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Juggling with media

The consequences of media multitasking for adolescent development

van der Schuur, W.A.

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CHAPTER 3

*Technological Interferences
during Offline Conversations
among Adolescents and
its Relationship with their
Emotional Problems*

ABSTRACT

As media and communication technologies are increasingly integrated in people's lives, these technologies frequently interfere with face-to-face interactions. This phenomenon – technological interferences during offline conversations (TIDOC) - has primarily been examined among college students and adults. Therefore, our understanding on how often media and communication devices interfere with conversations among adolescents is limited. Moreover, researchers have argued that TIDOC enhances adolescents' emotional problems. As a first step towards understanding TIDOC among adolescents and its relationship with emotional problems, we conducted a three-wave longitudinal study among 1,440 adolescents (11-15 years, 51% boys). The results showed that TIDOC among adolescents is common. Adolescents particularly engaged in sending text messages, watching television, listening to music, and using social networking sites during offline conversations. Similar to previous cross-sectional studies we found that TIDOC was positively related to emotional problems indicating that adolescents who more often reported TIDOC also reported more emotional problems. However, we found no evidence for the longitudinal relationship between TIDOC and emotional problems.

Media and communication technologies have become increasingly integrated in people's lives. Consequently, people also use these technologies during everyday situations, including face-to-face conversations with friends and family (e.g., Fulkerson et al., 2014; Harrison & Gilmore, 2012). We refer to this type of media use as technological interferences during offline conversations (TIDOC). While the number of studies on TIDOC among college students and adults has been increasing (e.g., Halpern & Katz, 2017; McDaniel & Coyne, 2016a; McDaniel & Coyne, 2016b; Roberts & David, 2016), we know little about how frequently adolescents use technologies during their offline conversations, and which types of technologies they typically use during these conversations. This is surprising because adolescents are known to frequently engage in other types of media multitasking (e.g., Rideout, Foehr, & Roberts, 2010), a behavior that is closely related to TIDOC (Pea et al., 2012).

Although media and communication technologies have the potential to be beneficial to adolescents' emotional functioning (e.g., Reinecke, Vorderer, & Knop, 2014; Valkenburg & Peter, 2011), when technologies interfere with offline conversation this may actually result in emotional problems (e.g., McDaniel & Coyne, 2016a; Roberts & David, 2016; Wang, Xie, Wang, Wang, & Lei, 2017). Emotional problems refer to difficulties in an individual's intrapersonal state, that is their subjective mental health, including symptoms of depression or anxiety (e.g., Durkin & Conti-Ramsden, 2007; Golombok, MacCallum, & Goodman, 2001; Goodman, 1997). Cross-sectional studies have demonstrated positive relationships between TIDOC and emotional problems among college students and adults (e.g., McDaniel & Coyne, 2016a; Roberts & David, 2016; Wang et al., 2017), but this has not yet been studied among adolescents. However, examining the relationships between TIDOC and emotional problems may be particularly important during adolescence. This developmental stage is marked by an increase in emotional problems (Steinberg, 2005, 2008), most notably depressive symptoms (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). Moreover, adolescents who experience emotional problems are more at risk for similar problems during adulthood (Hayden & Mash, 2014; Pine, Cohen, Gurley, Brook, & Ma, 1998). Therefore, it is crucial to examine whether TIDOC could potentially enhance adolescents' emotional problems.

Following the need to research TIDOC in general, and its relationship with emotional problems among adolescents in particular, this study has two aims. The first aim is to provide insight into both the frequency and the specific types of TIDOC that occur in adolescence, and to examine sex as a correlate of TIDOC. It is well established that adolescents' media multitasking differs for boys and girls (Foehr, 2006; Rideout et al., 2010), and therefore it is likely that these sex differences also predict the frequency of TIDOC among adolescents. A second aim of this study is to investigate the cross-sectional and longitudinal relationships between TIDOC and emotional problems among adolescents. It is yet unknown whether TIDOC is cross-sectionally and/or longitudinally related to adolescents' emotional

problems. Furthermore, because important predictors of media use may also moderate the influence of this use (Valkenburg & Peter, 2013), we will also examine sex as a moderator of the cross-sectional and longitudinal relationships between TIDOC and emotional problems.

Technological Interferences during Offline Conversations

TIDOC has mainly been conceptualized as interferences of technological devices during offline conversations. Recently, an increasing number of studies have examined how the use of smartphones can disrupt offline conversations (e.g., Chotpitayasunondh & Douglas, 2016; Roberts & David, 2017; vanden Abeele, Antheunis, & Schouten, 2016; Wang et al., 2017). These studies typically employ the term phubbing, which combines the words “phone” and “snubbing”. For example, a study on phubbing among romantic partners showed that approximately 46% of the adult respondents experienced phubbing in social settings with their romantic partner (Roberts & David, 2016). Other researchers have employed a broader approach, and examined the usage of a variety of technological devices during offline interactions. For example, McDaniel and Coyne (2016a, 2016b) investigated how the use of multiple devices interferes with offline conversations among adults. Their findings among adult females indicated that approximately 70% reported that a wide array of technological devices, such as smartphones, computers, and television, interfered with offline interactions with their romantic partner (McDaniel & Coyne, 2016a).

Although these studies on technological devices have been an important first step in understanding TIDOC, it remains unclear how these devices are used during offline interactions. After all, one device can be used for a variety of media activities. For example, smartphones can be used for sending text messages and using social networking sites, but also for looking up information on the internet and watching videos. Therefore, to understand what adolescents actually do when using these devices during offline conversations, it is crucial to examine which specific media activities they engage in. Only a few studies have examined more specific media activities during offline conversations among college students and adolescents, such as playing video games, sending text messages, and using social media (e.g., Fulkerson et al., 2014; Pea et al., 2012; Xu, Wang, & David, 2016). For example, Fulkerson et al. (2014) examined various types of media activities among adolescents during family mealtime as reported by parents. According to two thirds of the parents, their adolescent sometimes watched television or movies during family mealtime, while a quarter of the parents indicated that their children frequently watched television or a movie. Additionally, 28% of the parents reported that their adolescent at least sometimes engaged in text messaging.

Investigating specific media activities instead of just looking at devices that are used, allows us to draw a detailed picture of the media activities that adolescents engage in during offline conversations. Moreover, this approach allows us to categorize these behaviors in a

more meaningful way. Specifically, based on media use categorizations in previous research (Elhai, Levine, Dvorak, & Hall, 2017; Song, Larose, Eastin, & Lin, 2004; van Deursen, Bolle, Hegner, Kommers, 2015; Xu et al., 2016), we distinguish between two main types of TIDOC, social and non-social TIDOC. Social TIDOC involves media activities that are predominantly used for social reasons, for example, sending text messages, using social networking sites, and calling. Non-social TIDOC includes media activities that are mainly used for entertainment or relaxation purposes, such as watching television, listening to music, and playing video games. This distinction will provide a more theory-driven understanding of TIDOC. As specific media activities rapidly change over time, due to ongoing technological developments, categorizing such behaviors may help to understand TIDOC on a theoretical rather than technological-driven basis.

In all, we still know little about the prevalence of TIDOC in general and about which types of media activities adolescents engage in during offline conversations. For this reason, the current study aims to measure TIDOC broadly by examining a wide array of media activities and by distinguishing between social and non-social technology-related behaviors. We propose the following two research questions:

RQ1a: Which types of media activities do adolescents engage in during offline conversations?

RQ1b: How frequently do adolescents engage in these media activities during offline conversations?

RQ2: Do adolescents more frequently engage in social or non-social media activities during offline conversations?

Differences among boys and girls. Studies among adolescents have repeatedly shown that girls more frequently engage in various media multitasking behaviors than boys (e.g., Foehr, 2006; Rideout et al., 2010; Baumgartner, Weeda, van der Heijden, & Huizinga, 2014). Foehr (2006) found that girls more frequently use multiple media simultaneously than boys. Furthermore, girls more often use media during non-media activities, such as during homework or face-to-face interactions (Baumgartner et al., 2014). Although our specific knowledge of adolescent sex differences in TIDOC is limited, a few studies suggest that girls more frequently engage in TIDOC. A study among college students showed that the amount of phubbing is higher among women compared to men (Chotpitayasunondh & Douglas, 2016). Similarly, a study among adolescents found that girls more frequently used technologies during family mealtimes than boys (Fulkerson et al., 2014). Thus, based on our current knowledge, our first hypothesis is that girls are more likely to engage in TIDOC than boys (H1). Moreover, as researchers have argued that girls are more likely to use technologies for social purposes than boys (van Deursen et al., 2015, Yang & Zhu, 2015),

we expect that this difference is particularly present for social TIDOC (H2).

The Relationship between Technological Interferences and Emotional Problems

It has been assumed that frequently using technologies during offline conversations may be positively related to emotional problems. Several, cross-sectional studies support these claims among college students and adults (e.g., David & Roberts, 2017; McDaniel & Coyne, 2016a; Roberts & David, 2017; Wang et al., 2017). For example, McDaniel and Coyne (2016a) found that adults who more frequently used technological devices, such as smartphones, computers, or tablets, during offline interactions with their romantic partner reported more symptoms of depression and lower life satisfaction. Similarly, Wang et al. (2017) showed that phubbing among romantic partners was related to more depressive symptoms.

It has been argued that TIDOC may enhance emotional problems, through two main mechanisms. First, it may hinder adolescents' relationships with their friends due to the repeated disruption of offline conversations. Second, it may lead to higher levels of stress that in turn increase emotional problems. With respect to the first mechanism, TIDOC may lead to a lower quality of offline relationships because if offline conversations are repeatedly disturbed, adolescents may not be able to build and maintain healthy relationships with others. When using technologies during offline conversations, it is not possible to pay attention to and process both, the information provided by the conversation partner and the information contained in the media (e.g., Bowman, Levine, Waite, & Gendron, 2010; Ophir, Nass, & Wagner, 2009). This assumption is based on cognitive learning theories which state that an individual's cognitive resources are limited (Lang, 2000, 2006).

Thus, adolescents who use technologies during conversations may pay less attention to and insufficiently process information provided by the conversation partner, which is likely to hinder the quality of the conversations (Leggett & Rossouw, 2014). In line with this assumption, two studies among young adults found that the mere presence of technological devices during a face-to-face conversation was related to less perceived empathic concern, and less interpersonal connection with the conversation partner (Misra, Cheng, Genevie, & Yuan, 2016; Przybylski & Weinstein, 2013). Additionally, two other studies found that the actual use of a smartphone during a conversation was negatively related to conversation quality among college students (Brown, Manago, & Trimble, 2016; vanden Abeele et al., 2016). For example, vanden Abeele and colleagues found that participants were less positive about the conversation and reported lower conversation quality when they had been instructed to use their mobile phone and send text messages during a conversation with a confederate peer.

This lower quality of conversations may in the long run adversely affect adolescents' relationships. It is thus not surprising that several previous studies have found that TIDOC

was associated with a lower quality of offline relationships (e.g., Halpern & Katz, 2017; Roberts & David, 2017; Wang et al., 2017; Xu et al., 2016). For example, Xu et al. (2016) found that among college students using media while having face-to-face interactions was negatively related to social success (i.e., the perception of having friends). In addition, studies that have investigated the role of TIDOC in romantic relationships found that TIDOC was adversely related to relationship satisfaction (Halpern & Katz, 2017; Roberts & David, 2017; Wang et al., 2017). High quality relationships, however, are crucial for adolescents' emotional well-being (Hartup, 1996; Hartup & Stevens, 1997), and may help to prevent emotional problems among adolescents. For example, adolescents with stronger social relationships reported higher levels of happiness (Hartup & Stevens, 1997). In addition, friendships can provide emotional support and therefore provide a buffer against stressors (e.g., Bukowski, 2001; Hartup, 1996; Hefner & Eisenberg, 2009). In sum, TIDOC might result in emotional problems as it negatively effects relationships with others.

With respect to the second mechanism, the cognitive demands resulting from TIDOC, may evoke stress (Reinecke et al., 2017). The transactional theory of stress (Lazarus & Folkman, 1987) posits that when activities are cognitively demanding, these activities are more likely to trigger stress responses (e.g., Lepp, Barkley, & Karpinski, 2014; Thomée, Härenstam, & Hagberg, 2011). In line with the assumption that TIDOC may be experienced as stressful, several studies already demonstrated that other types of media multitasking are positively associated with stress, assessed by both physiological and subjective measures (Mark, Gudith, & Klocke, 2008; Mark, Wang, & Niiya, 2014).

Stress has been positively related to several aspects of emotional problems, such as symptoms of depression, emotional distress, and a negative self-image (e.g., Dumont & Provost, 1999; Moksnes, Moljord, Espnes, & Byrne, 2010; Wiklund, Malmgren-Olsson, Ohman, Bergstrom, & Fjellman-Wiklund, 2012). In addition, stress predicted a rise in depressive symptoms over time (Carter, Garber, Ciesla, & Cole, 2006; Hankin, Mermelstein, & Roesch, 2007). Taken together, as TIDOC - similar to other forms of media multitasking - may be experienced as stressful, it is expected that TIDOC is positively related to adolescents' emotional problems and will positively predict their emotional problems over time.

Based on the above explanations, we expect that adolescents who report more TIDOC show more emotional problems (H3). Moreover, we predict that TIDOC is related to more emotional problems over time (H4). In addition, Roberts and David (2017) suggested that non-social TIDOC (e.g., television viewing) may be less disruptive than social TIDOC (e.g., interacting with friends). Thus, although our knowledge is limited, the relationship between TIDOC and emotional problems may differ for social and non-social TIDOC. Therefore, next to overall TIDOC, we will also examine the relationships of social and non-social TIDOC with emotional problems, resulting in the following research question (RQ3): Does

the relationship between TIDOC and emotional problems depend on the specific type of TIDOC (i.e., social and non-social TIDOC)?

Differences among boys and girls. Several researchers have argued that there may be differences between boys and girls in the relationship between TIDOC and emotional problems as well (Chotpitayasunondh & Douglas, 2016; McDaniel & Coyne, 2016a; Pea et al., 2012). Studies suggest that girls may be more susceptible for the impact of TIDOC on emotional problems. In general, girls more often experience emotional problems, such as depressive symptoms, than boys (Hankin & Abramson, 2001). Furthermore, researchers have argued that girls value their peer relationships more than boys (Thomas & Daubman, 2001). Therefore, girls may also be more emotionally affected when their peer relationships are disrupted by TIDOC. Based on these research findings, we expect that the concurrent and longitudinal relationships between TIDOC and emotional problems are stronger in girls than in boys (H5).

METHOD

Sample

This study was part of a three-wave longitudinal study with three-to-four month intervals (Wave 1: early November 2014, Wave 2: early March 2015, and Wave 3: end of June 2015). Adolescents were recruited at seven secondary schools in the Netherlands. Participants were excluded if they reported incorrect identification numbers or had missing values on all main variables ($N_{\text{Wave1}} = 27$; $N_{\text{Wave2}} = 38$; $N_{\text{Wave3}} = 71$). The total sample consisted of 1,441 adolescents who filled out the survey in at least one wave ($M_{\text{age}} = 12.61$, $SD_{\text{age}} = 0.75$; 51% boys). Because it was not possible to schedule the data collection for all classes in each wave, some classes did not participate in all three waves. Specifically, of the total sample, 904 participants (63%) filled out the survey in each of the three waves, 311 participants (22%) in two waves, and 226 participants (15%) in one wave. For the descriptive and cross-sectional findings, the participants of each wave were included ($N_{\text{Wave1}} = 1,241$; $N_{\text{Wave2}} = 1,216$; $N_{\text{Wave3}} = 1,103$), whereas for the longitudinal findings we used the data of the total sample ($N = 1,441$).

Procedure

We received approval from the ethical committee of the authors' institute. Thereafter, Dutch schools were contacted. Seven schools were willing to participate. Together with these schools, we selected the classes and retrieved passive informed consent of the participants' parents. Before the participants filled out the survey, informed assent was obtained. Specifically, we explained the content of the survey to the participants and assured that their participation was completely confidential and voluntary. The survey was filled out online during class, which took approximately 30 minutes. To thank the

participants for their participation, we handed out small incentives to the participants after filling out the survey in each wave.

Measurements

Technological interferences during offline conversations. To measure TIDOC, participants had to indicate how frequently they typically engage in the following eight types of media activities during a face-to-face conversation: (1) watching television, (2) listening to music, (3) talking on the phone, (4) sending messages via phone or computer, (5) using social network sites, (6) watching movies on the computer, (7) playing video games, and (8) other computer activities. Participants indicated their TIDOC behaviors on a five-point scale, with 0 = *never*, 1 = *almost never*, 2 = *sometimes*, 3 = *often*, and 4 = *very often*².

For overall TIDOC, we computed the average of the eight items into one mean for each wave (Wave 1: $M = 1.14$, $SD = 0.79$, Cronbach's $\alpha = .84$; Wave 2: $M = 1.14$, $SD = 0.82$, Cronbach's $\alpha = .86$; Wave 3: $M = 1.16$, $SD = 0.84$, Cronbach's $\alpha = .87$). For social TIDOC, we calculated an average of the three items that included the use of technologies for social reasons, that is talking on the phone, sending messages via phone or computer, and using social network sites (Wave 1: $M = 1.20$, $SD = 0.97$, Cronbach's $\alpha = .73$; Wave 2: $M = 1.21$, $SD = 0.98$, Cronbach's $\alpha = .76$; Wave 3: $M = 1.21$, $SD = 0.97$, Cronbach's $\alpha = .75$). For non-social TIDOC, we computed the average of the remaining five items that all reflected the use of technologies for non-social reasons (Wave 1: $M = 1.10$, $SD = 0.81$, Cronbach's $\alpha = .76$; Wave 2: $M = 1.11$, $SD = 0.85$, Cronbach's $\alpha = .79$; Wave 3: $M = 1.13$, $SD = 0.98$, Cronbach's $\alpha = .81$). Higher scores indicated more frequent TIDOC.

Emotional problems. To measure emotional problems, we used the emotional problems scale of the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997). This measure has been successfully used in previous studies that have examined emotional problems and is highly correlated with other scale focused on measuring symptoms of depression and anxiety (Stone, Otten, Engels, Vermulst, & Janssens, 2010). The emotional problems scale consisted of five items and are rated on a three-point scale, 0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*. Example items are 'I worry a lot' and 'I am often unhappy, depressed or tearful'. We averaged the five items into one mean index (Wave 1: $M = 0.55$, $SD = 0.45$, Cronbach's $\alpha = .70$; Wave 2: $M = 0.54$, $SD = 0.46$, Cronbach's $\alpha = .73$; Wave 3: $M = 0.58$, $SD = 0.48$, Cronbach's $\alpha = .77$). Higher scores on emotional problems scale implied more emotional problems.

² Reading was originally also included in this measure, but because the focus in of this paper is on media activities performed on technological devices and reading was rarely reported among adolescents, we excluded this item from this study.

Analyses

In SPSS, we examined the frequency and the specific types of media activities in Wave 1 (RQ1), we used Paired sampled *t*-tests to examine differences between social and non-social TIDOC (RQ2), and we used One-Way ANOVA's to investigate the possible differences between boys and girls in TIDOC (H1 & H2). Sex was coded as 0 = *boy* and 1 = *girl*. In addition, we used Pearson's *r* to examine the cross-sectional relationships between TIDOC and emotional problems (H3) and PROCESS to investigate if this relationship differs among boys and girls (H5). To examine the longitudinal relationships between TIDOC and emotional problems (H4) and the moderating role of sex (H5), we applied structural equation modeling. Specifically, we employed the random intercept cross-lagged panel model (RI-CLPM; Hamaker, Kuiper, & Grasman, 2015).

The RI-CLPM model is a recent adaptation of commonly used cross-lagged models in that it splits between-person variance from within-person variance (see Keijsers, 2016; Samek et al., 2017; te Poel, Baumgartner, Hartmann, & Tanis, 2016, for applications of this model). Thereby, the RI-CLPM provides insights in the stable between-person relationship and within-person relationships over time. Additionally, it controls for all stable confounders at the within-person level. However, to explore these within-person relationships, within-person variance is needed. Based on the intra-class correlations (ICC), we concluded that all variables showed sufficient within-person variance (overall TIDOC = 44%; social TIDOC = 43%; non-social TIDOC = 50% emotional problems = 42%), meaning that substantial parts of the variances were due to within-person changes over time.

For each of the three types of TIDOC (i.e., overall, social, and non-social TIDOC) we ran a RI-CLPM, resulting in three models. The RI-CLPMs were examined using the statistical program Mplus 7 (Muthén & Muthén, 2012). We carefully followed the procedures discussed by Hamaker and colleagues (2015); see Figure 1 for an illustration of the model. At the between-person level, the observed scores of TIDOC and emotional problems at all waves were the indicators of the two random intercept factors. These random intercept factors reflected the between-person variance of TIDOC and emotional problems. The factor loadings were constrained at 1. In addition, a covariance was added between the two random intercept factors, to control for the between-person correlation. This between-person correlation reflects the association between the stable rank order position of an individual in TIDOC and the stable rank order position of an individual's emotional problems across the school year.

At the within-person level, each observed variable was regressed on its own latent factor resulting in six within-person latent factors (TIDOC Wave 1 to Wave 3 and emotional problems Wave 1 to Wave 3), with each loading constrained to 1. These latent factors reflect the within-person variances. Between these six within-person latent factors, stability paths, cross-lagged paths, a covariance at Wave 1, and covariances between the

disturbances at Wave 2 and Wave 3 were added, see Figure 1. We also included the cross-lagged paths from emotional problems to subsequent TIDOC, to control for this direction of the relationship. Both the stability and the cross-lagged paths were constrained to be equal from Wave 1 to Wave 2 and from Wave 2 to Wave 3. We employed Full Information Maximum Likelihood (Muthén & Muthén, 2012) to deal with missing data across the three waves. We used multiple fit indices to examine the model fit of our models (e.g., Kline, 2004). The chi-square measure was used to examine exact fit of the model, with p -values below .05 indicating exact fit. RMSEA values below .05 and CFI values above .95 indicated good fit.

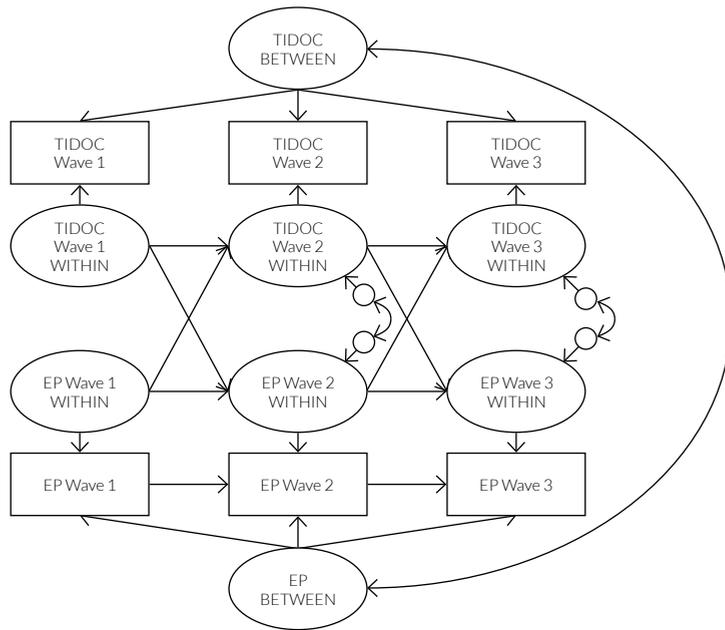


Figure 1. A depiction of a random intercept cross-lagged panel model including the relationships between technological interferences during offline conversations (TIDOC) and emotional problems (EP) across the three waves. The observed variables are represented in the squares. Of these observed variables, latent variables at both the between- and within level were constructed. These latent variables are displayed as ovals. The two random intercepts (TIDOC BETWEEN and EP BETWEEN) reflect the between-person variances. The six latent within-person variables (TIDOC WITHIN Wave1 –Wave 3 and EP WITHIN Wave 1-Wave 3) reflect the within-person variances. The within-person paths are illustrated by the modeling structure between the six latent within-person variables: two autoregressive paths from the latent factors of TIDOC WITHIN to TIDOC WITHIN and two autoregressive paths from the latent factors of EP WITHIN to EP WITHIN; two cross-lagged paths from the latent factors of TIDOC WITHIN to EP WITHIN and two cross-lagged paths from the latent factors of EP WITHIN to TIDOC WITHIN; correlation between TIDOC WITHIN and EP WITHIN at Wave 1, and between the residual correlations of TIDOC WITHIN and EP WITHIN at Waves 2 and 3.

RESULTS

TIDOC among Adolescents

To answer RQ1 we examined the TIDOC scale at item level. In Table 1, the means, standard deviations, and percentages for the items of the TIDOC scale at Wave 1 are presented. Adolescents most frequently engaged in texting (i.e., reading and sending text messages) during offline conversations, followed by watching television, listening to music, using social networking sites, and playing video games. Specifically, more than half of the adolescents reported that they at least sometimes engaged in reading or sending text messages during offline conversations. In addition, between approximately 35% and 50% of the adolescents reported that they at least sometimes watched television during offline conversations, listened to music, used social networking sites, and played video games. Although the other three media activities, watching online videos, doing other things on the computer, and calling during offline conversations, were less common, still 14 to 25% of the adolescents reported that they at least sometimes engaged in them.

Table 1. The Means, Standard Deviations and Percentages for the Eight Items of the TIDOC Scale.

During conversations,	<i>M</i>	<i>SD</i>	Percentages				
			0	1	2	3	4
... I read or send messages	1.75	1.30	22	22	28	17	12
... I watch television	1.49	1.14	23	28	29	15	5
... I listen to music	1.31	1.23	35	20	22	12	8
... I use social networking sites	1.30	1.30	39	20	22	11	8
... I play video games	1.16	1.23	42	21	21	11	5
... I watch movies on the internet	0.84	1.10	53	23	15	6	4
... I do other things on the computer/internet	0.72	1.00	57	23	14	4	2
... I call someone	0.56	1.00	68	17	8	3	3

Note: TIDOC = technological interferences during offline conversations; 0 = *Never*; 1 = *Almost never*; 2 = *Sometimes*; 3 = *Often*; 4 = *Always*.

To examine our second research question (RQ2), we tested whether there were differences in the prevalence of social and non-social TIDOC among adolescents. The means showed that social TIDOC (Wave 1: $M = 1.20$, $SD = 0.97$; Wave 2: $M = 1.21$, $SD = 0.98$; Wave 3: $M = 1.21$, $SD = 0.97$) was more prevalent among adolescents than non-social TIDOC (Wave 1: $M = 1.10$, $SD = 0.81$; Wave 2: $M = 1.11$, $SD = 0.84$; Wave 3: $M = 1.13$, $SD = 0.85$). Paired sampled *t*-tests showed that these differences were significant in all three waves (Wave 1: $t(1237) = 4.62$, $p < .001$; Wave 2: $t(1213) = 4.89$, $p < .001$; Wave 3: $t(1099) = 3.92$, $p < .001$).

Table 2. The Differences in Overall, Social, and Non-Social TIDOC in all Three Waves in Boys and Girls.

	Boys		Girls		F	p
	M	SD	M	SD		
Overall TIDOC W1	1.11	0.80	1.18	0.79	2.53	.112
Overall TIDOC W2	1.11	0.84	1.18	0.80	1.81	.178
Overall TIDOC W3	1.10	0.81	1.21	0.87	4.59	.032
Social TIDOC W1	1.02	0.94	1.39	0.98	44.38	<.001
Social TIDOC W2	1.07	0.98	1.36	0.96	27.18	<.001
Social TIDOC W3	1.04	0.91	1.38	1.01	35.28	<.001
Non-Social TIDOC W1	1.15	0.84	1.05	0.78	4.99	.026
Non-Social TIDOC W2	1.14	0.86	1.07	0.81	2.27	.132
Non-Social TIDOC W3	1.14	0.84	1.11	0.85	0.40	.525

Note: TIDOC = Technological interferences during offline conversations; W1 = Wave 1; W2 = Wave 2; W3 = Wave 3.

Demographic correlates. As for our first hypothesis (H1) and second hypothesis (H2), we examined if girls were more likely to engage in TIDOC than boys. In Table 2, the means for both sexes and the test statistics are provided. With respect to overall TIDOC, although the means in general indicated that girls more often engaged in TIDOC, the differences between boys and girls in Wave 1 and Wave 2 were not significant. However, in Wave 3 we found that girls reported more overall TIDOC compared to boys. For social TIDOC the differences between girls and boys were more consistent. Within all three waves, girls were more likely to engage in social TIDOC than boys. This is in line with H2. For non-social TIDOC, the means indicated that boys were more likely to engage in non-social TIDOC than girls. However, this difference was only significant in Wave 1.

TIDOC and Emotional Problems

Cross-sectional relationships. Overall, the different types of TIDOC were positively correlated with emotional problems in all waves, see Table 3. This means that adolescents who reported more TIDOC also reported more emotional problems. This is in line with H3.

Table 3. Zero-order Pearson Correlations, Means, and Standard Deviations for the Three Types of TIDOC (Overall, Social, and Non-Social) and Emotional Problems.

	1			2			3			4		
	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3
1 Overall TIDOC	-	-	-									
2 Social TIDOC	.87**	.89**	.91**	-	-	-						
3 Non-Social TIDOC	.94**	.95**	.96**	.64**	.70**	.74**	-	-	-			
4 Emotional problems	.06 [†]	.14**	.22**	.03	.11**	.21**	.06*	.15**	.21**	-	-	-
5 Sex (0 = boy)	.05	.04	.06*	.19**	.15**	.18**	-.06*	-.04	-.02	.18**	.21**	.16**
M	1.14	1.14	1.16	1.20	1.21	1.21	1.10	1.11	1.13	0.55	0.54	0.58
SD	0.79	0.82	0.84	0.97	0.98	0.97	0.81	0.85	0.98	0.45	0.46	0.48

Note: ** $p < .001$; * $p < .05$; [†] $p < .06$. TIDOC = technological interferences during offline conversations; W1 = Wave 1; W2 = Wave 2; W3 = Wave 3.

Longitudinal relationships. We examined three models to test the longitudinal relationships between the three types of TIDOC (i.e., overall, social, and non-social TIDOC) and emotional problems. The three models showed good model fit (overall TIDOC: $\chi^2(5) = 4.60$, $p = .466$, RMSEA = .00 (90% CI [.00, .04]), and CFI = 1.00; social TIDOC: $\chi^2(5) = 10.89$, $p = .054$, RMSEA = .03 (90% CI [.00, .05]), and CFI = 1.00; non-social TIDOC: $\chi^2(5) = 2.89$, $p = .717$, RMSEA = .00 (90% CI [.00, .03]), and CFI = 1.00). For all three models, we found moderate between-person correlations between the random intercept factors of the specific types of TIDOC and emotional problems, see Table 4. These findings imply that adolescents who more often reported TIDOC, reported more emotional problems across the school year.

Table 4 also provides an overview of the main within-person processes of the three models. The within-person processes reflect if changes in adolescents' TIDOC predict changes in their emotional problems, and if changes in adolescents' emotional problems predicts changes in their TIDOC. With respect to the cross-lagged relationships, all three types of TIDOC were not significantly related to subsequent emotional problems from Wave 1 to Wave 2 nor from Wave 2 to Wave 3. These findings do not support H4.

Demographic moderators. To examine H5, we also examined the possible moderating role of sex cross-sectionally and longitudinally. The Moderation Analysis via PROCESS (Model 1) showed that the cross-sectional relationships between the three different types of TIDOC and emotional problems did not differ among boys and girls (see Appendix B). Similarly, we examined the moderating role of sex using multiple group analyses in the RI-CLPM, and, again, we found no support for differences among boys and girls (see Appendix C).

Table 4. The Standardized Between-Person and Within-Person Correlations between the Three Types of TIDOC (Overall, Social, and Non-Social TIDOC) and Emotional Problems.

	Model 1		Model 2		Model 3	
	Overall TIDOC		Social TIDOC		Non-Social TIDOC	
<i>Between-person correlation</i>						
TIDOC & Emotional Problems	.20**		.21**		.18*	
<i>Within person correlations</i>						
	W1-W2	W2-W3	W1-W2	W2-W3	W1-W2	W2-W3
<i>Stability paths</i>						
TIDOC	.20**	.21*	.13*	.13*	.18**	.19*
Emotional Problems	.16*	.15*	.16*	.15*	.15*	.14
<i>Cross-lagged paths</i>						
TIDOC → Emotional Problems	.05	.05	.01	.01	.07	.07
Emotional Problems → TIDOC	-.01	-.01	-.05	-.05	.01	.01

Note: ** $p < .001$; * $p < .05$. TIDOC = technological interferences during offline conversations; W1 = Wave 1; W2 = Wave 2; W3 = Wave 3.

DISCUSSION

Studies that examined technological interferences during offline conversations (TIDOC) and their relationship with emotional problems among adolescents were lacking. This is surprising because adolescents frequently engage in the simultaneous use of multiple media (Rideout et al., 2010), which is known to be closely related to TIDOC (Pea et al., 2012). Furthermore, examining the relationship between TIDOC and emotional problems may be particularly important during adolescence as emotional problems increase during this developmental stage (e.g., Costello et al., 20003). Therefore, the first aim of this study was to examine the frequency and types of TIDOC among adolescents and the possible differences among boys and girls. To do this, we examined specific media activities, and categorized these behaviors into social and non-social forms of TIDOC. In addition, we examined if TIDOC (overall, social, non-social) differed among boys and girls. Finally, we investigated the cross-sectional and longitudinal relationships between TIDOC (overall, social, non-social) and emotional problems, and the moderating role of sex.

Technological Interferences during Offline Conversations Among Adolescents

To further our insight in TIDOC during adolescence, we investigated eight specific TIDOC behaviors. Of these eight behaviors, five media activities were particularly prominent during offline conversations, namely text messaging, watching television, listening to music, using social networking sites, and playing video games. The finding that adolescents mainly engage in these five media activities during offline conversations is largely in line with a study on media multitasking among adolescents (Baumgartner, Lemmens, Weeda,

Huizinga, 2016). Specifically, Baumgartner and colleagues suggested that adolescent media multitasking behaviors predominantly evolve around text messaging, watching television, listening to music, and using social networking sites. The current findings indicate that these media activities are also frequently used during offline conversations.

With respect to the five main types of media activities, the findings of our study indicate that adolescents commonly engaged in these behaviors during their offline conversations. Overall, the percentages of TIDOC in our study were somewhat higher than in the study of Fulkerson et al. (2016). This could be due to the different social settings of the studies. While this study focused on offline conversations in general, Fulkerson and colleagues focused specifically on media use during family mealtimes. This stresses the need to advance our understanding of TIDOC among adolescents in different social settings. In addition, we also distinguished between two types of TIDOC, namely social and non-social TIDOC. Adolescents more frequently engaged in social than non-social TIDOC. The higher prevalence of social TIDOC is supported by research that showed that media multitasking behavior among adolescents typically involves social media activities, for example, using social networking sites and sending text messages (Baumgartner et al., 2016; Pea et al., 2012). This finding supports the claims that particularly social media interrupt everyday activities (Roberts & David, 2016).

In line with our expectation (H2), we found that social TIDOC was particularly prevalent among girls. It has been previously argued that girls are particularly drawn to the social aspects of media activities (Sánchez-Martinez & Otero, 2009; van Deursen et al., 2015), and therefore they may be less likely to resist the urge to engage in these behaviors during offline conversations. For example, a previous study (Beyens, Frison, & Eggermont, 2016) indicated that adolescent girls generally report a higher fear of missing out than adolescent boys, which in turn was related to using Facebook more frequently. In contrast, boys seemed to engage more often in non-social TIDOC than girls. Although the difference between boys and girls in non-social TIDOC was only significant in Wave 1, it may be important to further examine this difference in the future. Studies have indicated that boys in general engage more often in non-social media activities, such as watching television and playing video games (e.g., Babey, Hastert, & Wolstein, 2013; Borgogna et al., 2015). Overall, the current findings support the notion that girls and boys differ in the specific types of media activities they engage in during offline conversations.

The Relationship between Technological Interferences and Emotional Problems

In line with previous studies (e.g., McDaniel & Coyne, 2016a; Wang et al., 2017), we found that TIDOC was positively related to emotional problems. As expected, adolescents who reported more frequent TIDOC, reported more emotional problems. These relationships were observed for overall, social, and non-social TIDOC. However, concerning the longitudinal relationship of TIDOC and emotional problems, we found no empirical

evidence for TIDOC further increasing emotional problems among adolescents. This suggests that TIDOC may not have a long-term effect on adolescents' emotional problems. In addition, we found no sex differences for both the cross-sectional and longitudinal relationships between the three types of TIDOC and emotional problems. Together, our results indicate that adolescents who reported more TIDOC also reported more emotional problems during the school year, but that engaging in TIDOC does not further increase these emotional problems. In contrast to previous expectations (e.g., McDaniel & Coyne, 2016a; Wang et al., 2017), the cross-sectional relationship between TIDOC and emotional problems may thus not mean that TIDOC increases emotional problems in the long run. The present findings might suggest that adolescents with emotional problems are more likely to engage in TIDOC, rather than emotional problems being a consequence of TIDOC.

Another explanation for the lack of support for the longitudinal effect of TIDOC on emotional problems is that adolescents may use media and communication technologies as facilitators of their conversations. Although the main assumption is that communication devices interrupt the offline conversations, they may actually facilitate them. When adolescents use these media and communication devices as facilitators for their offline conversations, this may not interrupt but rather extend or inspire the offline interaction. For example, adolescents may use their smartphone during offline conversations with peers to show pictures or search for information online.

Moreover, researchers have argued that TIDOC may have become socially acceptable behavior among young people, in particular (Sprecher, Hampton, Heinzl, & Felme, 2016; Miller-Ott & Kelly, 2017; Xu et al., 2016). While paying full attention to offline conversations is traditionally seen as normative behavior, these social norms may be changing (Forgays, Hyman, & Schreiber, 2014), in response to the dramatic rise in the availability and role of media and communication devices in society (Sprecher et al., 2016). Specifically, Sprecher et al. (2016) argued that adolescents may find a way to use such devices without interrupting the conversation.

Besides these theoretical explanations for the absence of the longitudinal relationship between TIDOC and emotional problems in this study, there are also methodological explanations for this absence. For example, it could be that there are specific contextual factors that may affect the longitudinal relationship between TIDOC and emotional problems. For example, a recent study showed that smartphone use by the romantic partner was particularly perceived as negative within specific contexts, for example, when one of the partners expected more attention from the other (Kelly, Miller-Ott, & Duran, 2017). Additionally, although we have looked at sex as a moderator, this may still not capture the wide variability within adolescents. Thus, both contextual as well as individual differences may affect the relationship between TIDOC and emotional problems.

Suggestions for Future Research

The present study provided much needed evidence for TIDOC among adolescents. Future studies are advised to focus on the following three main directions. First, as this study is one of the first in its kind, it is valuable that future studies advance our knowledge on TIDOC among adolescents. Although we included a wide variety of media activities, we do not know why and with whom adolescents used these technologies. For example, it could be that adolescents sometimes use these technologies to facilitate their offline conversations, instead of disrupting them. Additionally, the frequency of TIDOC may depend on specific types of conversation partners, for example, family members, friends, or romantic partners. Similar to the existing studies on phubbing that focused on interactions with the romantic partner (e.g., McDaniel & Coyne, 2016a; Wang et al., 2017), it might be important to study TIDOC in a friend setting separately from TIDOC in a family setting, or a partner setting. Thus, future studies are advised to examine adolescents' motivations for TIDOC and the various contexts in which TIDOC occurs.

Second, future researchers are advised to examine if the norms for TIDOC are changing among adolescents. Although researchers generally assume that media and communication technologies interfere with offline conversations, adolescents may not perceive it like this. Therefore, when examining the impact of TIDOC on adolescents' emotional problems it is critical to examine whether adolescents view the use of media and communication technologies as problematic or impolite (Coyne et al., 2012). It could also be that adolescents differ in this perception, and this might explain possible individual differences in the relationship between TIDOC and emotional problems.

Lastly, particularly with respect to the relationship between TIDOC and emotional problems, future studies are advised to examine a wider range of outcome variables and examine underlying mechanisms. For example, we focused on one specific measure of emotional problems. Therefore, other studies could include broader measures of emotional functioning, for example, by focusing on both measures of emotional problems and emotional well-being, such as social anxiety and life satisfaction. With respect to the underlying mechanisms, future studies could focus on processes that may explain the relationship between TIDOC and adolescents' emotional problems, most notably quality of offline relationships and stress.

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