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More facebook, less homesick? Investigating the short-term and long-term reciprocal relations of interactions, homesickness, and adjustment among international students

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ABSTRACT

Homesickness is one of the challenges that international students may encounter when they leave home. Homesickness is associated with social interactions and sociocultural adjustment, yet the directions of associations and temporal precedence are not clear. Thus, in this study, we tested a model which proposes that face-to-face (FtF) interaction with the host-country network, and Facebook interactions with the host- and the home-country networks predict homesickness, which, in turn, predicts sociocultural adjustment. We used cross-lagged and non-lagged reciprocal effects path analyses on a three-wave panel data gathered via online surveys. The results indicated that Facebook interaction with the host-country network lowered homesickness, in the long-term and the short-term. Paradoxically, homesickness increased Facebook interaction with the host-country network in the short-term. Lastly, homesickness lowered sociocultural adjustment in the short-term. We discuss how Facebook interaction with the host-country network could provide solace to international students when they miss home; and describe the implications of these findings for Facebook use and sociocultural adjustment among international students.

Introduction

When international students leave their home country to pursue academic careers in another country, it is quite a common experience to miss family and friends, as well as long for the familiarity of home (Thurber & Walton, 2012; Vingerhoets, 2005). However, when feelings of unhappiness and misery are too intense, when there is a strong preoccupation with thoughts of home, and a deep sense of grief for the home, the individual could be suffering from homesickness (Furnham, 2005). Homesickness is often associated with host-country social contacts and interactions. Previous studies found that social interactions with the host-country network help international students deal with homesickness (Hannigan, 2005; Thurber & Walton, 2012). However, somewhat paradoxically, these social interactions could also intensify longing for home and family (Hannigan, 2005). The other direction has also been observed: Homesick individuals tend to avoid social interactions (Thurber & Walton, 2012). Thus, the directions of the associations of homesickness and social interactions are not clear in the research literature. Homesickness can either be a predictor or an outcome of social interactions (Thurber & Walton, 2012). This current study aimed to address the question of directionality and

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temporal precedence between social interactions and homesickness.

In investigating homesickness and social interactions, it may be important to distinguish among various types of social interactions with the home- and the host-country networks (English, Davis, Wei, & Gross, 2017). Aside from face-to-face (FtF) social interactions, social network sites (SNSs) have become a popular venue of interactions. SNSs such as Facebook have "partially moved the interactions people have from offline (i.e., "face-to-face") to online contexts" (Verduyn, Ybarra, Résibois, Jonides, & Kross, 2017, p. 294). Facebook is currently the most popular social network site (Smith & Anderson, 2018). More crucially, it is widely used by students to build new networks and connect with their existing networks (Ellison, Steinfield, & Lampe, 2007). Thus, this study also aimed to extend current theorizing by examining the roles of various types of social interactions, including those facilitated by communication technologies (such as Facebook), in homesickness experiences (Stroebe, Schut, & Nauta, 2015a). We investigated the relative importance of FtF interactions with the host-country network and Facebook interactions with the host- and the home-country networks in homesickness experiences.

Aside from social interactions, homesickness is also linked to lower sociocultural adjustment to the new situation in the host country (Stroebe et al., 2015a; Van Tilburg, 2005). Among college students, homesickness was a predictor of lower overall adjustment (English et al., 2017). However, homesickness and adjustment may have reciprocal associations. Homesickness and adjustment are parallel reactions to being in a new environment and they may trigger each other, "causing incremental difficulties" (Stroebe, Schut, & Nauta, 2015b). Thus, this study also aimed to contribute to existing literature by investigating the reciprocal associations of homesickness and sociocultural adjustment.

Taken together, the overall aim of this paper is to investigate the influences of social interactions (i.e., Facebook interactions with the host- and home-country networks, and face-to-face interactions with the host-country network) on a negative subjective outcome that is highly relevant to international students' experiences (i.e., homesickness), and its eventual effect on sociocultural adjustment. This paper also clarifies the reciprocal effects between social interactions and homesickness, as well as homesickness and sociocultural adjustment. Current theorizing in this area of study suggests these reciprocal associations (Stroebe et al., 2015a, 2015b). However, to our knowledge, empirical evidence investigating these predictions in one model is lacking. This paper aims to fill this gap in the current literature.

Theoretical background

International student sojourners are individuals who leave their home countries to pursue academic careers in another country for a temporary period (Ward, Bochner, & Furnham, 2001). Compared to long-term migrants (e.g., those who intend to permanently settle in the new location), sojourners expect to return to the place of origin once the purpose of stay has been achieved (Safdar & Berno, 2016). Thus, for international students, the place of origin is still what is considered "home" and home-country relationships are still a salient part of their lives (Ye, 2005).

Being away from home and significant others may cause distress and suffering for many individuals (Thurber & Walton, 2012). Homesickness is a negative psychological state primarily due to separation from significant others and familiar surroundings (Archer, Ireland, Amos, Broad, & Currid, 1998; Stroebe et al., 2015b). It is characterized by negative emotions, ruminations about home, and even include somatic symptoms (Van Tilburg, 2005). In its mild form, it could help instigate the development of coping skills and motivates relationship maintenance behaviors with significant others (Stroebe et al., 2015b; Thurber & Walton, 2012). However, intense or severe homesickness can manifest itself as an obsession and an overwhelming emotion, and can be painful and debilitating (Furnham, 2005; Thurber & Walton, 2012). Extremely homesick individuals may suffer psychologically (e.g., feel miserable, anxious, lonely, depressed, apathetic, listless) and physically (e.g., appetite loss, attention loss, sleep disturbances, headaches) (Thurber & Walton, 2012; Van Tilburg, 2005). Severe homesickness may lead to withdrawal from school and further social isolation (Thurber & Walton, 2012). Also, homesickness has been linked to Internet addiction (Ni, Yan, Chen, & Liu, 2009).

Social interactions may have a direct impact on one's experience of homesickness (Berry, 2006; English et al., 2017; Van Vliet, 2001). In turn, homesickness may impact sociocultural adjustment (Berry, 2006; Ward et al., 2001). Sociocultural adjustment refers to one's "ability to fit in, to acquire culturally appropriate skills, and to negotiate interactive aspects of the host environment" (Ward & Kennedy, 1999, p. 660). In short, sociocultural adjustment refers to how well a sojourner is able to manage daily life in the host country (Berry, 2006). Based on these theoretical assumptions, we proposed a model where social interactions are predictors of homesickness, which, in turn, is a predictor of sociocultural adjustment.

A concurrent communication model

The seminal models of sojourners' adjustment focused on the role of FtF interactions with the host-country network in adjustment (Berry, 2006; Ward et al., 2001). However, with the development of communication technologies in the past years, the possibilities of social interactions have expanded. In this study, we proposed a concurrent communication model where we examined the relative importance of FtF and Facebook interactions in international students' experiences of homesickness. Based on the reinforcement hypothesis of media use, people use various forms of communication channels concurrently, and that these communication channels are complementary and not necessarily isolated (Dienlin, Masur, & Trepte, 2017; English, Davis, Wei, & Gross, 2017; Rui & Wang, 2015). It has been demonstrated, for instance, that those who use SNSs to communicate with others were also more likely to communicate with others FtF (Dienlin et al., 2017). Thus, one communication channel does not necessarily displace the other. In this study, we extended earlier models of sojourners' adjustment (e.g., Berry, 2006; Ward et al., 2001) by including not just FtF interactions with the host-country network, but also Facebook interactions with both the host- and the home-country networks in our investigation.

FtF interactions and homesickness

Research shows that friendships in the host country are important for social support, satisfaction, and success of international students studying in foreign universities (Hendrickson, Rosen, & Aune, 2011; Ward et al., 2001). Students who feel welcomed, connected, and "at home" in their host culture were less likely to experience intense homesickness (Thurber & Walton, 2012). Thus, it seems likely that more frequent social interactions with significant others in the host country would reduce homesickness. Indeed, it has been found that greater social contact with the host-country network was linked to lower homesickness (Pedersen, Neighbors, Larimer, & Lee, 2011). However, interactions with the host-country network may also leave international students longing more for home (Hannigan, 2005). Students have been observed to experience bouts of homesickness even after a particularly good experience at a party with friends. According to Hannigan (2005), it could be that after FtF host-country interactions, international students become acutely aware of their longing for home and loved-ones. Given the inconsistent results, we posed the following research question:

RQ1: What is the impact of FtF interaction with the host-country network on homesickness?

Facebook interactions and homesickness

Currently, SNS use is one of the most popular Internet activities, and Facebook is the most popular SNS globally (Ahmad, 2019; Smith & Anderson, 2018; Social media statistics & facts, 2018). Among migrants, Facebook is the most popular and most frequently used SNS (Cassar, Gauci, & Bacchi, 2016). SNSs have most of the features of other forms of CMC (e.g., email, video call, instant messaging, etc.) and social media (e.g. YouTube, Instagram, Snapchat, etc.) have in a single platform. SNSs enable private (e.g., messaging, chatting, video telephony) and public interactions (e.g., group messaging, posting) and can be used both in a synchronous and asynchronous manner. They also allow unobtrusive observation of others' online activities. For these reasons, this paper will focus on SNS use, and more specifically the use of Facebook, by international sojourners instead of general CMC or social media use.

Research on the association of homesickness and the use of social network sites such as Facebook is still very limited (Stroebe et al., 2015a). Previous studies on the associations of the use of social network sites and psychological states similar to homesickness (such as loneliness and connectedness) yielded inconsistent results (Verduyn et al., 2017). On the one hand, SNS and Facebook use was found to be associated with greater sense of connection, greater feelings of bonding social capital, and lower levels of loneliness (Burke & Kraut, 2016; Verduyn et al., 2017). On the other hand, Facebook use has been shown to be associated with lowered wellbeing (Kross et al., 2013; Shakya & Christakis, 2017). In a cross-sectional study, Hofhuis, Hanke, and Rutten (2019) found that (passive and active) SNS contacts with home-country relations of international students had a negative association with psychological alienation (which included social inclusion, sense of belonging, homesickness). The inconsistencies of these findings were attributed to the variety of ways Facebook use were measured (e.g., active versus passive use, with strong ties versus weak ties) (Burke & Kraut, 2016; Verduyn et al., 2017). According to Burke and Kraut (2016), people may benefit from Facebook communication when they are direct interactions from people they care about. In our current study, we defined Facebook use as social interactions (active) with significant others.

Klingensmith's (2010) findings provided initial evidence that the use of Facebook might not be necessarily helping students to cope with homesickness. Homesickness experienced specifically in relation to friends (i.e., friendsickness) has been found to be positively associated with students' Facebook use intensity. Since the finding was correlational, it could imply both directions of causation, namely that greater Facebook use increased friendsickness; or, friendsick students were more likely to use Facebook. Similar questions arise with respect to the use of Facebook with the host- and the home-country networks. In this research too, it is still a question whether communication via Facebook (with the host- and the home-country networks) is an opportunity to cope with homesickness or a source of homesickness (Stroebe et al., 2015a). Considering the lack of consensus in previous studies, we asked:

RQ2: What is the impact of Facebook interactions with the host-country network on homesickness?
RQ3: What is the impact of Facebook interactions with the home-country network on homesickness?

The question of directionality

This current study addresses the relevant issue of directionality of associations. For instance, social interactions, psychological states, and adjustment are often discussed together in theory, but their reciprocal interactions are rarely tested empirically (Meng, Martinez, Holmstrom, Chung, & Cox, 2017; Trepte & Scharkow, 2016). In the case of social interactions and homesickness, directionality is a crucial issue to address. There are findings in the literature suggesting that social interaction impacts homesickness (Hendrickson et al., 2011; Pedersen et al., 2011; Thurber & Walton, 2012; Ward et al., 2001). And there are findings that homesickness impacts social interactions: Either homesick individuals seek company (Brewin, Furnham, & Howe, 1989; Thurber & Walton, 2012), or they avoid social situations (Thurber & Walton, 2012; Van Tilburg, 2005). As for homesickness and sociocultural adjustment, Stroebe et al. (2015b) theorized that the two are reactions to being in a new environment that may have a reciprocal effects. The rationale for these arguments is discussed more specifically in the succeeding sections.

Reciprocal associations of social interactions and homesickness

When examining the potential effects of types of social interactions on homesickness, it may be relevant to look at how homesickness may also impact social interactions (English et al., 2017). Not only does social interaction impact homesickness, people who feel homesick are also inclined to seek company (English et al., 2017; Furnham, 2005). This implies that a homesick individual is

more likely to have FtF interactions with the host-country network. However, there were contradicting findings showing that homesick individuals avoid social situations and tend to withdraw even from enjoyable activities (Van Tilburg, 2005). Thus, we asked:

RQ4: What is the impact of homesickness on FtF interaction with the host-country network?

When it comes to Facebook interactions, several models hypothesized that media effects are transactional (Slater, 2015; Valkenburg, Peter, & Walther, 2016). This transactional feature of media effects predicts paths both from media use (e.g., Facebook use) to outcomes (e.g., homesickness), and from these outcomes to media use. Thus, it is possible that homesickness has a reciprocal effect on Facebook use. The reciprocal effects of media use and outcomes were conceptualized as dynamic, such that there is a possibility for effects to "grow out of control" or to reach extreme levels if left unchecked (i.e., reinforcing spirals); or may tend toward homeostasis (Slater, 2015, p. 3).

Given the limited studies on how homesickness might impact Facebook interaction with the host- and the home-country networks, we posed the following research questions:

RQ5: What is the impact of homesickness on Facebook use with the host-country network?
RQ6: What is the impact of homesickness on Facebook use with the home-country network?

Reciprocal associations of homesickness and sociocultural adjustment

According to Stroebe et al. (2015b), homesickness is fundamentally a separation phenomenon as a consequence of leaving home. It should be clearly delineated from new place adjustment experiences. Homesickness is a negative psychological state due to separation from home (home factor), whereas adjustment is a reaction to "the demands that are made on the person in the new environment (new place factor)" (Stroebe et al., 2015b, p. 4). Homesickness and adjustment may have reciprocal effects and exacerbate each other (Stroebe et al., 2015b). In our current study, we focused on a particular type of adjustment, sociocultural adjustment, which are reactions related to the acquisition of social and practical skills in negotiating and managing daily life in the new environment (i.e., host country) (Berry, 2006; Ward & Kennedy, 1999). In the tradition of cross-cultural studies of sojourn experiences, homesickness has been theorized as a predictor of sociocultural adjustment (Berry, 2006; Constantine, Kindaichi, Okazaki, Gainor, & Baden, 2005; Poyrazli & Lopez, 2007; Ward et al., 2001). Poor adjustment in the host country could be a consequence of homesickness. However, poor adjustment may impact homesickness as well (Stroebe et al., 2015a, 2015b). We, therefore, hypothesized that:

H1. Higher homesickness predicts lower sociocultural adjustment.

H2. Higher sociocultural adjustment predicts lower homesickness.

Fig. 1 provides a summary of the model with reciprocal associations of social interactions, homesickness, and sociocultural adjustment.

Method

In testing the model (Fig. 1), we used a 3-wave longitudinal panel design. The longitudinal panel design is useful in establishing directions of impacts and evaluating temporal order (Finkel, 1995; Kline, 2016). In this study, we examined the lag time by testing both short-term and long-term reciprocal associations between social interactions, homesickness, as well as between homesickness and sociocultural adjustment.

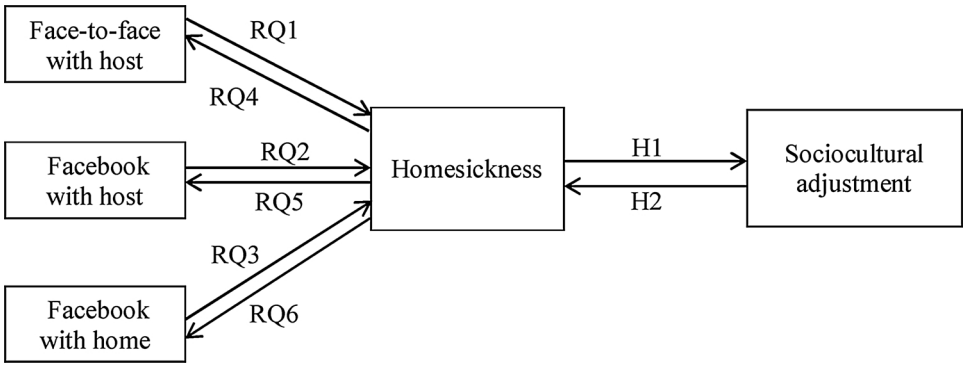

Fig. 1. The proposed model for three types of interaction (FtF interaction with the host-country network, Facebook interaction with the host-country network, and Facebook interaction with the home-country network), homesickness, and sociocultural adjustment.

Participants

For the first data collection, there was a total of 414 participants (n = 246, 59.4 % women; n = 168, 40.6 % men). For the second round of data collection, we contacted via email 350 participants (84.5 %) from the first survey who indicated their willingness to participate in the succeeding surveys. There were 174 participants (n = 104, 59.8 % women; n = 70, 40.2 % men) who completed the survey, which comprised 49.7 % of those who agreed for follow-up surveys. For the final data collection, we collected data from those who participated in the second round of data collection. Ninety-eight participants (n = 61, 62.2 % women; n = 37, 37.8 % men) answered the survey.

At Time 1, the average age of our participants was 25.21 (SD = 4.50), with a range of 16–49 years. They came from 76 home countries and studied in 32 host countries. The average number of months they had been in the host country was 18 months (SD = 19.35; range = 1 month to 8 years). Most of the participants were single (94.2 %, n = 390). Many of the participants pursued their Master's degree (55.8 %, n = 231). The rest pursued a Bachelor's degree (n = 97, 23.4 %), Doctoral studies/PhD (n = 74, 17.9 %), professional studies (e.g., Medicine, Law) (n = 10, 2.4 %), and post-doc studies (n = 2, 0.5 %).

Procedure

Data collection

We collected a 3-wave panel data via an online questionnaire on Qualtrics. The data collection had an interval of three months in-between assessments consistent with a previous study on student sojourners (Hechanova-Alampay, Beehr, Christiansen, & Van Horn, 2002). We recruited international students to participate in our first survey on Facebook by posting several announcements on relevant Facebook pages (e.g., Erasmus Student Network, university international offices). Participation in the study was voluntary. As a form of compensation and to encourage participation, the participants could join a raffle draw in each time point, where ten of them got the chance to be selected to each receive 50 euros gift voucher.

Measures

This study was a part of a larger research that aimed to investigate the roles of communication in sojourners' adjustment (Billedo, Kerkhof, Finkenauer, & Ganzeboom, 2019). Only the measures relevant in this paper are reported here.

Frequency of interactions with significant others. We measured each of the frequencies of interaction with the home- and the host-country networks via FtF and Facebook communication with the following instruction: "Please rate the frequency with which you interacted with (home/host-country) significant others (e.g., family and friends) (via Facebook/in person) in the past two weeks". The items were rated on a 5-point Likert scale (1 = *never*; 5 = *all of the time*).

Homesickness. To assess homesickness, we used a single item similar to previous studies (English et al., 2017; Fisher & Hood, 1987). We asked the participants to indicate "To what extent are you currently experiencing homesickness" on a 4-point scale ranging from 1 = *not homesick* to 4 = *very homesick* (Fisher & Hood, 1987). This item was found to correlate highly with the total score of a 33-item homesickness scale (Archer et al., 1998) and the 20-item Utrecht Homesickness Scale (Stroebe, van Vliet, Hewstone, & Willis, 2002). In their systematic review, Stroebe et al. (2015a) noted that a single item about homesickness is likely to be valid and that "people are typically able to assess whether they suffer from it" (p.2).

Sociocultural adjustment. A 15-item version of the Ward and Kennedy (1999) Sociocultural Adaptation Scale (SCAS-15) was used to assess sociocultural adjustment. The original SCAS consisted of 16 items but other versions had up to 40 items (Ward & Kennedy, 1999). For our study, we used the same 15 items previously employed in studies on computer-mediated communication use of international students (Cemalcilar, Falbo, & Stapleton, 2005). Participants rated the level of difficulty (1 = *no difficulty*; 5 = *extreme difficulty*) of various aspects of sociocultural experiences (e.g., "making friends", "using the transportation system", "dealing with the climate"; "expressing your ideas in the class", "living away from family members"). To make interpretation easier, the scoring was reversed so that a higher score indicated better sociocultural adjustment. We averaged the scores to come up with an index of sociocultural adjustment (α_{t1} = 0.82; α_{t2} = 0.76; α_{t3} = 0.80).

Length of stay in the host country. We considered length of stay in the host country as a control variable. Based on previous studies, length of stay has been shown to be relevant in homesickness (Van Vliet, 2001) and sociocultural adjustment of international students (Smith & Khawaja, 2011; Ward et al., 2001; Zhang & Goodson, 2011). The participants were asked to indicate the length of time (in years and months) they have been in the host country as international students. We converted number of years to months to come up with a total of number of months as a measure for length of stay.

Results

Panel attrition

There were no significant differences between the participants who were retained and those who dropped out after the first round of data collection in terms of age ($M_{retained}$ = 25.88, SD = 4.84; $M_{dropped}$ = 25.00, SD = 4.38; $t(412)$ = 1.68, p = .093, Cohen's d =

0.19) and gender ($\chi^2(1, N = 414) = 0.42$, p = .515, $\varphi = .032$). Those who were retained had significantly lower number of months of stay in the host country during T1 compared to those who dropped out ($M_{retained} = 13.69$, $SD = 15.76$; $M_{dropped} = 19.17$, $SD = 20.18$; $t(204.36) = -2.80$, $p = 0.006$, Cohen's $d = 0.30$). It is likely that some of those who dropped out had already completed their study, which made them ineligible for the second and/or third round(s) of data collection. There were no significant differences on any of the main study variables. We also examined the pattern of missing data for the main variables using Little's missing completely at random (MCAR) test, which indicated that the missing data can be considered as completely at random, $\chi^2(57, N = 414) = 57.24$, $p = .466$. Thus, it can be assumed that there were no serious selection problems due to attrition.

Table 1 summarizes the means, standard deviations and correlations of the study variables. Across the three time points, the rank order of the types of interaction in terms of frequency was the same, with FtF interaction with the host country significant others being the most frequent, and Facebook interaction with home being the least frequent.

Testing the proposed model using SEM

We tested the proposed model using cross-lagged (for the long-term effects) and non-lagged (for the short-term effects) reciprocal causality path analyses. The non-lagged reciprocal causality analysis is used to investigate causal effects that occur within a short span of time (Finkel, 1995; Kline, 2016). The use of panel designs does not necessarily prove causality as conclusively as experimental designs. However, they are useful to estimate reciprocal effects and assess whether a set of results is consistent with a causal model (Finkel, 1995).

To test the models, we conducted structural equation modeling (SEM) using Stata 14 and the estimation method maximum likelihood for missing values (MLMV). We used the observed variables for the three types of interaction and homesickness, as well as the composite mean for sociocultural adjustment to reduce the number of parameters to be estimated and ensure statistical power. We also used z-score standardization to ensure the comparability of the coefficients across the variables. Since the panel waves were equally spaced and the participants were in varying stages of their sojourn in T1, we estimated the models by placing equality constraints on the parameters (Finkel, 1995). We assumed that "the changes in the underlying reciprocal causations have already manifested their effects and that the system is already in a steady state" (Kline, 2016, p. 137). Firstly, with the cross-lagged model, we put equality constraints on the corresponding autoregressive paths from T1 to T2 and from T2 to T3; the corresponding cross-lagged causal paths across the waves, and the corresponding residual variances between variables within waves. Then, with the non-lagged model, we removed the cross-lagged paths and replaced the correlations within waves with reciprocal causal paths (please see (Billedo et al., 2019; Mathisen et al., 2007) for the application of similar procedures). Thus, within each wave, the directions of influence are clarified. The following evaluation criteria were used to check model fit: The ratio of the $\chi 2$ to its degree of freedom (a value ranging 2.0–5.0 indicates acceptable fit); the root mean square error of approximation (RMSEA) (a cut-off value of $<.08$ indicates acceptable fit); comparative fit index (CFI), and the Tucker-Lewis Index (TLI) ($>.90$ indicates acceptable fit) (Van de Schoot, Lugtig, & Hox, 2012; Vandenberg & Lance, 2000).

Cross-lagged path analysis

Table 2 provides a summary of the unstandardized estimates of the paths in all the models we tested. We only presented the values between T1 and T2 since we imposed equality constraints across the waves (i.e., the values between T1 and T2, T2 and T3 are the same).[1] Based on cross-lagged path analysis (Model 1a), the model had an adequate fit to the data ($\chi^2(85) = 105.21$; $p = 0.031$; $\chi 2/df = 1.32$; RMSEA = 0.02; CFI = 0.96; TLI = 0.95. The results showed that only the lagged causal path from Facebook interaction with the host-country network to homesickness was significant. Specifically, Facebook interaction with the host-country network decreased homesickness at a later time point ($b = -0.14$; $SE = 0.06$; $p = .021$, two-tailed) (RQ2). The cross-lagged paths between homesickness and sociocultural adjustment were not significant, thus H1 and H2 were rejected.

Non-lagged path analysis

We proceeded by testing the proposed model using non-lagged path analysis (Model 2). The results showed that Model 2a had a good fit to the data ($\chi^2(84) = 106.56$; p = 0.049; $\chi^2/df = 1.27$; RMSEA = 0.02; CFI = 0.96; TLI = 0.96). The results indicated that Facebook interaction with the host-country network decreased homesickness in the short-term ($b = -0.24$; $SE = 0.11$; $p = .026$, two-tailed). The reverse effect also held, homesickness increased Facebook interaction with the host-country network in the short-term ($b = 0.16$; $SE = 0.08$; $p = .047$, two-tailed) (RQ5). Moreover, homesickness decreased adjustment in the short-term ($b = -0.09$; $SE = 0.05$; $p = .040$, one-tailed) (H1). Thus, in the short-term, homesickness mediated the effect of Facebook interaction with the host-country network on sociocultural adjustment. In this model, H1 was supported and H2 was rejected.

Model tests controlling for length of stay

We tested both cross-lagged and non-lagged models with the control variable length of stay included. For the cross-lagged analysis, the model (Model 1b) showed a good fit to the data ($\chi^2(85) = 106.02$; $p = 0.061$; $\chi^2/df = 1.25$; RMSEA = 0.02; CFI = 0.97; TLI = 0.96). For the non-lagged analysis, we also found that the model (Model 2b) had a good fit to the data ($\chi^2(84) = 106.56$;

[1] To ensure that the assumption of constancy of structural effects is justified, we ran all the models again without equality constraints. Using $\chi^2 diff$ test, the results showed that the models with equality constraints did not have a significant difference in fit to the data compared to the models without equality constraints.

Table 1
Means, standard deviations, and correlations of the main study variables.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	15
1 FTFHOS1	4.17	1.05	1													
2 FBHOS1	3.97	1.05	0.30**	1												
3 FBHOM1	3.83	1.10	0.05	.35**	1											
4 HS1	1.93	0.78	−0.14**	−0.03	0.11*	1										
5 ADJ1	3.93	0.56	0.14**	0.04	−0.10	−0.40**	1									
6 FTFHOS2	4.32	0.89	.52**	0.31**	0.15*	−0.16*	0.09	1								
7 FBHOS2	3.98	1.01	.20**	0.57**	0.33**	0.07	−0.04	.30**	1							
8 FBHOM2	3.89	1.03	−0.04	0.34**	0.61**	0.17*	−0.13	0.06	.48**	1						
9 HS2	1.79	0.70	−.012	−0.05	0.08	0.46**	−0.22**	−0.15*	−0.00	0.10	1					
10 ADJ2	3.96	0.47	0.24**	0.01	−0.11	−0.33**	0.67**	0.17*	0.05	−0.06	−0.27**	1				
11 FTFHOS3	3.98	1.20	0.34**	0.23*	0.12	−0.12	0.06	0.35**	0.13	0.07	−0.11	0.08	1			
12 FBHOS3	3.97	0.95	0.17	0.44**	0.30**	−0.06	0.12	0.29**	0.50**	0.34**	−0.02	0.09	0.34**	1		
13 FBHOM3	3.66	1.01	0.05	0.17	0.42**	0.16	−0.11	0.17	0.22*	0.60**	0.10	−0.09	0.05	0.37**	1	
14 HS3	1.79	0.69	−0.17	−0.04	0.06	0.38**	−0.18	−0.07	−0.19	0.11	0.55**	−0.17	−0.00	−0.04	0.15	1
15 ADJ3	3.98	0.49	0.37**	0.02	−0.19	−0.36**	0.73**	0.08	0.04	−0.16	−0.16	0.77*	0.02	0.05	−0.12	−0.24*

Note: ** $p < .01$; * $p < .05$, *two-tailed,* FtFHOS = FtF interaction with the host-country network; FBHOS = Facebook interaction with the host-country network; FBHOM = Facebook interaction with the home-country network; HS = homesickness; ADJ = Sociocultural adjustment.

Table 2
Unstandardized Parameter Estimates, Standard Errors, and P-values (two-tailed) of the Cross-lagged and Non-lagged Reciprocal Causality Path Analyses.

Paths	*Cross-lagged*						*Non-lagged*					
	Model 1a			Model 1b (with stay)			Model2a			Model 2b (with stay)		
	b	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*	*b*	*SE*	*p*
Autoregressive paths												
$FtFhos_1 \rightarrow FtFhos_2$	.42	.05	.000	.42	.05	.000	.42	.05	.000	.42	.05	.000
$FBhos_1 \rightarrow FBhos_2$	.49	.05	.000	.49	.05	.000	.51	.05	.000	.51	.05	.000
$FBhom_1 \rightarrow FBhom_2$	.58	.05	.000	.58	.05	.000	.59	.05	.000	.59	.05	.000
$HS_1 \rightarrow HS_2$	.49	.06	.000	.49	.06	.000	.50	.06	.000	.50	.06	.000
$Adj_1 \rightarrow Adj_2$	.75	.05	.000	.76	.05	.000	.74	.04	.000	.74	.04	.000
Causal paths												
$FtFhos_1 \rightarrow HS_2$	.05	.06	.352	.06	.06	.328	.15	.10	.138	.15	.09	.136
$FBhos_1 \rightarrow HS_2$	−.14	.06	.021	−.14	.06	.019	−.24	.11	.026	−.25	.11	.023
$FBhom_1 \rightarrow HS_2$	.07	.06	.256	.07	.06	.237	.09	.09	.324	.10	.09	.303
$HS_1 \rightarrow FtFhos_2$	−.05	.06	.354	−.05	.06	.335	−.13	.09	.148	−.14	.09	.148
$HS_1 \rightarrow FBhos_2$	.04	.05	.410	.04	.05	.411	.16	.08	.047	.16	.08	.046
$HS_1 \rightarrow FBhom_2$	.07	.05	.168	.07	.05	.166	.06	.07	.407	.06	.07	.419
$HS_1 \rightarrow Adj_2$	−.02	.05	.730	−.02	.05	.699	−.09	.05	.080	−.09	.05	.081
$Adj_1 \rightarrow HS_2$	−.04	.06	.545	−.04	.06	.527	−.06	.07	.435	−.06	.07	.436
Covariances												
$FtFhos_1 - FBhos_1$	.16	.05	.001	.16	.05	.001	.14	.05	.003	.14	.05	.003
$FtFhos_1 - FBhom_1$	−.04	.04	.384	−.04	.04	.387	−.04	.04	.377	−.04	.04	.381
$FBhos_1 - FBhom_1$	.20	.04	.000	.20	.04	.000	.20	.04	.000	.20	.04	.000
$FtFhos_1 - HS_2$	−.02	.05	.722	−.02	.05	.732						
$FBhos_1 - HS_2$	.01	.04	.785	.01	.04	.796						
$FBhom_1 - HS_2$	.04	.04	.321	.04	.04	.326						
$HS_2 - Adj_2$	−.10	.04	.004	−.10	.04	.005						
Control variables												
Stay → $FtFhos_3$				.04	.08	.580				.04	.08	.631
Stay → $FBhos_3$				−7.47e-06	.07	>.999				.005	.07	.948
Stay → $FBhom_3$				−.01	.07	.869				−.007	.07	.924
Stay → HS_3				−.06	.07	.415				−.06	.08	.413
Stay → Adj_3				.06	.06	.316				.06	.06	.337

Note. FtFHos = Face-to-Face with the host-country network; FBHos = Facebook with the host-country network; FBHom = Facebook with the home-country network; HS = Homesickness; Adj = Sociocultural adjustment; Stay = length of stay. All variables were standardized within waves. Since equality constraints were imposed: for the autoregressive paths, only the values between T1 to T2 are shown; for the causal paths, only the values between T1 to T2 (cross-lagged models), and the values within T2 (non-lagged models) are shown; for the covariances, only the values within T2 are shown.

$p = 0.049$; $\chi 2/df = 1.27$; RMSEA = 0.02; CFI = 0.96; TLI = 0.96). The pattern of the main results was similar in both the cross-lagged and the non-lagged models with and without the control variable. Moreover, both in the cross-lagged and non-lagged models, length of stay did not have significant effects on the main variables.

Summary of results

Figs. 2 and 3 summarize the statistically significant results for Model 1b and Model 2b, respectively. We found that face-to face interaction with the host-country network had neither long-term nor short-term effect on homesickness (RQ1); Facebook interaction with the host-country network decreased homesickness both in the long-term and in the short-term (RQ2); Facebook interaction with the home-country network had neither long-term nor short-term effect on homesickness (RQ3); homesickness had neither long-term nor short-term effect on FtF interaction with the host-country network (RQ4); homesickness increased Facebook interaction with the host-country network in the short-term, but not in the long-term (RQ5); and, homesickness had neither long-term nor short-term effect on Facebook interaction with the home-country network (RQ6). For our hypotheses, we found that homesickness decreased sociocultural adjustment in the short-term, but not in the long-term (H1). The prediction that sociocultural adjustment will decrease homesickness was not supported (H2). Lastly, length of stay did not have any significant effect on any of the variables in the models. This indicates that the pattern of results is similar regardless of the duration of stay of the international students in the host country. Note that our results indicated small effect sizes. These, however, are similar in magnitude to those found in previous studies (Shakya & Christakis, 2017; Valkenburg et al., 2016).

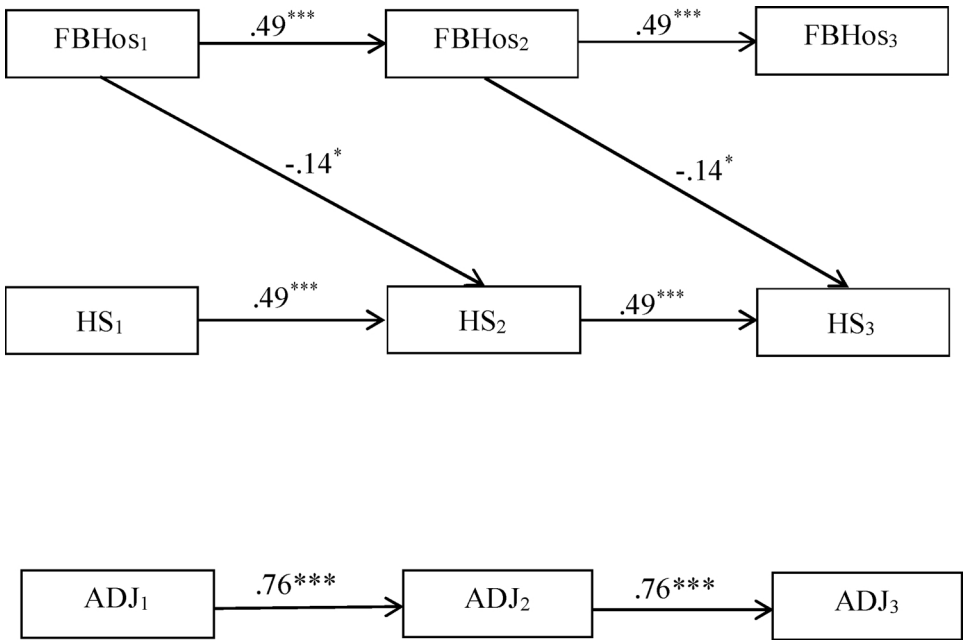

Fig. 2. Simplified version of the cross-lagged reciprocal causality mediation model (Model 1b) presented with the unstandardized regression coefficients of the statistically significant paths.
Note: ***$p < .001$; *$p < .05$, two-tailed; FBHos = Facebook with host-country network; HS = homesickness; ADJ = sociocultural adjustment. All variables were standardized within waves. For visual clarity, correlations between error terms were not included.

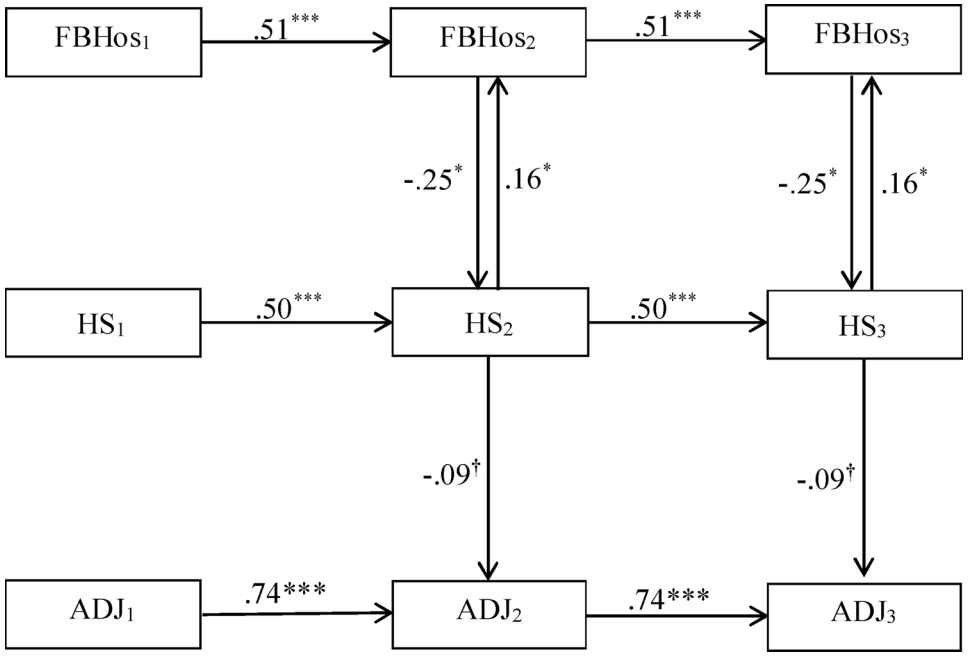

Fig. 3. Simplified version of the non-lagged reciprocal causality mediation model (Model 2b) presented with the unstandardized regression coefficients of the statistically significant paths.
Note: ***$p < .001$; *$p < .05$, two-tailed; †$p < .05$, one-tailed; FBHos = Facebook with host-country network; HS = homesickness; ADJ = sociocultural adjustment. All variables were standardized within waves.

Discussion

This study examined a model which proposed that FtF interaction with the host-country network and Facebook interactions with the home- and the host-country networks predict homesickness, which in turn, predicts sociocultural adjustment. We also tested for

the reciprocal effects of social interactions and homesickness, as well as the reciprocal effects of homesickness and sociocultural adjustment. We tested the model under long-term and short-term temporal assumptions using cross-lagged and non-lagged reciprocal effects path analyses, respectively. The results indicated that Facebook interaction with the host-country network lowered homesickness, both in the long-term and the short-term. Also, homesickness increased Facebook interaction with the host-country in the short-term. Homesickness lowered sociocultural adjustment in the short-term. Facebook use with the host-country network had an effect on sociocultural adjustment via homesickness.

Concurrent communication and homesickness

Facebook interactions and homesickness

We found that Facebook interaction with the host-country network lowered homesickness, both in the short- and in the long-term. Facebook is an inexpensive and convenient way to interact with the host-country network. For instance, they could interact with others from the host-country without having to formally arrange meet-ups or having to spend money on social activities. These Facebook interactions with the host-country network proved to be helpful for international students in dealing with homesickness.

In our current study, we specifically asked about the frequency of interactions on Facebook with significant others from the host-country. Previous studies have shown that in the general population, active, targeted, and composed communication on Facebook with significant others (i.e., strong ties) promote overall wellbeing (Burke & Kraut, 2016; Verduyn et al., 2017). This might partly explain our finding on the positive effect of Facebook interaction with the host-country network on homesickness. We can surmise that the active Facebook use among international students with co-located (i.e., host country) significant others is comparable to the positive effects of active Facebook use with significant others in the general population.

We also found that higher levels of homesickness predicted greater Facebook interaction with the host-country network in the short-term. In other words, when international students feel homesick, they go on Facebook and interact with host-country network to seek reprieve. Thus, Facebook interaction with the host-country network and homesickness reinforce each other. It appears that international students' use of Facebook to interact with significant others in the host country had short- and long-term alleviating effects on homesickness. Reciprocally, whenever international students experience bouts of homesickness, they turn to Facebook and interact with host-country significant others.

At first glance, the reciprocal effects of Facebook interaction with the host-country network lowering homesickness (both in the long- and the short-term), and homesickness increasing Facebook interaction with the host-country network (in the short-term) may suggest an optimistic view on international students' Facebook use with the host-country network. Indeed, it appears that Facebook use with the host country network is helpful in alleviating homesickness. However, the reciprocal effects may also suggest a positive feedback loop, or reciprocal associations that could potentially lead to extreme levels if left unchecked (Slater, 2015). This means that the alleviating effects of Facebook use on homesickness could potentially lead to ever increasing Facebook use (Slater, 2015). Sheldon, Abad, and Hinsch (2011) offered a similar explanation as to how Facebook use could lead to extremes (e.g., Facebook addiction). Using the two-process view of Sheldon et al. (2011), the findings of this current study could be interpreted as: Increased homesickness might serve as a motivation for Facebook interaction with the host-country network; and decreased homesickness could be an outcome of Facebook interaction with the host-country network. One possible implication of these relations based on the two-process view is that users are likely to build reliance on Facebook for relief; and this reliance might lead to more negative consequences such as Facebook addiction (Sheldon et al., 2011). Thus, the positive feedback loop between Facebook use with the host-country network and homesickness suggests a possible mechanism in which international students could become embroiled in Facebook use with the host-country network because of the solace it provides. This is not to say that Facebook use should be avoided, when in fact it does help international students alleviate homesickness. However, Facebook interactions should not be viewed as an exclusive mechanism to relieve homesickness. Otherwise, the continuous rewards that they get from Facebook interactions with the host-country network might eventually lead to greater psychological dependency on this type of interaction (Griffiths, Kuss, & Demetrovics, 2014). It is important to note that in a previous study, homesickness has been found to be associated with Internet addiction among freshmen students (Ni et al., 2009).

Our results also showed that Facebook interaction with the home-country network did not have an effect on homesickness. On the one hand, it could be that Facebook use with the home-country network was not sufficiently relevant to have an impact on one's longing for home. On the other hand, it could be that the lack of significant effects was due to the co-existence of both positive and negative effects of Facebook use with the home-country network on homesickness. For instance, it has been shown that maintaining connections with home via regular mediated communication promotes healthy connection and positive adjustment while one is away (Thurber & Walton, 2012). However, it is also possible that constant interaction with the home-country network could cause more homesickness and distress, rather than an opportunity to cope with homesickness (Klingensmith, 2010; Stroebe et al., 2015b). The design of our current study could not account for concurrent positive and negative effects of Facebook use with the home-country network on homesickness. We suggest that future studies should provide an in-depth examination of the dynamic processes within the various types of social interactions and their impact on homesickness.

FtF interaction and homesickness

The results showed that FtF interaction with the host-country network did not predict homesickness. It is likely that international students' level of FtF social interactions with significant others in the host country, whether it is thriving or failing, is distinct from how much they miss home. It is also possible that the absence of effect might be due to the paradoxical effects of FtF interaction with the host-country network on homesickness found in previous studies. It has been shown that FtF social interactions with the host country

could both decrease and increase homesickness (Hannigan, 2005; Pedersen et al., 2011; Thurber & Walton, 2012); and the presence of both effects might have cancelled out each other. In our research, we only measured frequency of social interactions. Future research should look more into the mechanisms that delineate when FtF interactions might be helpful in reducing homesickness.

Homesickness and sociocultural adjustment

Homesickness had an immediate negative impact on sociocultural adjustment. The results suggest that whenever international students felt homesick, they had greater difficulty in managing their daily life and functioning in their new social environment. Indeed, homesick individuals have a hard time fitting in and navigating their new environment (Berry, 2006; Constantine et al., 2005; Poyrazli & Lopez, 2007; Stroebe et al., 2015a, 2015b; Ward et al., 2001). However, we did not find any long-term effects of homesickness on sociocultural adjustment. Homesick individuals were not necessarily less adjusted in the host environment in the long-term. Nonetheless, whenever one feels homesick, he or she is more likely to perceive and experience adjustment difficulties. For example, when international students felt homesick, they had greater difficulty in making friends or dealing with climate. Our results suggest that the effects of homesickness on sociocultural adjustment is temporary. Our findings also showed that sociocultural adjustment did not impact homesickness. This implies that an international student might experience homesickness, whether or not they were experiencing social and practical issues in managing their daily lives in the host country. Together, our results provide partial support to the model we proposed. We found Facebook interaction with the host-country network could have an effect on homesickness, and, in turn, homesickness had an immediate effect on sociocultural adjustment. In other words, Facebook interaction with the host-country network made international students feel less homesick. This, in turn, helped them to manage their daily life in the host country, although this effect is short-term and had no long-term consequences.

Finally, the results also showed that sojourners' length of stay in the host country did not have any effect on their homesickness and adjustment. According to the systematic review of Stroebe et al. (2015a), there is still a lack of consistency when it comes to the trajectory of homesickness over time. It could be that homesickness peaks in certain occasions (e.g., holiday periods). It could also be that for some, feelings of homesickness fade away after a few months after arrival in the host country; and for others, it could be persistent. It might be too simplistic to assume that homesickness fades over time (Stroebe et al., 2015a). Our study showed that homesickness was not associated with the duration of stay of sojourners in the host country, or the length of time they have been away from home. This implies that people should not assume that sojourners, or other migrants for that matter, are less likely to experience homesickness just because they have been away for a relatively longer period of time. This also points to the importance of providing support even to sojourners or migrants who have been in the host country for some time.

Theoretical and societal contributions

This current investigation extends theorizing in the fields of Media and Communication, as well as Acculturation and Clinical Psychology. First, we extend current theorizing in sojourners' adjustment by incorporating a concurrent communication model. Previously, studies on the impact of social interactions on homesickness and adjustment looked at social networks and communication channels separately (Berry, 2006; English et al., 2017; Rui & Wang, 2015; Ward et al., 2001). A concurrent communication model adopts a reinforcement assumption on the simultaneous use of communication channels (Dienlin et al., 2017). This allows for the investigation of the relative impacts of sojourners' social interactions (with the home- and the host-country networks via two communication channels, Facebook and FtF) on homesickness, and, in turn, on sociocultural adjustment.

This study also contributes by extending the application of the transactional feature of media effects and the reinforcing spirals model (Slater, 2015; Valkenburg et al., 2016) in the context of sojourners' adjustment. These are important assumptions in media and communication with regards to the reciprocal effects of media use and its outcomes. In particular, this current study demonstrated that sojourners' Facebook use with the host-country network and homesickness manifest a positive feedback loop – i.e., Facebook use with the host-country network lowered homesickness in the long- and short-term, and in turn, homesickness increased Facebook use with the host-country network in the short-term. This positive feedback loop is consistent with the two-process view proposed by Sheldon et al. (2011). Specifically, the two-process view explains how a particular social difficulty (e.g., homesickness) serves as a motivation for Facebook use, and how Facebook use, in turn, can alleviate the social difficulty. This current study provides an application of the two-process view in sojourn experiences.

Moreover, this study contributes to the body of literature on homesickness and adjustment by testing the assumptions of the Dual-Process Model of Homesickness (DPM-HS) proposed by Stroebe and colleagues (2015b) which hypothesizes that: 1) homesickness (home factor) is conceptually delineated from new place adjustment experiences (new place factor); and 2) homesickness and sociocultural adjustment have reciprocal effects. Previous theorizing on homesickness have confounded the conceptualization of homesickness as including both home and new place factors (Stroebe et al., 2015a, 2015b). This study attempted to validate the DPM-HS. On the one hand, the findings of this dissertation supported the argument that homesickness and adjustment are two separate constructs. However, we did not find support for the reciprocal effects of homesickness and adjustment that DPM-HS predicted. Our findings showed that that homesickness had an effect on sociocultural adjustment in the short-term, but did not provide evidence for the possible impact of sociocultural adjustment on homesickness. Future studies accounting for these reciprocal relations are needed to test the robustness of the current findings.

This study also contributes to society by providing sojourners and their support networks information that could help sojourners in their adjustment in the host-country. This study provides insights on the social factors that may help international students cope with homesickness. Such information could also be helpful for formal support providers (such as counselors, university international

offices, embassies, etc.) in designing programs and services for sojourners to cope with homesickness and other sojourn-related adjustment difficulties. It is important to note that the models tested in this study could have predictive values that might be useful in anticipating possible extreme negative consequences of using Facebook in dealing with sojourn-related social difficulties, such as homesickness. With these information, support providers and sojourners themselves are aware of the risks (e.g., online addiction) of relying on Facebook to deal with homesickness. There should be information campaigns, counseling services, therapies or rehabilitation programs available for sojourners in relation to (problematic) Facebook (or social media) use. Lastly, these results could also provide insights on the practical consequences of the use of other forms of computer-mediated communication among sojourners. It is important to note that support programs should not merely focus on early sojourners. Sojourners who have been in the host country for a relatively longer period of time still needs assistance.

Limitations and recommendations

We have to take into consideration several limitations when interpreting the results of this current study. Considering other studies that focused on similar populations, this study had a relatively good sample size (Zhang & Goodson, 2011). However, future studies should ensure a larger sample size across the waves for greater statistical power and greater flexibility in SEM (e.g., latent variable modeling). Due to the limited sample size, the results of this current study should be interpreted with caution. The sample size also limited the inclusion of potential moderators or control variables (e.g., level of education, general Facebook use, host- versus co-national host-country networks, number of home-country visits, distance from the home country, etc.). Future studies should provide a more nuanced exploration of these variables to effectively capture the complexities of SNS use in sojourners' adjustment.

We selected the measures in this study based on the most commonly used operationalization of the variables in the literature. We recommend for future studies to validate the findings of this current study by using more current measures of the variables. We also recommend for future studies to explore the multidimensionality of homesickness and sociocultural adjustment. Our data are a part of a larger survey that covered several variables related to international students sojourn experiences, so we had to use shorter versions of scales. Also, we decided on a single-item measure for homesickness, not only because it was a short, valid measure, but also because most of the validated scales have items that overlapped with other variables in the survey (e.g., sociocultural adjustment, depression, perceived social support) (English et al., 2017; Stroebe et al., 2015a; Ward & Kennedy, 1999).

Another limitation of this current study is that the concept of culture was not directly tackled and was not included as a variable in the study. In previous research on sojourners' adjustment, culture was a prominent concept (Berry, 2006; Kim, 2017; Ward et al., 2001). Future studies should problematize and incorporate cultural variables in the study of homesickness. Stroebe et al. (2015a), for instance, mentioned that there might be cultural differences with respect to the experience of homesickness.

As of yet, there are no established theoretical or empirical bases for the choice of the time lag. We recommend doing more longitudinal studies to establish the temporal factor to detect effects among the variables in the study. We also suggest daily diary studies for a more in-depth examination of the interplay of home- and host-country interactions. It is also important to note that although this current study assessed directions of influence, it did not conclusively establish causal effects (Finkel, 1995). Further investigations could help validate the causal assumptions included in this study.

The results of this study are limited to Facebook and cannot be generalized to other relevant communication platforms such as video-calling and instant messaging. It would be useful to validate our findings in relation to other forms of computer-mediated communication and social media in general. Finally, we recommend testing our models on other populations migrant populations (e.g., domestic sojourners, expatriates, immigrants, refugees, and asylum seekers). Some populations are at a higher risk and receive less institutional support compared to international students, such as undocumented immigrants and refugees.

Conclusions

In summary, international students experienced less homesickness when they interacted with the host-country network on Facebook, both in the short- and in the long-term. When they did feel homesick, they immediately turned to the host-country network on Facebook to seek solace. Furthermore, homesickness had an immediate negative impact on international students' sociocultural adjustment. We did not find any support to the idea that sociocultural adjustment might cause homesickness. The findings of our current study extend current theorizing by providing further empirical support to relevant theories in the fields of communication and cross-cultural studies. First, we provided support for the sojourner's adjustment models (e.g., Berry, 2006; Ward & Kennedy, 1999) as applied in the context of Facebook interactions. Moreover, our study provided additional evidence for important theoretical assumptions such as the transactional feature of media effects (Valkenburg et al., 2016), reinforcing spirals (Slater, 2015), the two-process view of Facebook use (Sheldon et al., 2011), and the Dual Process Model of Homesickness (Stroebe et al., 2015b). Our findings present important implications on the value of Facebook use for international students. Facebook interaction with the host-country network could help international students in dealing with homesickness; however, there are potential serious implications that they must be aware of when Facebook is used to solve social difficulties. To answer the question, does more Facebook use predict less homesickness? Facebook, particularly when used to interact with the host-country network, could be useful to relieve homesickness, and this in turn, could facilitate sociocultural adjustment.

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