his problems.
	8. My parent/guardian cancels our plans without a valid reason.

Question answered by Parents on their parenting style (PBs)

Parental control (PC)	1. I limit the amount of time my child spends with her/his mobile device.
	2. I set up restrictions on my child's use of mobile device (e.g., parental control, screen time)
	3. I require my child to complete her/his homework before using her/his mobile device for leisure activities.
Parental Monitoring (M)	4. I monitor what my child does online.
	5. I check the web sites visited and/or apps used by my child.
	6. I know well as to what my child does online.
Unstructured time (UT)	7. Outside school hours, my child has plenty of free time.
	8. Outside school hours, my child does not engage in any scheduled activities (e.g., homework, interest class) most of the time.
	9. Outside school hours, my child always has plenty of time when she/he can do whatever she/he wants.
Dissuasion (D)	10. I attempted to discourage my child from using a mobile device at a young age.
	11. I advise my child to limit her/his use of mobile device.
	12. I constantly remind my child of the dangers in the online world.
Rationalisation (R)	13. I regularly educate my child about potential online risks.
	14. I use educational videos to help my child understand the potential consequences of excessive mobile device usage.
	15. I use examples from media and news reports to help my child understand potential online risks.