Research article

Digital social multitasking (DSMT) and digital stress among adolescents: A peer norm perspective

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A B S T R A C T

Background: Digital stress refers to the stress resulting from persistent use of digital media. Given its major implications for well-being, it is crucial to explore how the use of digital media would contribute to the stress. Drawing on the frameworks of DSMT (i.e., using a digital device during social interactions) and perceived peer norms, we explored whether and how perceived peer norms of DSMT and adolescents' own DSMT were associated with digital stress.
Method: Adolescents between the ages of 12 and 18 were recruited through the Qualtrics survey panels. A total of 2105 adolescents completed a one-time online survey ($M_{age} = 15.39$, *S.D.* = 1.82).
Results: Path analysis revealed that all three self-DSMT variables (level, positive self-perception, negative self-perception) were associated with higher digital stress, with level and negative self-perception having stronger associations than did positive self-perception. Furthermore, peer DSMT level was related to higher digital stress both directly and indirectly through all three self-DSMT variables. Positive peer perception of DSMT was indirectly related to higher digital stress through higher self-DSMT level and more positive self-perception of DSMT, but was related to lower digital stress through reduced negative self-perception of DSMT. Negative peer perception of DSMT contributed to higher digital stress both directly and indirectly by intensifying teens' own negative perception of DSMT. Judging from the total-paths coefficients, all three peer norm variables were related to higher digital stress, with level having the largest coefficient, followed by negative peer perception and finally positive peer perception of DSMT.
Discussion and conclusion: All three perceived peer norms of DSMT (level, positive perception, negative perception) had the potential to increase digital stress directly and/or via impacting teens' own engagement in and perceptions of DSMT, with perceived peer engagement and negative peer perception being the greater risk factors. At the individual level, a similar pattern emerged—self-DSMT level and negative self-perception had noticeably stronger associations with digital stress than did positive self-perception.

1. Introduction

Digital stress is broadly defined as the stress resulting from persistent use of digital media [1,2]. It is a common experience among adolescents [3] that has major health and developmental implications [4,5]. Because the digital stress model is still fairly new, much remains unknown about what specific media behaviors would serve as a stress trigger. In this study, we focused on digital social

multitasking (DSMT), or the use of digital devices during social interactions [6]. While earlier research has established the relationship between DSMT and digital stress [5], we took a unique approach by studying it from a peer norm perspective. Adolescents' digital experience is often shaped by peer norms, which play a central role in teens' behaviors and attitudes [7,8]. Examining DSMT and digital stress from a peer norm perspective offers a deeper understanding of how adolescents navigate their digital experiences within peer contexts. Drawing on the DSMT framework [9] and the literature of perceived peer norms [10,11], we aimed to examine how perceived peer norms of DSMT would directly relate to digital stress as well as contribute to it through adolescents' own engagement in and perceptions of the behavior.

1.1. Digital stress

With the widespread use of digital media, people have higher expectations for constant and immediate access to information and connectivity [1]. However, such expectation has led to an increase in demands on users' attention and responses, thereby increasing stress [1]. Many types of digital stress have been identified [4,12], and Steele et al.'s [2] recent conceptualization of digital stress provides a useful framework to study the phenomenon. Steele et al. defined digital stress as the subjective experience of having insufficient resources to cope with the stress caused by digital media in one's social and relational contexts. Specific types of digital stress include availability stress (i.e., feeling obligated to be constantly available and responsive through digital media), approval anxiety (i.e., anxiety about how others would judge or respond to one's posts), fear of missing out (i.e., FoMO; distress of not being part of others' rewarding social experiences), connection overload (i.e., feeling overwhelmed by the amount of input received through digital media), and online vigilance (i.e., feeling a strong and compulsive need to access one's digital devices) [2,13]. Despite the multidimensional nature of digital stress, in this study, we treated it as a holistic concept rather than delving into specific types of stress. This approach is deemed appropriate by scholars [13], especially given the recent finding that the various types of digital stress are related to psychosocial outcomes in similar ways [14].

Digital stress is a common experience among today's adolescents [3,5]. While people at different developmental stages can all experience digital stress, adolescents' need for closeness with and approval from peers [4] likely makes digital stress especially relevant and influential at this stage. Indeed, among adolescents, digital stress is associated with concurrent anxiety, depressive symptoms, poorer social relationships and greater psychosocial difficulties, and fatigue [3,5,13]. It also predicts adolescent depressive symptoms after a one-year lag [3]. Recently, a meta-analysis confirmed that the various types of digital stress had a significant correlation with psychosocial distress ($rs = 0.26$ to 0.34, $ps < 0.001$) [14]. Given its implications for adolescent well-being, it would be important to explore possible contributors to adolescent digital stress, and DSMT appears to be a viable candidate.

1.2. Digital social multitasking (DSMT)

Digital social multitasking (DSMT) is defined as "technology-based multitasking during a social interaction" (p. 1210) [6]. Scrolling social media feeds or texting while simultaneously holding an in-person conversation is an example of DSMT, as the individual is multitasking with both a digital device and a communication partner. Although the DSMT framework was informed by the research of media multitasking (i.e., using multiple media simultaneously [15]), the latter focuses on attending to multiple technological activities without any activities needing to be social (e.g., surfing the Internet while watching TV). In contrast, DSMT does not require all multitasked activities to be media-based, but at least one of them must be social in nature (e.g., texting during a face-to-face interaction). The social focus of DSMT makes it an especially relevant framework to study adolescents' mobile communication. Indeed, DSMT is a common activity among adolescents. A recent study observed that 89 % of the adolescent participants engaged in DSMT during a recent face-to-face peer interaction at least part of the time [9]. Under the DSMT framework, when examining the implications of multitasking, one should consider both the *level (i.e., frequency)* by which someone performs this behavior and the multitasker's *positive and negative perceptions* of the behavior.

Frequent engagement in DSMT contributes to various types of digital stress, including availability stress, connection overload, and FoMO [5]. Research has also established links between levels of DSMT-adjacent behaviors (e.g., media multitasking) and digital stress [16], as well as stress-related longitudinal outcomes (e.g., sleep problems [17]). Although some research suggests that levels of DSMT and media multitasking do not lead to increased digital stress or psychosocial challenges for young and emerging adults [6,18], this may be a different story for younger users, who are not as readily equipped to reallocate their cognitive resources and can be easily distracted when they multitask [9]. In other words, adolescents may face a higher risk of experiencing depleted coping resources when they multitask. Thus, the relationship between the level of DSMT and digital stress may exist among adolescents.

Positive perceptions of technology multitasking behaviors operate under the uses and gratifications perspective [19], where it has been suggested that media multitasking is motivated by its ability to fulfill certain desires [20], including social, emotional, and informational needs [21,22]. Theories surrounding needs fulfillment posit that when these requirements are met, individuals will have more inner resources to achieve effective functioning and optimized psychological health [23]. Positive perceptions of DSMT reported by adolescents include easy access to information, greater efficiency, entertainment, and enhanced social connection, which are associated with satisfaction of basic psychological needs and higher friendship quality [9]. Given that stress is the result of insufficient resources [2], and that positive perceptions of DSMT indicate needs fulfillment and adequate resources, positive perceptions should thus provide a buffer against feelings of digital stress.

Negative perceptions of technology use during face-to-face interactions can be best understood through the lenses of *technoference*

(technology interference in a relationship [24]) and *phubbing* (i.e., snubbing a communication partner by using the phone [25]). Specifically, the negative perception of feeling distracted by the phone is a main reason why multitaskers experience reduced enjoyment during time spent with others [26]. Distractions occur when one's focus is interrupted by a task that is not essential to the main task [27], demanding the individual to divide their already limited attentional resources. Unable to fully focus on multiple tasks when in the state of distraction, people may feel overwhelmed and experience information overload (see Ref. [28] for a review), which is a type of digital stress. This relationship has been identified among adolescents, where DSMT-induced distractors (e.g., smartphone notifications) are associated with various indicators of digital stress [29]. In sum, whereas DSMT level and negative perception of the behavior may relate to higher digital stress, positive perception of DSMT may relate to lower digital stress.

1.3. Perceived peer norms

Social norms are rules and standards within a group that guide group members' behaviors [30]. During adolescence, due to teens' heightened conformity to peers, socio-affective sensitivity to peer feedback, and susceptibility to peer influence [31], peer norms become one of the most influential social norms associated with a wide range of adolescent behaviors (e.g., Refs. [7,8]). Because norms are not always explicitly stated, people have to rely on their observations of and interactions with group members to estimate norms [30]. It is not surprising that teens' perceived norms do not always accurately reflect the reality [7,32,33]. Yet, perceived norms are more influential than peers' actual behaviors to adolescents' behaviors or attitudes [10,34]. Thus, in this study, we focused on perceived peer norms.

Social norms come in two forms: descriptive norms concern behaviors (i.e., what most people do), and injunctive norms concern attitudes (i.e., what most people approve or disapprove) [30]. Both have been found to be associated with adolescents' own *behaviors*. For example, in terms of descriptive norms, teens are more likely to be sexually active [35], send a sext [7], victimize others [33], and use their mobile phone while driving [8] when they perceive their peers to also engage in these activities. Regarding injunctive norms, adolescents report greater risk taking [11], cyber-perpetration [36], sexual activity [35], and distracted driving [8] when they believe their peers view these activities as acceptable. Significant correlations between perceived injunctive norms and adolescents' own *attitudes* have also been reported. Adolescents who believe their peers are supportive of bullying are more likely to report pro-bullying attitudes [33]. Although there is little research on the impact of descriptive norms on teen attitudes, it is plausible that the two would also have a positive association, because people often use perceived norms, including perceive prevalence of a behavior, to develop their own attitudes about the behavior; the more prevalent a behavior is, the more likely it is the right thing to do, and thus the more likely one will develop a positive attitude toward the behavior (see a review in Ref. [36]).

1.3.1. Perceived peer norms of DSMT, Self-DSMT, and digital stress

The social norm and DSMT frameworks correspond well with one another. Level of engagement in DSMT and descriptive norms are both behavioral, whereas perceptions of DSMT and injunctive norms are both cognitive. The original DSMT framework largely focuses on the multitaskers' own behaviors and perceptions [37]. It appears to be a missed opportunity not to integrate the two frameworks and explore how perceived peer norms (peer DSMT level, positive peer perception of DSMT, and negative peer perception of DSMT) would be associated with adolescents' own engagement in and perceptions of the behavior.

Specifically, perceiving friends to frequently multitask on the phone during peer interactions (peer DSMT level) may lead teens to believe that this behavior is acceptable or even desirable among peers, consequently increasing their own engagement in DSMT (e.g., Ref. [8]) and fostering more positive and less negative self-perceptions of the behavior [36]. Perceived positive peer perception of DSMT indicates to teens that their peers approve of this behavior. Thus, it may also encourage more self-engagement in DSMT (e.g., Ref. [8]) and more positive and less negative self-perceptions of the behavior (e.g., Ref. [33]). Perceived negative peer perception of DSMT may relate to self-DSMT in the opposite direction, leading to lower self-DSMT level, less positive and more negative self-perceptions of the behavior. These potential connections, along with the prospect of self-DSMT influencing digital stress (as introduced in the previous section), suggest the possibility of perceived peer norms of DSMT indirectly contributing to digital stress.

The three peer norm variables may also have a direct relationship with digital stress. Drawing on the literature of social and peer norms [30,36], it is plausible that greater peer engagement in and positive perceptions of DSMT could signal that constantly multitasking and staying responsive is the default expectation, and one has the obligation to be permanently available. This perceived expectation can thus intensify digital stress. In contrast, when teens perceive peers to hold a negative view of DSMT, they may feel more comfortable disengaging from mobile communication and thus experience less digital stress.

1.4. Current study

The goal of the study was to examine the implications of DSMT for digital stress (see Fig. 1 for the conceptual model). It was hypothesized that perceived peer norms of DSMT would contribute to teens' digital stress through teens' own engagement in and perceptions of the behavior. To disentangle this path model, it would be necessary to first explore how the three dimensions of self-DSMT (level, positive perception, negative perception) are associated with digital stress. While the positive relationship between self-DSMT level and digital stress has been reasonably well-established (e.g., Refs. [5,16]), the associations between positive/negative perceptions and digital stress have not been empirically examined. Although we were able to present some speculations in a previous section, given the absence of robust empirical evidence for two of the three self-DSMT dimensions, we chose not to formulate a hypothesis but, instead, present a research question concerning self-DSMT.
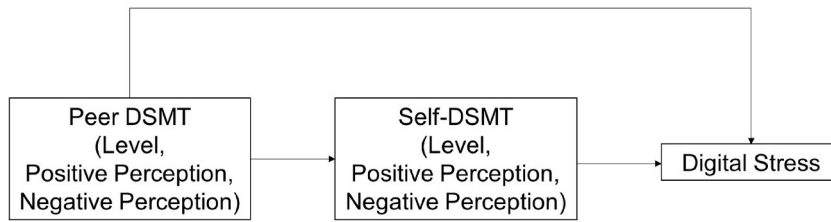
Fig. 1. Conceptual Model
Note. DSMT = digital social multitasking.

RQ1. How would self-DSMT (level, positive perception, negative perception) be associated with digital stress?

The second research question concerned perceived peer norms of DSMT in relation to digital stress. In the previous section, we delved into potential associations between perceived peer norms of DSMT, self-DSMT, and digital stress, with the goal of establishing that peer norms may directly associate with digital stress and also indirectly contribute to it through self-DSMT. Because the relationship between self-DSMT and digital stress was not entirely clear (especially for two dimensions), and considering the scarcity of literature on how norms would impact psychological well-being (given that most studies focus on their impact on behaviors and attitudes), we again proposed a research question rather than hypothesis concerning perceived peer norms in relation to digital stress.

RQ2. How would perceived peer norms of DSMT (level, positive perception, negative perception) be associated with digital stress both directly and indirectly via self-DSMT (level, positive perception, negative perception)?

2. Method

2.1. Participants and procedure

In this IRB-approved study, we recruited adolescent participants aged 12 to 18 who resided in the United States through the Qualtrics survey panel service. Participants had to pass at least two of the three embedded attention checks for the data to be considered valid. Invalid data were not included in the analyses. In the end, we received valid responses from 2105 adolescents (M_{age} = 15.39, *S.D.* = 1.82). The sample's gender and racial/ethnic makeup closely resembled national distributions (49 % female; 63 % White or European American; 20 % Latine, Hispanic, or Mexican American; 16 % Black or African American; 6 % Asian or Asian American; 2 % American Indian and Alaska Native). Age distribution was similar across all age categories (14 %–17 %), with the exception of those aged 12 (5 %). Prior to accessing the survey, both parental consent and adolescent assent were collected.

2.2. Measures

In the following subsections, we provide sample items. The full scales are available in Table 1 or the Appendix.

2.2.1. Digital stress

Ten items of the Digital Stress Scale (DSS) [13] were used to measure digital stress. Responses were assessed on a 5-point Likert scale, ranging from "1 = *Never*" to "5 = *Always*," where a higher mean score reflected higher levels of availability stress, approval

Table 1
Confirmatory factor analysis of the Scale of Perceived Peer Perceptions of DSMT.

	Factor Loading	α
Perceived Norm: Positive Peer Perception of DSMT		0.78
- It allows us to get the information we need	.53	
- It allows us to get things done quickly	.61	
- It is enjoyable	.81	
- It enhances our social experiences	.66	
Perceived Norm: Negative Peer Perception of DSMT		0.89
- It is distracting	.66	
- It is rude	.78	
- It is disrespectful	.77	
- It disrupts the interactions	.85	
- It makes people feel ignored	.81	

Note. DSMT = digital social multitasking. The scale instruction reads as follows: For the questions on this page, we would like to learn about your beliefs about how your friends may feel about **phone use during face-to-face peer interactions**. To the best of your knowledge, how much would your friends agree with the following statements? For example, if you believe most of your friends will strongly agree that phone use during face-to-face interactions with friends makes it easy to get the needed information, you would choose "My friends would strongly agree with this statement" for "It allows us to get the information we need."

anxiety, FoMO, connection overload, and online vigilance (α = 0.85). Example items included "I am nervous about how people will respond when I post new updates on social media" and "I have to check too many notifications".

2.2.2. Digital social multitasking: self-engagement (Self-DSMT)

Level of self-DSMT was assessed with a six-item, expanded measure of the original instrument [6]. On a 5-point Likert scale (1 = *Never*, 2 = *Rarely*, 3 = *Sometimes*, 4 = *Often*, 5 = *A lot*), participants reported how often they used their phone for six activities (e.g., social media, messaging, gaming) during face-to-face interactions with friends (α = 0.88). In the following sections, we referred to this variable as *self-DSMT level*.

Perceptions of DSMT were measured with four items regarding positive perceptions [9] and five items for negative perceptions [6] of phone use during social interactions. The items representing positive perceptions (α = 0.77) pertained to information access, enhanced social connection, efficiency, and entertainment (e.g., "allows me to get the information I need"; "enhances my social experience"). The items related to negative perceptions (α = 0.80) concerned feelings of distraction, less involvement, and delayed responses to face-to-face interactions (e.g., "I feel distracted by my phone"; "I feel less involved in the interaction with my friends because of my phone use"). All nine items were assessed on a 5-point Likert scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*). In the following sections, we referred to these variables as *positive self-perception* and *negative self-perception*, respectively.

2.2.3. Digital social multitasking: perceived peer norms (peer DSMT)

Drawing on the literatures of DSMT, media uses and gratifications, and phubbing/technoference [6,21,24], we created items measuring adolescents' perceptions of how much their friends engaged in DSMT (*peer DSMT Level*) and how positively and negatively their friends thought of DSMT (*positive peer perception* and *negative peer perception*, respectively). For perceived peer DSMT level, we thought it might be difficult for participants to know what their friends were doing on the phone during DSMT, so instead of using the six DSMT level items introduced in the previous section, we simply asked a single-item question (1 = *Never*, 2 = *Rarely*, 3 = *Sometimes*, 4 = *Often*, 5 = *A lot*): In general, when you have face-to-face interactions with friends, how often do your friends do something on the phone at the same time?

For perceived peer perceptions of DSMT, we created nine items, which mirrored the items measuring self-perceptions of DSMT. The instruction directed participants to consider how much their friends would agree with each statement (1 = *My friends would strongly disagree with this statement*, 2 = *My friends would kind of disagree with this statement*, 3 = *My friends would neither agree nor disagree with this statement*, 4 = *My friends would kind of agree with this statement*, 5 = *My friends would strongly agree with this statement*). Each statement concerned either a positive or negative perception of DSMT. See Table 1 for scale items, factor loadings, and Cronbach's alphas.

2.3. Plan for analysis

We started with confirmatory factor analysis (CFA) of the Scale of Perceived Peer Perceptions of DSMT. After the scale structure was confirmed, we examined the research questions by regressing digital stress on the self-DSMT variables and perceived peer norms of DSMT. The three self-DSMT variables were also regressed on the three peer norm variables. The error terms of the three self-DSMT variables were allowed to correlate. We controlled for the effects of gender, age, race/ethnicity, and amount of phone use on digital stress. All analyses were performed using Mplus, with MLR being the estimator. Model fit was considered acceptable when the CFI and TLI values approached or exceeded 0.95, in addition to the RMSEA value being below 0.08. CFA factor loadings were expected to reach 0.40 or higher.

3. Results

3.1. Confirmatory factor analysis

Results of CFA suggested that two items of positive perceptions should be correlated and two items of negative perceptions should be as well. After this modification, the model fit well and confirmed our presumed scale structure: $\chi^2(24) = 180.94, p < 0.001$; RMSEA = 0.056, 90 % CI [0.048-0.063]; CFI = 0.974; TLI = 0.961. The 9 items loaded on two factors, which were named *positive peer perception of DSMT* (4 items; α = 0.78) and *negative peer perception of DSMT* (5 items; α = 0.89). See Table 1 for scale details and Table 2 for scale descriptives and correlations.

3.2. Path analysis

The proposed model fit well after we followed the modification indices and added three controlled paths (gender and amount of phone use to self-DSMT level, and amount of phone use to positive self-perception of DSMT): $\chi^2(9) = 33.97, p < 0.001$; RMSEA = 0.036, 90 % CI [0.024-0.050]; CFI = 0.987; TLI = 0.952.

All three self-DSMT variables were related to higher digital stress: level (β = 0.15, $p < 0.001$), positive self-perception (β = 0.06, $p = 0.037$), negative self-perception (β = 0.21, $p < 0.001$). Perceiving friends to engage in a high level of DSMT was positively associated with adolescents' self-DSMT level (β = 0.25, $p < 0.001$), positive self-perception of DSMT (β = 0.14, $p < 0.001$), and negative self-perception of DSMT (β = 0.16, $p < 0.001$). Those who thought their friends viewed DSMT positively reported greater self-DSMT level (β = 0.18, $p < 0.001$), more positive self-perception (β = 0.46, $p < 0.001$), and less negative self-perception (β = −0.11, $p <$

Table 2
Descriptive statistics and correlations.

	Mean (S.D.)	1.	2.	3.	4.	5.	6.
1.Peer DSMT Level	3.31 (0.99)						
2.Positive Peer Perception of DSMT	3.43 (0.93)	0.22[c]					
3.Negative Peer Perception of DSMT	3.04 (1.04)	−0.05[a]	−0.18[c]				
4.Self-DSMT Level	3.31 (1.00)	0.32[c]	0.24[c]	−0.06[b]			
5.Positive Self-Perception of DSMT	3.53 (0.90)	0.25[c]	0.49[c]	−0.08[c]	0.52[c]		
6.Negative Self-Perception of DSMT	2.94 (0.99)	0.12[c]	−0.12[c]	0.30[c]	0.04	−0.10[c]	
7.Digital Stress	2.76 (0.86)	0.22[c]	0.10[c]	0.13[c]	0.26[c]	0.17[c]	0.24[c]

Note. DSMT = digital social multitasking. All scales are 5-point Likert scales.
[a] $p < .05$.
[b] $p < .01$.
[c] $p < .001$.

0.001). Perceiving friends to view DSMT negatively was not associated with adolescents' self-DSMT level ($\beta = -0.01$, $p = 0.525$) and positive self-perception ($\beta = 0.01$, $p = 0.521$), but it was related to more negative self-perception ($\beta = 0.29$, $p < 0.001$).

Perceiving friends to frequently perform DSMT was directly associated with higher digital stress ($\beta = 0.10$, $p < 0.001$); it was also indirectly associated with greater digital stress through the three self-DSMT variables: level ($\beta = 0.04$, $p < 0.001$), positive self-perception ($\beta = 0.01$, $p = 0.046$), negative self-perception ($\beta = 0.03$, $p < 0.001$). Perceiving friends to view DSMT positively was not directly associated with digital stress ($\beta = 0.05$, $p = 0.068$), but the three indirect paths were significant. Specifically, positive peer perception was related to higher digital stress through higher self-DSMT level ($\beta = 0.03$, $p < 0.001$) and positive self-perception ($\beta = 0.03$, $p = 0.039$); on the other hand, it was related to lower digital stress through reduced negative self-perception ($\beta = -0.02$, $p < 0.001$). Perceiving friends to view DSMT negatively was directly associated with greater digital stress ($\beta = 0.10$, $p < 0.001$); it was also indirectly related to higher digital stress through the participants' negative self-perception of DSMT ($\beta = 0.06$, $p < 0.001$), although the other two indirect paths via self-DSMT variables were non-significant: level ($\beta = -0.00$, $p = 0.525$), positive self-perception ($\beta = 0.00$, $p = 0.543$). Among the three peer norm variables, level had the largest total-paths coefficient ($\beta = 0.18$, $p < 0.001$), followed by negative peer perception ($\beta = 0.16$, $p < 0.001$); positive peer perception came in last by a noticeable margin ($\beta = 0.08$, $p = 0.001$). See Table 3 and Fig. 2.

More time spent on the phone was related to higher self-DSMT level ($\beta = 0.20$, $p < 0.001$), more positive self-perception of DSMT ($\beta = 0.11$, $p < 0.001$), and higher digital stress ($\beta = 0.12$, $p < 0.001$). Females reported higher self-DSMT level ($\beta = 0.14$, $p < 0.001$) and digital stress ($\beta = 0.18$, $p < 0.001$). White ($\beta = 0.17$, $p < 0.001$) and younger ($\beta = -0.05$, $p = 0.030$) adolescents reported higher digital stress.

Table 3
Path coefficients of perceived peer DSMT variables to digital stress.

	β	P
Peer DSMT Level		
Total	0.18	<0.001
Direct	0.10	<0.001
Total Indirect	0.08	<0.001
Peer DSMT Level → Self-DSMT Level → Digital Stress	0.04	<0.001
Peer DSMT Level → Positive Self-Perception → Digital Stress	0.01	0.046
Peer DSMT Level → Negative Self-Perception → Digital Stress	0.03	<0.001
Positive Peer Perception of DSMT		
Total	0.08	0.001
Direct	0.05	0.068
Total Indirect	0.03	0.022
Positive Peer Perception → Self-DSMT Level → Digital Stress	0.03	<0.001
Positive Peer Perception → Positive Self-Perception → Digital Stress	0.03	0.039
Positive Peer Perception → Negative Self-Perception → Digital Stress	−0.02	<0.001
Negative Peer Perception of DSMT		
Total	0.16	<0.001
Direct	0.10	<0.001
Total Indirect	0.06	<0.001
Negative Peer Perception → Self-DSMT Level → Digital Stress	−0.00	0.525
Negative Peer Perception → Positive Self-Perception → Digital Stress	0.00	0.543
Negative Peer Perception → Negative Self-Perception → Digital Stress	0.06	<0.001

Note. DSMT = digital social multitasking. All perceptions refer to perceptions of DSMT.
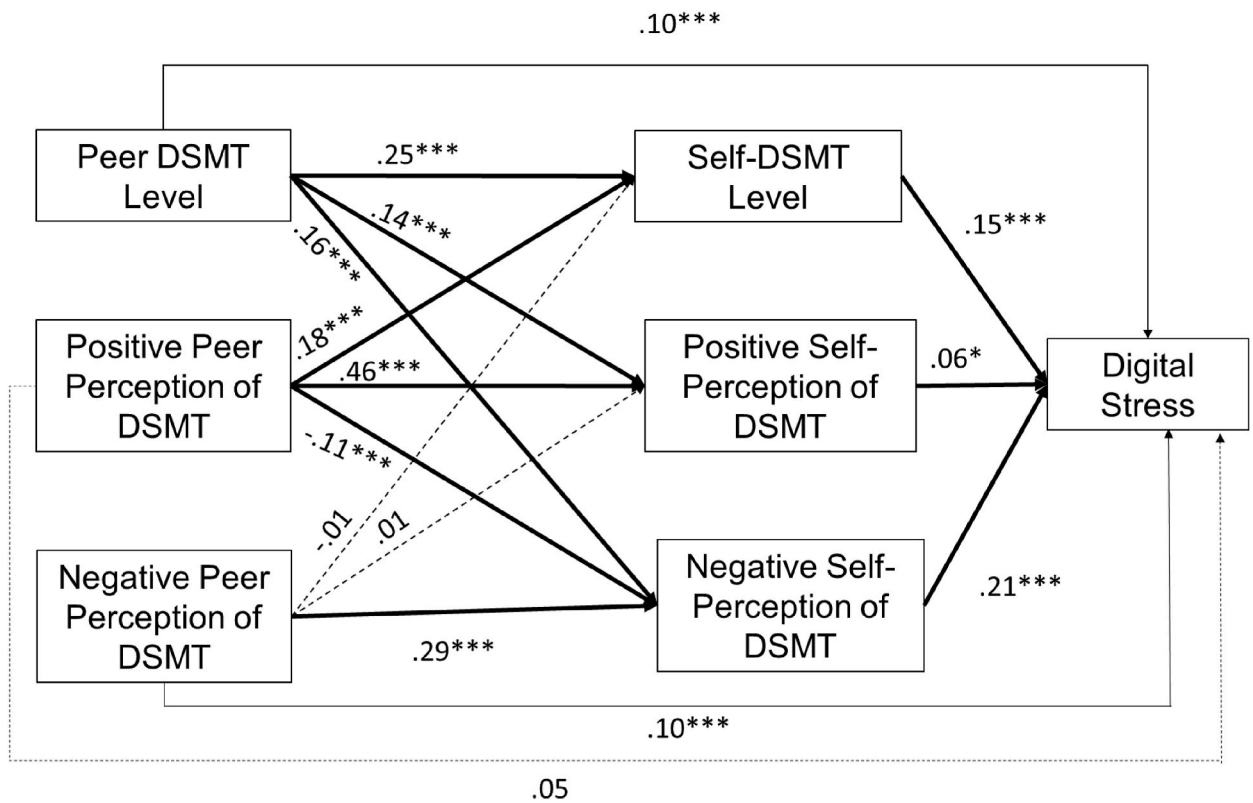
Fig. 2. Results of Path Analysis
Note. DSMT = digital social multitasking. Numbers are standardized coefficients. The dashed lines represent non-significant paths. The thin lines represent significant direct paths. The bold lines represent significant indirect paths. For clarity of presentation, controlled paths are not presented.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

4. Discussion

The study examined whether and how perceived peer norms of DSMT and adolescents' own DSMT were associated with digital stress. Our first research question concerned the associations between self-DSMT and digital stress, and the second research question concerned the direct and indirect relationships between peer DSMT and digital stress. For RQ1, all three self-DSMT variables were related to greater digital stress, with level and negative self-perception having stronger associations than did positive self-perception. For RQ2, perceiving friends to frequently perform DSMT was related to higher digital stress both directly and indirectly via all three self-DSMT variables. Perceiving friends to view DSMT positively was related to higher digital stress through higher self-DSMT level and more positive self-perception of DSMT, but was related to lower digital stress through reduced negative self-perception of DSMT. Perceiving friends to view DSMT negatively contributed to higher digital stress both directly and indirectly by intensifying teens' own negative perception of DSMT. Judging from the total-paths coefficients, all three peer norm variables were related to higher digital stress, with level having the largest coefficient, followed by negative peer perception and finally positive peer perception of DSMT.

4.1. Self-DSMT and digital stress

Existing research has established the relationship between higher levels of self-DSMT and digital stress [5], and our finding lends additional support to this observation. Digital stress can emerge when users allocate too much energy to the digital demands and underachieve other goals, when they have to stay alert to ongoing stimuli for an extended period of time, and when individuals have to constantly monitor their digital image [1]. Many activities youth frequently perform during DSMT, such as texting and using social media, have been found to be associated with various types of digital stress [38,39], likely because these activities deplete one's resources for other tasks, prompt one to immediately respond to multiple requests, and make one self-conscious about their online self-presentation.

Supplementing earlier research, this study showed that, in addition to self-DSMT level, adolescents' perceptions of DSMT were also associated with digital stress. Specifically, when adolescents held a negative view of DSMT, seeing it as distracting, they reported higher digital stress. As mentioned above, people experience digital stress when they perceive digital demands to undermine the achievement of other goals [1]. Similarly, users feel more stressed when they sense a conflict between their phone use and another

activity (i.e., goal conflict) [18]. When adolescents feel distracted by DSMT, they likely experience more goal conflict and feel less achieving, leading to higher digital stress.

The positive relationship between adolescents' positive perception of DSMT and digital stress is surprising. Digital stress emerges when individuals perceive a lack of resources to cope with the challenges presented by digital media [2]. In this study, positive perception was operationalized as teens perceiving DSMT to afford information, efficiency, enjoyment, and social connection, which could be interpreted as youth having more informational and psychosocial resources to cope with stress, but the data indicated the opposite. One study showed that adolescents' positive perceptions of DSMT were associated with better psychosocial outcomes, such as friendship quality and satisfaction of the basic psychological needs [9], and the authors viewed positive perceptions as the bright side of DSMT. Our results present more nuances complementing the earlier research. Although positive perception indeed had a much weaker relationship with digital stress, relative to the other two self-DSMT variables (level and negative perception), it was still a risk factor. At the same time, it is noteworthy that the standardized coefficient of this path was fairly small (0.06), and thus readers are advised to interpret the relationship cautiously.

4.2. Perceived peer norms, Self-DSMT, and digital stress

As hypothesized, perceived peer norms played a major role in adolescents' own DSMT experience and digital stress. Perceiving friends to frequently perform DSMT was related to higher digital stress both directly and indirectly via all three self-DSMT variables. While most research takes an individual approach, focusing on how one's own media behaviors would induce digital stress (e.g., Refs. [1,2]), our study shows that perceived peer behaviors can also directly trigger the stress. Perhaps the belief that most peers frequently engage in DSMT compels teens to make themselves available and tap into their insecurity of missing out on social events that take place on the phone. It is unexpected that the descriptive norm was related to stronger negative self-perception of DSMT (and thus indirectly contributed to higher digital stress). We thought greater peer DSMT level would relate to less negative self-perception, because when people perceive a behavior to be prevalent, they should see it as the right thing and thus develop a less negative attitude toward the behavior [36]. Note, however, that we followed the DSMT framework and focused negative self-perception on perceived distraction rather than the moral judgment of the behavior. It is possible that the more peers perform DSMT, the more adolescents receive texts/messages and notifications from their friends, leading to a stronger feeling of being distracted by the phone (and thus higher digital stress).

Perceiving friends to view DSMT positively was indirectly related to greater digital stress through higher self-DSMT level and more positive self-perception; on the other hand, it was related to lower digital stress through mitigated negative self-perception of DSMT. The results are consistent with existing research suggesting that positive injunctive norms should encourage more self-engagement in the behavior (e.g., Refs. [8,11,36]) and more positive and less negative perceptions of it (e.g., Ref. [33]). It is noteworthy that perceived positive peer perception generated the only indirect path where digital stress was alleviated—when teens thought their peers viewed DSMT positively, they felt less distracted and thus reported lower digital stress. The negative self-perception scale asked participants how much they were distracted from versus engaged with the face-to-face interaction. Perhaps when teens believe their peers hold a positive view of DSMT, they assume the behavior, including the almost inevitable disruption it brings, is accepted by peers, and thus they do not see their delayed response or divided attention as "less involved." In other words, these teens may already subscribe to a different definition of distraction or full engagement. When they do not self-perceive to be distracted and depleted of cognitive resources, they report less digital stress. At the same time, it is important to mention that this "protective route" had a small standardized coefficient (−0.02), and the total-paths coefficient of perceived positive peer perception remained positive, suggesting that, overall, this injunctive norm was still related to higher digital stress (albeit to a lesser extent relative to the other two peer norm variables).

Perceiving friends to view DSMT negatively was directly related to higher digital stress. When teens perceive negative injunctive norms of DSMT, they likely face a dilemma—while their friends consider DSMT disruptive, dismissive, and disrespectful, teens simultaneously sense a strong expectation for immediate digital response [12,29,40], which would be difficult to achieve without DSMT. The two expectations present a goal conflict, which has been found to be associated with higher digital stress [18] and may be an underlying mechanism for this direct path. Furthermore, when teens' peers frown upon DSMT, they may call out teens when they multitask and appear distracted. This may explain why negative injunctive norm is also associated with higher negative self-perception of DSMT and thus higher digital stress.

Among the three peer norm variables, level had the largest total-paths coefficient, followed by negative peer perception and finally positive peer perception. The results suggest that, while all three peer norms can increase digital stress through direct and/or indirect mechanisms, perceived descriptive norms may be more influential than respective injunctive norms in the context of DSMT and digital stress. Furthermore, between the two injunctive norms, positive peer perception presented a lower risk for digital stress. A few studies have also revealed the potentially differential impacts of descriptive and injunctive norms on youth behaviors (although not well-being). For example, one meta-analytic study on adolescent sexual behavior showed that perceived sexual activity of peers had a stronger correlation with self-reported sexual activity, relative to the effect of perceived peer approval [35]. However, a systematic review of distracted driving revealed that among young drivers (ages 16 to 25), descriptive norm had a smaller effect size than injunctive norm by a small margin [8]. The relative impact of normative versus injunctive norms may vary by the outcome of interest, but the few references dissuade us from drawing a conclusion. This may be a fruitful direction for future research on perceived peer norms.

4.3. Implications

At the theoretical level, the study enhances our understanding of how DSMT is associated with adolescent digital stress. It expands the existing literature in two ways. First, in the research of digital stress, most studies have focused on only level/frequency of multitasking or amount of media use as a contributor (e.g., Refs. [5,16,39]). Our study is among the first to unravel that positive and negative perceptions could both induce digital stress. The results also showed the relative impact of the three self-DSMT variables—although all three were associated with higher digital stress, positive self-perception presented least risk, indicated by the small standardized coefficient. Second, we moved beyond the individual approach to DSMT and explored its implications for digital stress from a perceived peer norm perspective. When one studies DSMT from an exclusively individual perspective, it would be difficult to imagine why or how perceived peer norms of the behavior would be associated with digital stress. Our innovative approach recognizes that teens' digital behavior is inherently embedded in and shaped by the peer context. When attending to both direct and indirect paths (i.e., total-paths coefficients), we noted that all three perceived peer norms of DSMT were associated with higher digital stress. However, positive peer perception presented the lowest risk, as it had the lowest total-paths coefficient and had the potential to lower digital stress by reducing teens' negative self-perception.

At the methodological level, we made a contribution by developing the scale of Perceived Peer Perceptions of DSMT. The scale development process was theory-driven and the scale structure was validated through confirmatory factor analysis. It should provide a useful tool for future scholars and practitioners interested in this topic to assess teens' perceptions of what their peers think of DSMT behaviors.

At the practical level, to help adolescents reduce digital stress, we propose three directions based on the results. First, at the individual level, adults can help adolescents become aware of the relationship between self-DSMT and digital stress and encourage them to reduce the behavior, especially when they feel negative about it (e.g., feeling distracted). Second, at the peer norm level, it may be worthwhile to encourage adolescents to discuss digital media use with their peers, as a way to collectively reshape the distressing norm. Social motive is a main drive of DSMT [37]. Teens likely multitask to live up to friends' expectations for immediate response [29]. Although this practice induces stress for many teens, they often assume they are the only ones struggling with the challenges presented by digital media, and thus they believe they need to endure the challenges by themselves [40]. It may be necessary to have open conversations about how the prevalence of peer DSMT overwhelms oneself, how peers actually think of DSMT, and what might be the more reasonable expectations of digital media use so that teens will not feel obligated to stay on the phone 24/7. Finally, policies should be established to hold digital media companies accountable for their design. Many digital media platforms prioritize keeping users on the sites for as long as possible, at the cost of youth's well-being (e.g., Snapchat Streak; see Refs. [29,40]), and these designs can prompt adolescents to multitask on the phone during social interactions. Platforms and apps, especially those targeting children and youth, should create self-directed and community-supported digital experiences for young people, and avoid design abuses that prioritize prolonging user engagement over well-being [41].

4.4. Limitations and future directions

Although this study makes important theoretical and practical contributions, there are some limitations to consider when interpreting the results. First, since this study is cross-sectional, the directionality among the variables remains uncertain. To help advance this line of research, future research should consider adopting a longitudinal design, which will not only clarify the directionality but also the long-term impact of DSMT on digital stress. Second, the study draws on samples from the United States; thus, readers are cautioned against generalizing the findings to other adolescent populations. Future research drawing on samples from different cultures that enable cross-cultural comparisons should be encouraged. Finally, a limitation concerns the conceptualization and operationalization of digital stress as a unitary unit rather than a multidimensional one. While this approach is appropriate and justifiable [13,14], there is a possibility that perceived peer norms of DSMT would have a stronger relationship with some types of digital stress whereas self-DSMT would have a stronger relationship with others. For instance, perceiving peers to frequently multitask may be an especially strong trigger for FoMO ("Everyone is constantly checking the phone. What did I miss?"), whereas self-DSMT may be especially relevant to approval anxiety, where adolescents worry about how their friends may judge their social media posts after they post something in the middle of a peer interaction. Future research may consider the individual components of digital stress and explore these possibilities.

5. Conclusion

Our findings suggest that all three perceived peer norms of DSMT (level, positive perception, and negative perception) had the potential to increase digital stress directly and/or via impacting teens' own engagement in and perceptions of DSMT, with perceived peer engagement and negative peer perception being the greater risk factors. At the individual level, a similar pattern emerged—self-DSMT level and negative self-perception had noticeably stronger associations with digital stress than did positive self-perception. To the best of our knowledge, no research has examined the relationship between adolescent DSMT and digital stress from a peer norm perspective. We attended to peer norms given its salient role in adolescent research. By merging the insights of communication scholars with the nuanced perspectives of developmental scientists, this interdisciplinary approach enables a deeper understanding of adolescents' digital experience embedded in the peer context. The approach also allows us to provide recommendations for intervention at individual, peer norm, and media/policy levels. We believe the integration of multidisciplinary studies enhances our ability to unravel and discuss the complexity of youth's digital experience.

Ethics statement

The study was approved by the authors' Institutional Review Board (IRB-23-76, the Social, Behavior, and Educational Committee).

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Chia-chen Yang: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Christina Smith:** Writing – review & editing, Writing – original draft.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT to avoid grammatical errors and improve readability. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication. ChatGPT was solely utilized for the purpose described above, with all ideas generated by the authors themselves.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Chia-chen Yang reports financial support was provided by Oklahoma Center for the Advancement of Science and Technology. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Below are the scales used in the current study.

1. Self-DSMT Level

In general, when you have face-to-face interactions with friends, how often do you do the following at the same time? (1 = *Never*, 2 = *Rarely*, 3 = *Sometimes*, 4 = *Often*, 5 = *A lot*)

(1) Use social media on the phone
(2) Use the phone to read or send messages
(3) Use the phone to find information
(4) Browse pictures on the phone
(5) Watch videos on the phone
(6) Play games on the phone

2. Self-Perceptions of DSMT

Think of the times when you do something on the phone while having face-to-face interactions with friends. In general, how much do you agree with each of the following statements? (1 = *Strongly Disagree*, 5 = *Strongly Agree*).

(1) It allows me to get the information I need
(2) It allows me to get things done quickly
(3) It is enjoyable
(4) It enhances my social experiences
(5) I feel distracted by the phone
(6) I miss what my friends say because of my phone use
(7) I feel less involved in the interaction with my friends because of my phone use
(8) I have to delay my response to my friends because of my phone use
(9) I pay full attention to my friends even when I am using the phone*

Note. Items (1) to (4) assess positive perceptions. Items (5) to (9) assess negative perceptions. * indicates a reverse-coded item.

3. Perceived Peer DSMT Level (a single-item scale to reduce burden on participants)

In general, when you have face-to-face interactions with friends, how often do your friends do something on the phone at the same time? (1 = *Never,* 2 = *Rarely,* 3 = *Sometimes,* 4 = *Often,* 5 = *A lot*)

4. Perceived Peer Perceptions of DSMT: See Table 1

5. Digital Stress

The following statements are about how people feel about their use of communication technologies (social media and the phone). Please indicate how frequently you have felt this way over the past 7 days. (1 = *Never*, 2 = *Rarely*, 3 = *Sometimes*, 4 = *Often*, 5 = *Always*)

(1) I am nervous about how people will respond to my posts and photos
(2) I feel anxious about how others will respond when I share a new photo on social media
(3) For my friends, it is important that I am constantly available online
(4) I feel a social obligation to be constantly available online
(5) I fear my friends are having more rewarding experiences than me
(6) I get worried when I find out my friends are having fun without me
(7) I have to check too many notifications
(8) On top of the other things I must do, keeping up with notification is a chore
(9) I must have my phone with me to know what is going on
(10) I feel lost or "naked" without my phone

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