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Practice makes perfect: The longitudinal effect of adolescents' instant messaging on their ability to initiate offline friendships

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ABSTRACT

The first aim of this study was to investigate whether instant messaging (IM) influences adolescents' ability to initiate offline friendships. The second aim was to study the validity of two underlying mechanisms that may account for this relationship: (a) the opportunities offered by IM to communicate with a variety of people, and (b) to disclose intimate information. A three-wave longitudinal study was conducted among 690 Dutch adolescents (10–17 years old). Results show that adolescents' IM use increased their ability to initiate offline friendships over time. Furthermore, IM use indirectly increased adolescents' ability to initiate offline friendships through the diversity of their online communication partners. These findings suggest that adolescents can practice social skills online and learn to relate to a variety of people, which, over time, may increase their ability to initiate offline friendships.

1. Introduction

An important developmental task in adolescence is to learn how to form and maintain close, meaningful relationships. In order to accomplish this task, adolescents need to develop *social competence*. Social competence consists of at least the ability to (a) initiate friendships and other relationships, (b) appropriately present and disclose oneself to others (i.e., self-disclosure), and (c) be assertive when necessary (Valkenburg & Peter, 2008). Traditionally, adolescents develop these skills in face-to-face communication (Valkenburg & Peter, 2011). However, with the rise of online communication adolescents' opportunities to learn and rehearse social skills have increased dramatically. Today's adolescents frequently use the Internet for communication purposes (Jones & Fox, 2009), spending on average almost an hour a day communicating online (SPOT, 2010).

Online communication has three characteristics that may stimulate adolescents' rehearsal of social skills (Valkenburg & Peter, 2011). First, it is characterized by *reduced visual and auditory cues*. According to hyperpersonal communication theory (Walther, 1996), an important consequence of these reduced nonverbal cues is that adolescents feel less concerned about how others perceive them. As a result, they feel less inhibited and have more opportunities to disclose their inner feelings (Joinson, 2001; Tidwell & Walther, 2002), which, in turn, may improve their social skills. Second, the *asynchronicity* of online communication allows changing and reflecting on a message before sending it, which increases the editability of communication (Valkenburg & Peter, 2011). This allows adolescents to optimize their self-disclosure and self-presentation (Walther, 2007) and by doing so rehearse their social skills. Third, online communication is characterized by *accessibility*, because it provides many opportunities to communicate with a broader variety of people. This allows adolescents to practice communication with people whom they would not easily meet in real life.

The aim of our study is to develop and test a hypothesis, which we named the *Internet-induced social skills hypothesis*. This hypothesis argues that online communication can stimulate adolescents' offline social skills because it offers them opportunities to rehearse these skills online (Valkenburg, Sumter, & Peter, 2011). Based on the three characteristics of online communication, this hypothesis seems plausible, but has received little scholarly attention. For the most part, it is still unclear whether and, if so, how online communication influences offline social skills. Therefore, the first aim of this longitudinal study is to investigate the potentially positive influence of adolescents' online communication on their offline social competence. The second aim is to study the validity of two underlying mechanisms that may account for this relationship, namely the opportunities given by online communication (a) to communicate with a variety of people, and (b) to disclose intimate information.

In this study, we focus on one crucial aspect of adolescents' social competence: their ability to initiate offline friendships. If there is one aspect of social competence that can be influenced by the Internet, it is the ability to start conversations and initiate

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relationships. After all, never before has it been so easy to practice with initiation skills as with online communication. We define online communication as adolescents' instant messaging. Instant messaging is a highly popular internet-based form of communication, especially for adolescents' everyday communication (Ramirez & Broneck, 2009). Instant messaging can stand alone as a software application or can be integrated in other technologies, such as social network sites (boyd & Ellison, 2007). In this study, instant messaging is defined as sending and receiving text-based person-to-person messages in a near-synchronous way, on a computer or mobile device. It can occur on any application, including, for example, *Windows Live Messenger*, *Yahoo! Messenger*, and *AOL Instant Messenger*.

1.1. Online communication and adolescents' social competence

To our knowledge, there are two studies that have examined the relationship between online communication and adolescents' offline social competence, showing mixed results. One study investigated whether the frequency of adolescents' general Internet use was related to difficulties in offline social skills (e.g., inappropriate assertiveness; Harman, Hansen, Cochran, & Lindsey, 2005). The study showed that Internet use was unrelated to offline social competence. A second study focused on the effect of adolescents' online self-presentation on their offline social competence, revealing a positive relationship between online self-presentation and social competence (Valkenburg & Peter, 2008). This relationship could be explained by adolescents' tendency to communicate online with a variety of people. In other words, this tendency mediated and thus explained the relationship between online self-presentation and offline social competence (Valkenburg & Peter, 2008).

Whereas the few studies on the relationship between online communication and offline social competence have revealed inconsistent results, the results of earlier studies on the effects of online communication on adolescents' friendships are more consistent. These studies do not directly investigate adolescents' social competence, yet they are relevant to the present study because friendship formation and maintenance are both crucial aspects of adolescents' social competence. Some studies have investigated the influence of online communication on adolescents' *online friendship formation* and on their attraction to potential online friends (Antheunis, Valkenburg, & Peter, 2007, 2010; Peter, Valkenburg, & Schouten, 2005). Adolescents who communicated online more often formed online friendships (Peter et al., 2005). Online communication also stimulated adolescents' social attraction to online communication partners (Antheunis et al., 2007, 2010). In all of these studies, enhanced intimate self-disclosure during online communication proved to be an important explanation of the effects of online communication on interpersonal attraction and friendship formation (Antheunis et al., 2007, 2010; Peter et al., 2005).

Another relevant line of research involves the effect of online communication on the *quality of adolescents' offline friendships*. When the Internet was introduced in the 1990s, it was assumed that it would have a negative effect on the quality of offline interaction, because online communication displaced the time adolescents spent in interactions with their existing friends (*displacement hypothesis*; Kraut et al., 1998; Mesch, 2003; Nie, 2001). However, more recent studies have consistently found that adolescents spend much of their time online communicating with offline friends, which, in turn, increases the quality of these friendships (*stimulation hypothesis*; Bryant, Sanders-Jackson, & Smallwood, 2006; Desjarlais & Willoughby, 2010; Valkenburg & Peter, 2007). Again, enhanced intimate self-disclosure was shown to account for the positive effect of online communication on the quality of adolescents' friendships. Online communication seems to facilitate online self-disclosure to their friends, which, in turn, increases the quality of adolescents' offline friendships (Valkenburg & Peter, 2009, 2011).

1.2. The Internet-induced social skills hypothesis

So far, Internet studies on offline social competence have yielded mixed results. The studies focusing on adolescents' friendships have revealed more consistent positive effects of online communication. However, the literature on both social competence and friendships has three important gaps that prevent us from drawing decisive conclusions concerning the influence of adolescents' online communication on their ability to initiate offline friendships. First, studies on offline social competence have focused either on adolescents' general Internet use or on their tendency to experiment with their self-presentation in online communication. Neither of the studies has assessed the effects of general online communication. Second, most are cross-sectional studies and therefore unable to single out the causality of the relationships between online communication, social competence, and friendships. Online communication may increase offline social competence but adolescents with good social skills may also use online communication more frequently (Kraut et al., 2002; Peter et al., 2005).

A third gap in the literature is that few studies have paid systematic attention to possible underlying mechanisms of the relationship between online communication and offline social competence. Some studies suggest that online communication has a positive effect on adolescents' offline social competence because they can practice social skills with a variety of people on the Internet (Valkenburg & Peter, 2008). However, these studies have dealt only with the relationship between online identity experiments and offline social competence. Other studies consider enhanced online self-disclosure as an underlying mechanism (Antheunis et al., 2007, 2010). However, these studies have focused only on the relationship between online communication and social attraction. Therefore, although both the opportunity to communicate with a diversity of communication partners and online self-disclosure have been suggested as viable explanations for the effects of online communication, they have never been investigated in the context of offline social competence.

1.3. Current study

The current study is the first to address the three aforementioned gaps in literature. To address the first and second gap, we investigate the effect of adolescents' instant messaging on their offline social competence in a longitudinal design. In order to establish causality, this study investigates the longitudinal relationship between adolescents' instant messaging and their ability to initiate offline friendships. Our *Internet-induced social skills hypothesis* states that:

H1: The frequency of adolescents' instant messaging has a positive longitudinal effect on their ability to initiate offline friendships.

To address the third gap in the literature, this study investigates why the relationship between instant messaging and social competence may exist. We focus on two possible mediators of this relationship: (a) the diversity of adolescents' online communication partners, and (b) adolescents' online self-disclosure. We firstly expect that instant messaging enables adolescents to communicate with a more diverse group of people than in face-to-face communication (Suler, 2005). Practicing social skills with a variety of people may consequently facilitate offline friendship initiation. We therefore hypothesize that:

H2a: The effect of adolescents' instant messaging on their ability to initiate offline friendships is explained (i.e., mediated) by their tendency to communicate online with a variety of people.

We also hypothesize that the intimacy of adolescents' online communication may explain the relationship between online communication and offline social competence. By talking about personal subjects adolescents can practice adequate self-disclosure. Because adolescents may feel less inhibited by the reduced cues and controllability of online communication (Walther, 1996), instant messaging may increase their opportunities to practice social skills, including the rehearsal of adequate and appropriate self-disclosure. Over time, online self-disclosure has been shown to lead to offline self-disclosure (Valkenburg et al., 2011). Because self-disclosure is important in initial stages of offline relationship formation (Buhrmester & Prager, 1995), practicing self-disclosure in online communication may, over time, facilitate offline relationship initiation. Therefore, we hypothesize that:

H2b: The effect of adolescents' instant messaging on their ability to initiate offline friendships is explained (i.e., mediated) by the level of their online self-disclosure.

2. Method

2.1. Sample and procedure

This longitudinal study was based on a sample of 690 Dutch adolescents between 10 and 17 years old (50% girls). Data were collected on three occasions with 6-month intervals. Sampling and fieldwork were done by Qrius, a Dutch market research institute that specializes in large-scale studies among youth. Respondents were recruited through an existing online panel managed by Qrius. Qrius had sampled in all parts of The Netherlands through e-mail invitations and respondents' social networks, resulting in a representative panel. The education level of our sample did not deviate from official Dutch statistics (CBS, 2005): 52% of the children were at a lower pre-vocational level, 25% at a senior general secondary education level, and 23% at a pre-university education level.

In the first data wave, which took place in May and June 2006, 1,158 adolescents participated. In the second wave, in November and December 2006, 812 respondents (70% of the first wave) participated again. In the third wave, which took place in May and June 2007, 690 respondents (85% of the previous wave) participated. In the three waves, 468 respondents (40%) were lost, partly because respondents left the online panel and partly because they failed to return the questionnaire or did not return a completed questionnaire.

In order to investigate whether this attrition biased our final sample, we checked whether adolescents who did not complete the second and third survey systematically differed from those who did. Boys did not drop out more often than girls. Furthermore, adolescents who dropped out did not differ from those who did not drop out with respect to their ability to initiate offline friendships and the diversity of their online communication partners. Adolescents who dropped out were slightly older ($M = 13.94$ years, $SD = 2.26$) than those who remained in the study ($M = 13.42$ years, $SD = 2.27$), $F(1,1,156) = 14.53$, $p < .001$. However, in the third wave, respondents were still equally distributed across age groups: 10–11-year-olds: 26%; 12–13-year-olds: 24%; 14–15-year-olds: 26%; 16–17-year-olds: 24%. Because older adolescents used instant messaging (IM) more and had a higher frequency of online self-disclosure than the younger ones, adolescents who dropped out showed higher levels of IM use (measured in hours per day) ($M = 1.71$, $SD = 1.71$) than the ones who did not drop out ($M = 1.32$, $SD = 1.35$), $t(1,156) = 4.32$, $p < .001$. Furthermore, they had a slightly higher level of online self-disclosure ($M = 2.37$, $SD = 0.75$) than adolescents who did not drop out ($M = 2.20$; $SD = 0.80$), $t(1,049) = 3.30$, $p < .001$.

Prior to the implementation of the survey, institutional approval, parental consent and adolescents' informed consent were obtained. Adolescents were notified that the questions would be about the Internet, emotions, and friendships, that the answers would be analyzed anonymously and that they could stop participation at any time. They were asked to complete the questionnaire in privacy. The questionnaire was part of a broader survey on the use and consequences of online communication. On average, it took adolescents 15 min to fill out the questionnaire in each wave.

2.2. Measures

2.2.1. Instant messaging

We measured adolescents' use of instant messaging software (*IM use*) with a measure commonly used to assess frequency of instant messaging (e.g., Valkenburg & Peter, 2007, 2009). IM was measured with four questions. The first question was: "On weekdays (Monday–Friday), on how many days do you usually use IM?" The same question was asked for weekend days: "On weekends (Saturday and Sunday), on how many days do you usually use IM?" These were open-ended questions on which the responses could range from 0 to 5 for weekdays and from 0 to 2 for weekend days. If respondents' answers to these questions were higher than 0, they were asked the question: "On the weekdays (Monday–Friday)/on a Saturday/on a Sunday that you use IM, how long do you then usually use it?" Respondents answered with the number of hours and minutes they used IM (i.e., actually chatting through an IM program; not just having the program running). Inspection of the data indicated two outliers in wave 2, which we recoded into the highest score that did not show up as an outlier (Osborne & A. Overbay., 2004). We calculated adolescents' IM use per week by multiplying the number of days per week that they used IM (range 0–7) by the number of minutes they used it on each day. This score was then converted to the average number of hours of IM use per day ($M = 1.32$, $SD = 1.35$ at wave 1; $M = 1.37$, $SD = 1.59$ at wave 2; $M = 1.48$, $SD = 1.63$ at wave 3).

2.2.2. Ability to initiate offline friendships

We measured adolescents' ability to initiate offline friendships (*initiation*) with a subscale of a social competence scale used by Valkenburg and Peter (2008) and Lemmens, Valkenburg, and Peter (2009). This scale is based on several earlier instruments measuring social skills, interpersonal competence or communicative efficacy among adolescents (Buhrmester, 2002; Buhrmester, Furman, Wittenberg, & Reis, 1988; Connolly, 1989; Inderbitzen & Foster, 1992). The initiation scale consisted of five items: "How easy or difficult was it in the past 6 months to…" (a) "start a conversation with someone you did not know very well?", (b) "introduce yourself for the first time to someone?", (c) "start a new friendship?", (d) "call someone who you wanted to get to know better?", and (e) "ask someone to get together and do something?" The response options for these items were: 1 (*very difficult*), 2 (*difficult*), 3 (*not difficult, not easy*), 4 (*easy*), and 5 (*very easy*). We created a scale based on the average of the five individual items. Cronbach's alpha of the scale was .86 at wave 1 ($M = 3.08$, $SD = 0.80$), .86 at wave 2 ($M = 3.17$, $SD = 0.78$), and .87 at wave 3 ($M = 3.16$, $SD = 0.77$).

2.2.3. Diversity of online communication partners

Adolescents' tendency to communicate online with people of various ages and cultural backgrounds was measured with 12 items (Valkenburg & Peter, 2008). Examples of items are: "When you are online, how often do you talk to people who…" (a) "are older than you?" (b) "have a different skin color?" (c) "live

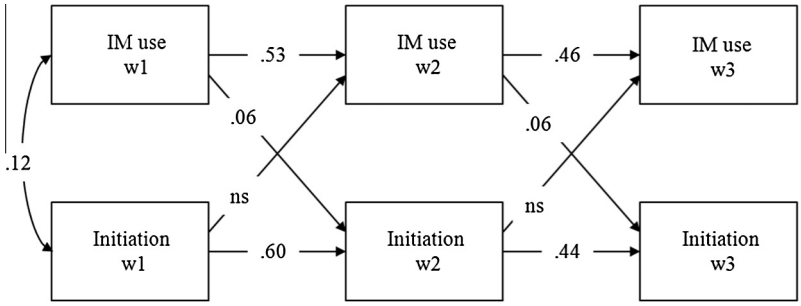

Fig. 1. Direct-effect model of the influence of instant messaging on the ability to initiate offline friendships. To simplify presentation, correlated disturbances of variables within time as well as regression paths of the same variables between wave 1 and wave 3, are not shown. Coefficients represent standardized betas.

abroad?" (d) "have different hobbies?" and (e) "like another style of clothing?" Response options for these questions were: 1 (*never*), 2 (*almost never*), 3 (*sometimes*), 4 (*often*), and 5 (*almost always*). Based on the average of the 12 individual items, we created a scale with a Cronbach's alpha of .88 at wave 1 ($M = 2.86$, $SD = 0.65$), .86 at wave 2 ($M = 2.90$, $SD = 0.61$), and .87 at wave 3 ($M = 2.94$, $SD = 0.60$).

2.2.4. Online self-disclosure

We measured online self-disclosure with a scale developed by Schouten, Valkenburg, and Peter (2007), which has been used in many other studies (Valkenburg & Peter, 2009; Valkenburg et al., 2011). The scales consists of five items: "When you are using IM on the Internet, how much do you usually tell your close friends[1] about…" (1) "your personal feelings?" (2) "the things you are worried about?" (3) "your secrets?" (4) "being in love?" and (5) "moments in your life you are ashamed of?". Items were measured on a 5-point scale with the following response options: 1 (*I tell nothing about this*), 2 (*I tell little about this*), 3 (*I tell neither little nor much about this*), 4 (*I tell much about this*), and 5 (*I tell everything about this*). We created a scale based on the average of the five individual items. Cronbach's alpha of the scale was .88 at wave 1 ($M = 2.21$, $SD = 0.76$), .87 at wave 2 ($M = 2.28$, $SD = 0.71$), and .89 at wave 3 ($M = 2.37$, $SD = 0.79$).

2.2.5. Data analysis

In order to investigate the longitudinal relationship between adolescents' online communication and the ability to initiate offline friendships and possible underlying mechanisms of this relationship, we tested three autoregressive cross-lagged models with three waves. These models control for previous levels of the same variables (for example, see Fig. 1), which increases the validity of the influence of variable X at wave N on variable Y at wave $N + 1$ (Schlüter, Davidov, & Schmidt, 2006).

The first model contains the direct effect of IM use on initiation (i.e., direct-effect model). The second model consists of the effect of IM use on initiation with the diversity of online communication partners as a mediator (i.e., mediated-effect model with diversity of online communication partners as a mediator) and the third model contains the effect of IM use on initiation with online self-disclosure as a mediator (i.e., mediated-effect model with online self-disclosure as a mediator). In all three models, the cross-lagged paths represent the causal-correlational relationships between the variables. We tested the models with the software package Amos. All paths in the models are presented with p-values for a one-tailed significance test. Furthermore, previous research suggests that our results may be influenced by gender and age (Harman et al., 2005; Valkenburg & Peter, 2008; Valkenburg et al., 2011). In order to investigate whether the models differ for gender and age groups, we conducted multigroup analyses.

[1] The word friend ("vriend") has another meaning in Dutch than the same word in English. The meaning of "vriend" resembles the meaning of "close friend" in English. Therefore, we translated "vriend" into "close friend".

3. Results

3.1. Zero-order correlations

Table 1 shows the correlations between all variables in the model. As expected, IM use was positively related to initiation in the subsequent wave, both from wave 1 to wave 2 ($r = .13$, $p = .001$) and from wave 2 to wave 3 ($r = .13$, $p = .001$). Furthermore, IM use at wave 1 was positively related to initiation at wave 3 ($r = .12$, $p = .002$).

3.2. Causal-correlational results

Hypothesis 1, i.e., the Internet-induced social skills hypothesis, stated that IM use has a positive direct effect on the ability to initiate offline friendships. In order to test the longitudinal relationship between IM use and initiation more rigorously, we analyzed the direct-effect model with structural equation modeling (see Fig. 1). We used two indices to evaluate the fit of our models: the root mean square of approximation (RMSEA) and the comparative fit index (CFI). Generally, fit indexes exceeding a value of .90 and a RSMEA value below .10 are considered evidence for adequate model fit (Fan, Thompson, & Wang, 1999). For conventional reasons we also report the χ^2 value. However, in case of large samples the χ^2 test is often unreliable because it underestimates the model fit (Byrne, 2010). Our model had a good fit, χ^2 (2, $N = 690$) = 0.18 $p = .915$, CFI = 1.00, RMSEA = .00 (90% confidence interval [CI]: .00/.03). Fig. 1 shows that, in line with Hypothesis 1, more frequent IM use increased initiation, both from wave 1 to wave 2 ($b^* = .06$, $p = .031$) and from wave 2 to wave 3 ($b^* = .06$, $p = .013$). Hypothesis 1 was thus supported. The independent variables accounted for 38% of the variance of initiation at wave 2 and 48% of the variance of initiation at wave 3. However, although IM use at wave 1 and initiation at wave 3 were positively correlated ($r = .12$, $p = .002$), this effect was not significant in the structural equation model ($b^* = .05$, $p = .060$).

3.3. Testing the mediated-effect models

3.3.1. Diversity of online communication partners as a mediator

Table 1 shows that IM use was positively related to diversity of online communication partners in the following wave, both from wave 1 to wave 2 ($r = .22$, $p < .001$) and from wave 2 to wave 3 ($r = .21$, $p < .001$). Furthermore, diversity of online communication partners was positively related to initiation in the subsequent

Table 1
Zero-order correlations between the variables in the hypothesized models.

	1	2	3	4	5	6	7	8	9	10	11	12
1. IM use (w1)	1											
2. IM use (w2)	.53[c]	1										
3. IM use (w3)	.42[c]	.55[c]	1									
4. Initiation (w1)	.12[b]	.07	.05	1								
5. Initiation (w2)	.13[b]	.09[a]	.06	.61[c]	1							
6. Initiation (w3)	.12[b]	.13[b]	.05	.60[c]	.64[c]	1						
7. Diversity comm. partners (w1)	.18[c]	.18[c]	.21[c]	.13[b]	.12[b]	.20[c]	1					
8. Diversity comm. partners (w2)	.22[c]	.25[c]	.22[c]	.06	.13[b]	.12[b]	.55[c]	1				
9. Diversity comm. partners (w3)	.14[c]	.21[c]	.29[c]	.07	.13[b]	.17[c]	.54[c]	.56[c]	1			
10. Online self-disclosure (w1)	.19[c]	.13[b]	.09[a]	.17[c]	.14[c]	.13[c]	.28[c]	.17[c]	.19[c]	1		
11. Online self-disclosure (w2)	.17[c]	.19[c]	.14[c]	.17[c]	.18[c]	.15[c]	.26[c]	.27[c]	.22[c]	.53[c]	1	
12. Online self-disclosure (w3)	.17[c]	.18[c]	.22[c]	.21[c]	.23[c]	.24[c]	.23[c]	.19[c]	.24[c]	.51[c]	.52[c]	1

Note. IM = instant messaging; comm. = communication; w1 = wave 1; w2 = wave 2; w3 = wave 3.
[a] $p < .05$.
[b] $p < .01$.
[c] $p < .001$.

wave, both from wave 1 to wave 2 ($r = .12$, $p = .003$) and from wave 2 to wave 3 ($r = .12$, $p = .002$).

Hypothesis 2a stated that the effect of IM use on the ability to initiate offline friendships is explained (i.e., mediated) by adolescents' tendency to communicate online with a variety of people. Fig. 2 shows the mediated-effect model with diversity of online communication partners as a mediator. The model had a good fit, χ^2 (10, $N = 690$) = 23.34, $p = .010$, CFI = .99, RMSEA = .04 (90% CI: .02/.07). As Fig. 2 shows, more IM use increased the diversity of adolescents' online communication partners from wave 1 to wave 2 ($b^* = .13$, $p < .001$), which is in line with Hypothesis 2a. The same effect also occurred from wave 2 to wave 3 ($b^* = .06$, $p = .038$). Furthermore, in line with Hypothesis 2a, online communication with people of different ages and background increased initiation from wave 2 to wave 3, ($b^* = .05$, $p = .037$). This effect was not significant from wave 1 to wave 2 ($b^* = .05$, $p = .056$).The independent variables and mediator variables accounted for 38% of the variance of initiation at wave 2 and 48% of the variance of initiation at wave 3.

A longitudinal test of mediation in the logic of Baron and Kenny (1986) entails that: (1) the independent variable *X* should predict the dependent variable *Y*, (2) *X* should predict the mediator, and (3) the mediator should predict *Y* controlling for *X*. Because the effect of IM use at wave 1 on initiation at wave 3 was not significant in a structural equation model, it was not possible to establish that diversity of online communication partners mediated the effect of IM use on initiation. However, in our case the indirect effect of IM use at wave 1 on initiation at wave 3 through diversity of online communication partners at wave 2 is still worth investigating (Preacher & Hayes, 2004). If *X* predicts the mediator and the mediator predicts *Y*, it follows that there is a reduction in the effect of *X* on *Y* (Kenny, 2012). We assessed the significance of this indirect effect on the basis of the bootstrapping method using Amos (MacKinnon, Lockwood, & Williams, 2004). Because the bootstrapping method does not allow the sample to include missing values, the sample size is slightly smaller in this analysis ($N = 577$). Based on 1000 bootstrapping samples, we estimated a 95% bias-corrected confidence interval (CI) for the indirect effect of IM use at wave 1 on initiation at wave 3 through diversity of online communication partners at wave 2. Generally, when the bias-corrected CI does *not* include zero, the effect can be said to significantly differ from zero. Bootstrapping results supported the significance of the indirect effect. Although Hypothesis 2a could not be supported following Baron and Kenny's criteria (1986), the results suggest that IM use has an indirect effect on initiation through diversity of online communication partners.

3.3.2. Online self-disclosure as a mediator

Table 1 shows that IM use was positively related to online self-disclosure in the following wave, both from wave 1 to wave 2 ($r = .17$, $p < .001$) and from wave 2 to wave 3 ($r = .18$, $p < .001$).

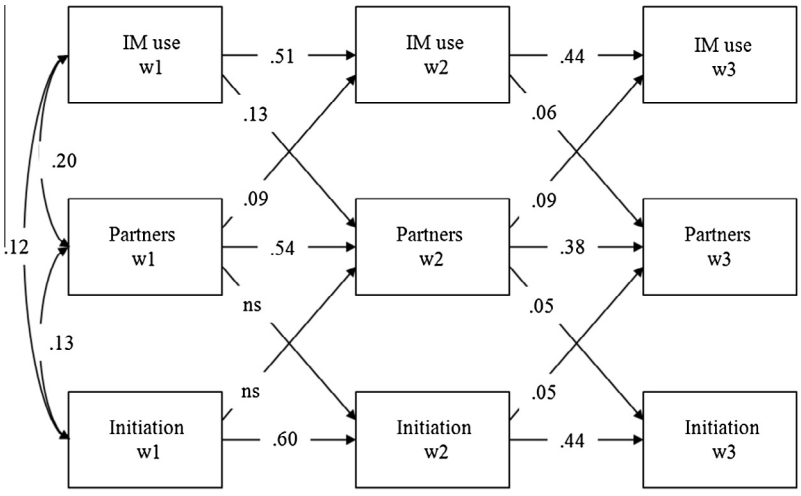

Fig. 2. Mediated-effect model of the diversity of online communication partners as an underlying mechanism of the effect of instant messaging on the ability to initiate offline friendships. To simplify presentation, correlated disturbances of variables within time as well as regression paths of the same variables between wave 1 and wave 3, are not shown. Coefficients represent standardized betas. Partners = diversity of online communication partners.

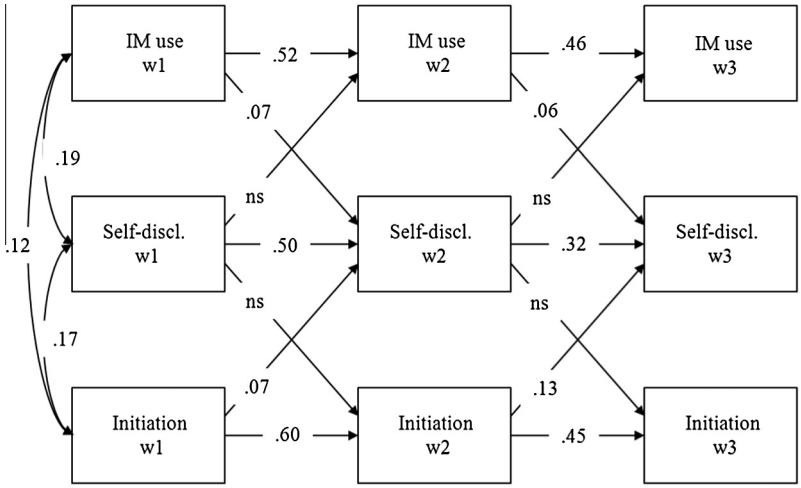

Fig. 3. Mediated-effect model of online self-disclosure as an underlying mechanism of the effect of instant messaging on the ability to initiate offline friendships. To simplify presentation, correlated disturbances of variables within time as well as regression paths of the same variables between wave 1 and wave 3, are not shown. Coefficients represent standardized betas. Self-discl. = online self-disclosure.

Furthermore, online self-disclosure was positively related to initiation in the subsequent wave, both from wave 1 to wave 2 ($r = .14$, $p < .001$) and from wave 2 to wave 3 ($r = .15$, $p < .001$).

Hypothesis 2b stated that the effect of IM use on the ability to initiate offline friendships is explained (i.e., mediated) by adolescents' online self-disclosure. Fig. 3 shows the mediated-effect model with online self-disclosure as a mediator. The model had a good fit, $\chi^2(10, N = 690) = 9.79$, $p = .459$, CFI = 1.00, RMSEA = .00 (90% CI: .00/.04). Fig. 3 shows that IM use increased adolescents' self-disclosure from wave 1 to wave 2 ($b^* = .07$, $p = .024$). The same effect also occurred from wave 2 to wave 3 ($b^* = .06$, $p = .030$). However, online self-disclosure did not increase initiation from wave 1 to wave 2 ($b^* = .03$, $p = .142$) and from wave 2 to wave 3 ($b^* = .01$, $p = .328$). In contrast, initiation increased adolescents' online self-disclosure, both from wave 1 to wave 2 ($b^* = .07$, $p = .017$) and from wave 2 to wave 3 ($b^* = .13$, $p < .001$). Hypothesis 2b was thus not supported. The independent variables and mediator variables accounted for 37% of the variance of initiation at wave 2 and 48% of the variance of initiation at wave 3.[2]

3.4. Additional analyses: gender and age differences in the three models

3.4.1. Gender

In order to investigate whether the three models differed for both boys and girls, we conducted multigroup analyses with gender as the grouping variable. The unconstrained models for the two gender groups had a good fit (direct-effect model: χ^2 [4, $N = 690$] = .92, $p = .922$, CFI = 1.00, RMSEA = .00 [90% CI: .00/.02]; mediated-effect model with diversity of online communication partners as a mediator: χ^2 [20, $N = 690$] = 32.45, $p = .039$, CFI = .99, RMSEA = .03 [90% CI: .01/.05; mediated-effect model with online self-disclosure as a mediator: χ^2 [20, $N = 690$] = 15.48, $p = .748$, CFI = 1.00, RMSEA = .00 [90% CI: .00/.02]). Constraining the four cross-lagged paths did not lead to significant χ^2 changes, indicating that the path coefficients of the direct effect of IM use on initiation did not differ between boys and girls. These results indicate that all three models hold for both boys and girls.

3.4.2. Age

In order to investigate whether the three models differed for younger and older adolescents, we again conducted multigroup analyses, this time with age as the grouping variable (two age groups: 10–13-year-olds and 14–17-year-olds). The unconstrained models for the two age groups had a good fit (direct-effect model: χ^2 [4, $N = 690$] = .97, $p = .914$, CFI = 1.00, RMSEA = .00 [90% CI: .00/.02]; mediated-effect model with diversity of online communication partners as a mediator: χ^2 [20, $N = 690$] = 32.25, $p = .041$, CFI = .99, RMSEA = .03 [90% CI: .01/.05]; mediated-effect model with online self-disclosure as a mediator: χ^2 [20, $N = 690$] = 18.40, $p = .561$, CFI = 1.00, RMSEA = .00 [90% CI: .00/.03]). When we compared each model in which we constrained the cross-lagged paths across the two groups with a model in which we allowed these paths to vary, no significant χ^2 changes occurred. Thus, the effect of IM on initiation did not differ between younger and older adolescents. These results indicate that all three models hold for both younger and older adolescents.

4. Discussion

The first aim of this study was to investigate the influence of adolescents' instant messaging on their ability to initiate offline friendships. The second aim was to examine the validity of two possible underlying mechanisms of this relationship: the opportunities offered by instant messaging (a) to communicate with a variety of people and (b) to disclose intimate information. It seems that instant messaging indeed has a positive longitudinal effect on adolescents' ability to initiate offline friendships. The diversity of adolescents' online communication partners seems to play an important explanatory role in this effect.

Our Internet-induced social skills hypothesis stated that the frequency with which adolescents use instant messaging has a positive effect on their ability to initiate offline friendships (H1). The data supported this expectation. Instant messaging was positively related to adolescents' ability to initiate offline friendships six months later. This effect was found from wave 1 to wave 2 and from wave 2 to wave 3. We did not find this longitudinal effect from wave 1 to wave 3. This means that the positive effects were only found when the intervals between data waves lasted 6 months and not when they lasted 1 year. An explanation may be that adolescents' social skills only benefit from the Internet on the short term. Adolescents may purposely use instant messaging

[2] As suggested by one anonymous reviewer, we also tested a model in which both mediators were simultaneously included. This model had a good fit, $\chi^2(20, N = 690) = 38.98$, $p = .007$, CFI = .99, RMSEA = .04 (90% CI: .02/.05) and did not lead to any significant changes in the size of the longitudinal paths to and from the mediators.

to experiment with social skills. They may apply new social skills to the offline world soon after having acquired these skills. It is conceivable that this takes place within a few months but that the effects wane after a longer period of time.

Our second hypothesis stated that the direct effect of instant messaging on the ability to initiate offline friendships is explained (i.e., mediated) by adolescents' tendency to communicate online with a variety of people (H2a). We expected that instant messaging at wave 1 would have a positive effect on the diversity of online communication partners at wave 2 and that this would subsequently have a positive influence on the ability to initiate offline friendships at wave 3. The data supported these expectations and bootstrapping analyses showed a significant indirect effect. This suggests that instant messaging provides adolescents with opportunities to practice social skills with a diverse group of people, which, over time, seem to facilitate the initiation of offline friendships. Thus, our results validate this previously hypothesized explanatory role of the diversity of online communication partners (Suler, 2005).

Our third and final hypothesis stated that the direct effect of instant messaging on the ability to initiate offline friendships is explained (i.e., mediated) by adolescents' level of online self-disclosure (H2b). The data did not support this hypothesis. Rather, we found that adolescents' ability to initiate offline friendships had a positive effect on their online self-disclosure at a later point in time. This result suggests that online self-disclosure is more likely to be a consequence than an antecedent of adolescents' social competence. This is in contrast to what would be expected on the basis of previous research (Antheunis et al., 2007, 2010; Peter et al., 2005; Valkenburg & Peter, 2009; Valkenburg et al., 2011). However, these earlier studies were mainly cross-sectional. Over time, online self-disclosure may be related to social competence in the opposite causal direction. Furthermore, a longitudinal study that revealed a mediating role of online self-disclosure focused on the quality of *existing* friendships (Valkenburg & Peter, 2009). This suggests that adolescents may need a certain level of social competence to initiate friendships and that self-disclosure plays a more important role after friendships have already been formed.

At the time of the data collection of our study, instant messaging was the mostly used and available online communication application among adolescents. The far majority of the adolescents (99.5%) reported using instant messaging. Of course, they may have used other online communication tools during the time of data collection (e.g., social network sites and text messaging). However, like instant messaging, these other tools are typically used for person-to-person communication and allow for the control of visual cues. It is, therefore, unlikely that measuring adolescents' use of these other tools would have led to significantly different outcomes than those reported in this study.

The specific online communication applications and websites popular among adolescents have changed since our study was fielded. However, instant messaging, especially through mobile phones, is still one of the most popular means of online communication. In addition, instant messaging tools are still incorporated in many popular websites, including social network sites. Thus, whereas the specific tools may have changed, instant messaging itself, that is, the sending and receiving of text-based messages in a near-synchronous way, has not changed. Therefore, our results concerning the influence of instant messaging on adolescents' offline social competence remain relevant even within the context of newer tools.

We found an overall effect of adolescents' instant messaging on their ability to initiate offline friendships. Our results did not differ for boys and girls and for adolescents in different age groups. However, other individual difference variables may moderate the strength of the relationship between online communication and social competence. Future research should therefore address the moderating influence of dispositional factors, such as shyness, sensation seeking, and sociability. It should also investigate the moderating influence of environmental influences. For example, it has been shown that the way in which parents mediate their children's online communication can reduce negative consequences, such as adolescents' exposure to online risks (Livingstone & Helsper, 2008). It may thus also be likely that parents can stimulate positive consequences of online communication for adolescents, such as the development of friendships and social skills.

To our knowledge, this is the first longitudinal study that investigated whether and how adolescents' online communication influences their offline social competence. In spite of public concern over negative Internet effects, this study shows that online communication can have a positive effect on the development of adolescents' offline social competence. More specifically, through instant messaging adolescents can practice relationship initiation skills with a variety of people and, over time, apply these skills in face-to-face situations, increasing their ability to initiate offline friendships. Thus, it seems that indeed practice makes perfect – at least when it comes to social skills for making new friends.

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