Self-Esteem, Self-Disclosure, Self-Expression, and Connection on Facebook: A Collaborative Replication Meta-Analysis

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ABSTRACT. This replication meta-analysis explored the robustness of a highly cited study showing that those with low self-esteem perceived benefits for self-disclosure through Facebook compared to face-to-face interactions (i.e., Forest & Wood, 2012, Study 1). Seven preregistered direct replication attempts of this study were conducted by research teams as part of the Collaborative Replication and Education Project (CREP), and results were meta-analyzed to better understand the strength and consistency of the effects reported in the original study. Half of the original results were clearly supported: Self-esteem negatively predicted perceived safety of self-disclosure on Facebook as compared to face-to-face interactions (meta-analytic effect size = -.28, original effect size = -.31), and self-esteem did not relate to perceived opportunities for self-expression; across the 7 replications, all 95% confidence intervals (CIs) for effect sizes included 0. However, 2 other findings received less support: Self-esteem only weakly and inconsistently predicted perceived advantages of self-disclosure on Facebook (meta analytic effect size = -.16, original effect size = -.30), and contrary to the original study, there was no evidence for self-esteem predicting perceived opportunities for connection with others on Facebook (6 of the 7 replication effect size CIs contained 0). The results provided further evidence regarding the original study’s generalizability and robustness. The implications of the research and its relevance to social compensation theory is presented, and considerations for future multisite replications are proposed.

Among social network sites, Facebook is a dominant platform that affects the thinking, emotions, behavior, and interactions of its active users, some two billion people worldwide, including 70% of the U.S. population (Facebook, 2017; Fiegerman, 2017; Kemp, 2017). It is therefore important that psychologists better understand how Facebook use is related to psychosocial factors. Indeed, since its advent in 2004, scholars have published over a thousand articles on psychological issues related to Facebook.

Forest and Wood (2012) provided one of the first and most highly cited psychological examinations of Facebook use and psychosocial factors. As of December 2017, Elsevier’s Scopus citation metrics show the article has been cited 145 times (12.17...
times the average for similar articles), putting it in the 99th percentile of citations for psychology articles in the previous 18 months. Forest and Wood speculated that Facebook had benefits for people with low self-esteem who might otherwise have difficulty with face-to-face (FTF) interactions, and hypothesized that people with low self-esteem would perceive Facebook as a safer place to self-disclose, and a better place to express their emotions with others as compared to FTF interactions. Study 1 provided mixed support for their hypothesis: Compared with higher self-esteem individuals, those lower in self-esteem saw Facebook as a safer and more advantageous place for self-disclosure as compared to FTF interactions (Forest & Wood, 2012, Study 1), but self-esteem did not predict participants’ perceptions of Facebook as offering greater opportunities for self-expression. Thus, the authors concluded that people with low self-esteem might prefer Facebook over FTF interactions as a means to improve their social relations.

Given the potential implications of these findings and their high impact, several research teams at U.S. colleges and universities replicated the study as part of the Collaborative Research and Education Project (CREP; Grahe et al., 2016; https://osf.io/wfc6u/). CREP was designed to verify research findings that are highly cited in top journals by conducting large-scale replications, and to give valuable research experience to undergraduate psychology students. Thus, as they complete their courses, students have become producers of science rather than merely consumers. The present research presented a meta-analysis of these studies, and to our knowledge, was the first published research completing a meta-analysis of a CREP replication and the first replication(s). Conceptual replications alter one or more aspects of the study to extend the original study to report the degree of similarity between the original research findings and the replication(s). Conceptual replications alter one or more aspects of the study to extend the original conclusions. All studies reported in this research were direct replications of the original.

Increasingly, replications are seen as a mechanism to improve our scientific enterprise (Edlund, 2016). Social media and technology have increasingly been used to conduct large-scale crowd-sourced replications, including the Reproducibility Project for Psychology (Open Science Collaboration, 2015), whereby 200 researchers replicated 100 studies published in three top journals in 2008, as well as the various Many Labs projects (Many Labs 1–5; Ebersole et al., 2016; Ebersole et al., 2017; Klein et al., 2014; Klein, Ebersole, et al., 2017; Klein, Vianello, et al., 2017). CREP developed to address the replication crisis by capitalizing on research projects completed by undergraduate psychology majors in methods and capstone courses† (Grahe et al., 2012; Grahe & Hauhart, 2013; Hauhart & Grahe, 2010). These projects reflect major advances in replication methodology and meta-science by going beyond single “episodes” of replications, taking better account of the “historical track record” of scientific theories (Faust & Meehl, 2002, p. 2).

The CREP compiles replication efforts from independent teams of undergraduate researchers across the United States. Projects are peer-reviewed before the data collection begins to ensure fidelity to the original procedures. Data and results are made publically available on the Open Science Framework (OSF) repository, and a researcher might include the results of individual replications into a meta-analysis as Calin-Jageman, Lehmann, and Elliott (2017) are doing with both published and CREP samples.

There have been debates about the “proper” way to conduct replications. For example, one debate distinguished between direct (also called “close”) and conceptual replications (Brandt et al., 2014; Simons, 2014; Stroebe & Strack, 2014). Direct replications approximate the exact conditions of the original study to report the degree of similarity between the original research findings and the replication(s). Conceptual replications alter one or more aspects of the study to extend the original conclusions. All studies reported in this research were direct replications of the original.

Beyond the degree of match between the original and replication, the goals of replication also vary across studies. Anderson and Maxwell (2016) identified six goals of replications: (a) to infer the existence of an effect, (b) to infer the null effect, (c) to accurately estimate the effect size, (d) to combine

† It is important to note that the CREP is not the only meta-science project for undergraduate research (see e.g., Registered Reports and Pipeline projects; Grahe et al., 2016).
the results between replication and original, (e) to determine if the replication and original provide inconsistent results (disparity of effect sizes), and (f) to determine if the replication and original provide consistent results (equivalence of effect sizes). In their content analyses of 50 studies, there was a clear preference for Goal 1, to infer the existence of an effect, but they recommended that researchers broaden their definition of replication by recognizing these various goals in planning and reporting replication studies.

Because of the nature of our replication study, we were most interested in addressing Anderson & Maxwell’s (2016) Goals 1 and 5, and a modified version of Goals 3 and 4. We now describe these goals as applied to the current study in more detail. In addition to traditional significance tests on the focal effects in the replication studies (Goal 1), we tested whether the effect size from each replication study was statistically different from the original (Goal 5). We did not develop these studies expecting a null finding, so Goals 2 and 6 are not presently applicable. Consistent with Goal 3, we reported confidence intervals (CIs) around our effect sizes to highlight accuracy, but fully committing to Goal 3 would require a different form of sample size planning (accuracy in parameter estimation; see Maxwell, Kelley, & Rausch, 2008). Further, because we had the advantage of presenting findings from several replication studies, rather than a single replication, we conducted a modified version of Goal 4, wherein we meta-analytically combined the seven replication study results rather than combining a single replication with the original. By using these cutting-edge methods to evaluate the CREP replications, our results provided a more complete picture of replication than the majority of previously published replication studies, many of which used only a simple significance test on a single replication.

**The Present Replication Meta-Analysis**

In the present investigation, we meta-analyzed replications of Forest & Wood’s (2012) Study 1 that were retrieved from CREP contributions with published data and/or results on the CREP project pages. These CREP research teams represented five diverse institutions, both public and private, in urban, suburban, and rural settings in the eastern, midwestern, and western United States, both teaching-focused and research-intensive, and from fewer than 2,000 to over 50,000 students. The teams of 2–9 undergraduate students and faculty mentors followed the same methodology, with slight deviations.

**Method**

**The General CREP Procedure**

The CREP Advisory Board (see https://osf.io/z4k5/) selected high-impact studies for replication. Specifically, the board selected the top three or four most-cited articles from the top journal in each of nine subdisciplines from the prior three years. Studies were selected based on high feasibility for undergraduate researchers. Forest and Wood’s (2012) Study 1 was selected for this reason by the CREP team in 2015. Authors of selected articles received a standard letter informing them of the purpose of the CREP project and how their study was selected. Authors were able to provide further suggestions to the project leaders before studies were published for replication. In the present research, the authors provided no further suggestions for the replication.

A list of selected studies was published on the CREP project page (see https://osf.io/flaue/). Potential contributors (most often undergraduates, but also their faculty mentors) reviewed the list and informed project leaders of their intention to replicate as either Direct replications (matching the procedures of the original study as closely as possible) or Direct-Plus replications (where additional dependent variables can be measured after the original procedure is complete).

Contributors and their faculty mentors (whose function was to guide contributors and ensure high quality procedures for data collection and analyses) compiled evidence of their ability to conduct the study (completed study materials, a video of the experimental procedure, and evidence of institutional review board approval). Contributors’ project materials were reviewed by a CREP team consisting of three faculty reviewers (Executive Reviewer, plus two reviewers) and a student administrative advisor. After receiving approval of the replication materials and procedure, contributors preregistered their studies before data collection. The CREP team specified the minimum sample size required for the replication; this size was generally set at the original study’s sample size, which was small enough to be feasible for undergraduate student researchers, but set at 100 for larger studies. All studies in this meta-analysis received this approval by the CREP team, collected the minimum number of participants specified by the CREP (80 for the present study because this was the sample size in
the original study), posted their raw dataset, and reported a summary of results.

**Participants in and Procedures of Forest and Wood (2012) CREP Replications**

Participants in all studies were undergraduate students at the five universities and colleges in the United States where the replications were conducted from February 2016 to June 2017 (see Table 1 for a list of the participating institutions). Sample sizes ranged from 80 to 374. Five participants who were not Facebook users were excluded from analyses. The average age in the seven datasets ranged from 19.3 to 26.2 (SDs ranging from 1.4 to 9.7), compared with 21.35 years for the original study. Across datasets, 67% of all participants were women and 33% were men, compared with 73% and 21% in the original study (6% were “undisclosed”).

In three replications (BYU-Wi17, IIT-Sp16, and IIT-Sp17), race data was collected, but in all other studies no other demographic information was collected because the original Forest and Wood (2012) research did not indicate that any other demographic information was collected (see Table 2 for demographic statistics).

After informed consent, participants completed the 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965), which assesses global self-esteem on a scale of 1 to 4 (1 to 5 in two of the studies). Research teams combined all items such that higher scores indicated higher self-esteem. The score showed good reliability across datasets (α coefficients range from .88 to .91). The composite self-esteem score was mean centered in accord with the Forest and Wood (2012) analysis.

Next, participants completed a measure of Facebook use perceptions created by the original researchers (Forest & Wood, 2012). Three items each assessed the degree to which participants believed Facebook enabled them to express themselves and to connect with others. Perceived safety of self-disclosure on Facebook compared to in-person interactions was measured with nine items. Ten more items assessed perceived advantages of disclosing on Facebook versus FTF. All items were rated on a scale ranging from 1 to 7 with higher scores representing greater perceived expression, connection, safety, and advantages. Subscale scores showed adequate to good internal consistency (expression: α ranged from .70 to .80; connection: .68 to .84; safety: .84 to .91; advantages: .89 to .94; these compare to .88, .72, .87, and .93, respectively, in the original study).

Some research teams chose a Direct-Plus replication and included additional personality-type measures following the primary measures. Because they followed the primary measures, and the results are not relevant to the present research, they are not presented here.

As the original research did not specify whether participants completed questionnaires in a lab or online, researchers employed both methods (three replications had participants complete in lab only, two used online only, and two used both methods). Participants completing questionnaires in the lab did so alone, except for the Southern Arkansas University replication, which ran participants in groups of two to six. Two other known differences across replications involved minor discrepancies in presentation of the Rosenberg Self-Esteem Scale: (a) one study (IIT-Sp16) had slight differences in item order and in wording on 4 out of 10 items (e.g., ‘At times I think I am no good at all’ vs. ‘I think I am no good at all’), and (b) most replications used the original four-point scale, although two replications (IIT-Sp16 and IIT-Sp17) used a five-point scale. Three studies were Direct-Plus replications that included measures of personality, presented after participants completed self-esteem and Facebook perception measures for the replication, in order to test novel hypotheses (see https://osf.io/726nx/ for a spreadsheet listing various study characteristics). These –Plus measures were not included in the present analyses although interested researchers can find the original data at the CREP OSF project (see https://osf.io/pcm95/ for links).

After completion of data collection, teams independently analyzed the results and posted their materials, data, and results on their project’s OSF pages. Contributors did not always post analysis scripts, so procedures to account for missing data are not known for all studies. Two studies included analysis scripts that showed scores for all scales were mean averaged. The means for scores in most studies implied that the items were mean averaged, but the Gordon study’s mean implied items were summed.
The Present Meta-Analysis

This meta-analysis synthesized seven direct preregistered replications of Forest and Wood (2012) Study 1 that were part of the CREP project (see https://osf.io/pcmq5). The Forest and Wood (2012) CREP replication project page on the OSF has 17 “forks” representing research teams or institutions that have started the replication process (see https://osf.io/pcmq5/forks/). These teams generated seven studies that met the minimum sample size, and posted data and results for the study in the OSF repository. All seven studies were included in this meta-analysis.

Effect size extraction. The original Forest and Wood (2012) regression results included $t$ statistics and degrees of freedom for all variables, so we chose to calculate effect size $r$ for all four outcome variables in the study. The replication effect size $r$ statistics were calculated in the same way for consistency. One replication study failed to report regression results, so we calculated the regression statistics from the study’s dataset, which

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Study & Authors & \multicolumn{4}{c}{Express} & \multicolumn{4}{c}{Connect} & \multicolumn{4}{c}{Safety} & \multicolumn{4}{c}{Advantageous} \\
& & $N$ & $\beta$ & $p$ & $\beta$ & $p$ & $\beta$ & $p$ & $\beta$ & $p$ & $\beta$ & $p$ & $\beta$ & $p$ \\
Original & Forest & 80 & n/a & .181 & .220 & .050 & .310 & .005 & .300 & .011 & \\
BYU-Wi17 & Foster et al. & 90 & .124 & .245 & .048 & .651 & .205 & .052 & .193 & .069 & \\
Gordon & Nicholson et al. & 80 & -.098 & .388 & -.209 & .062 & -.335 & .002 & -.300 & .007 & \\
IIT-Sp17 & Legate et al. & 94 & .048 & .647 & .178 & .087 & -.396 & <.001 & -.173 & .096 & \\
MSU & Tweiten et al. & 374 & .060 & .240 & .060 & .269 & -.280 & <.001 & -.110 & .032 & \\
SAU & Everett et al. & 81 & .060 & .594 & .237 & .033 & .300 & .006 & -.235 & .034 & \\
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\caption{Regression Results for Original and Replication Studies}
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& & & & & & & & & \\
Study & Gender & Race/Ethnicity & Predictor & Outcome Mean (SD) & \\
& & & & & & & & & \\
BYU-Sp16 & Male & Female & Other & White & Hispanic & Asian & Black & Other & \\
& 90 & 23 & 67 & n/c & n/c & n/c & n/c & n/c & \\
BYU-Wi17 & 90 & 19 & 71 & 70 & 3 & 1 & 3 & 1 & \\
Gordon & 80 & 14 & 66 & 70 & 9 & 3 & 1 & 21 & \\
IIT-Sp16 & 116 & 78 & 38 & n/c & n/c & n/c & n/c & n/c & \\
IIT-Sp17 & 94 & 47 & 47 & 42 & n/c & 39 & 13 & 21 & \\
MSU & 374 & 112 & 260 & 2 & n/a & 38 & 13 & 21 & \\
SAU & 81 & 14 & 67 & n/c & n/c & n/c & n/c & n/c & \\
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\end{tabular}
\caption{Descriptive Statistics for All Replication Studies}
\end{table}

Note. Beta coefficients are standardized (consistent with the original research). Effect size $r$ is equivalent to the beta coefficient. BYU = Brigham Young University—Idaho, Rexburg, ID; Gordon = Gordon College, Wenham, MA; IIT = Illinois Institute of Technology, Chicago, IL; MSU = Michigan State University, East Lansing, MI; SAU = Southern Arkansas University, Magnolia, AR.

* The original study did not report a beta coefficient for this variable.

For one variable (opportunity to express self), only a marginal $t$ statistic ($< 1.36$) and nonsignificance were reported. Effect size $r$ for this variable was inferred by using the mean degrees of freedom from the three other outcome variables, and calculating effect size $r$ using a $t$ statistic of 1.35.

For the simple linear regressions considered in this meta-analysis, the standardized beta coefficient is equivalent to effect size $r$ but we used the calculated effect sizes because one result in Forest & Wood (2012) did not include the standardized beta coefficient.
was made openly available on OSF. Effect size \( r \) represented the size and direction of the relationship of self-esteem scores to the four outcome variables (opportunity to express self, opportunity to connect with others, safety of self-disclosure, and advantageous self-disclosure). The effect sizes had a positive sign if self-esteem was positively associated with the outcome variable and a negative sign if the relationship was negative.

**Meta-analytic method.** Each study was a direct replication of the original, so the materials and methods were very close to the original. However, methodological variations among the studies (e.g., collecting data on computers vs. paper-pencil) and heterogeneity of the host institution population led us to use a random- rather than fixed-effects model (Borenstein, Hedges, Higgins, & Rothstein, 2009). Analyses were conducted using the R package metafor (Viechtbauer, 2010). The \texttt{rma} function was used, which accepts the effect size \( r \) and N parameters (syntax is available on the OSF page https://osf.io/r659c/). We chose to use the restricted maximum likelihood (REML) model because it has been shown to exhibit less bias than the more commonly used DerSimonian and Laird (DL) model with small numbers of studies (Veroniki et al., 2016). The \texttt{rma} function converted effect size \( r \) to Fisher's \( z \) for the calculations, and we converted \( z \) back to effect size \( r \) for reporting of results (Borenstein et al., 2009). The function also reports heterogeneity statistics \( Q, I^2 \), and \( T^2 \). Finally, we conducted a fail-safe number (FSN) analysis (Rosenberg, 2005) using the \texttt{fsn} function. The FSN analysis was intended to identify the number of nonsignificant, unreported studies required to add to the meta-analysis to reduce a significant meta-analytic result to nonsignificance.

We also chose to analyze the effect size differences between the original study and each of the replications. Anderson and Maxwell (2016) proposed this as one of the goals of replication analysis (Goal 5, To assess whether replication is clearly inconsistent with original) and provided a statistical method for this goal. We adapted the method to use effect size \( r \) to estimate 95% CIs for the difference in effect sizes for each of the replications compared with the original study (Anderson & Maxwell, 2016; Bonett, 2008; syntax is available on the OSF, https://osf.io/r659c/). These CIs informed whether the replication effect sizes, \( r \), were significantly larger or smaller than the original study’s results.

**Results**

The original and replication study regression results are presented in Table 1. For each of the four outcome variables, we present the standardized beta and \( p \) value for the regressions. Table 2 shows each study’s descriptive statistics for gender, race, and the mean and standard deviation for self-esteem and each of the four outcome variables. Table 3 shows the effect size differences between the original and replication studies and their 95% CIs.
Facebook and Self-Esteem Meta-Analysis | Leighton, Legate, LePine, Anderson, and Grahe

Opportunity to Express Self
Consistent with the original study, all seven replications showed that self-esteem was not a significant predictor of participants seeing Facebook as enabling them to express themselves. Five of the seven studies showed an effect size descriptively smaller than the original study (.06 to .12 vs. .15), but all 95% CIs for the effect size difference included zero, indicating that the differences in magnitude between the original and replication studies were not significantly different than zero. Even though the effect size meta-analysis revealed that the point-estimate meta-analytic effect size of the seven replication studies, \( r = .08, p = .021 \), was statistically different from zero, and the 95% CI and prediction interval (PI) indicated that future studies would show an effect size between .01 and .14 (smaller than the original), all individual replications found regression coefficients not significantly different from zero. A forest plot of the effect size estimates is presented in Figure 1. The between-study variance in the replication studies did not appear to be heterogenous. Q(df = 6) = 4.75, \( p = .576 \); \( T^2 = 0 \), 95% CI [0%, .03]; \( I^2 = 0% \), 95% CI [0%, 79%]. The FSN was three studies. Effect size differences between the replications and the original study were small.

Opportunity to Connect With Others
Contrary to the results of the original study, six of the seven replication studies did not find self-esteem to be a significant predictor of opportunity to connect. It is worth noting that the original study obtained a \( p \) value of .05, and \( p \) values between .04 and .05 have been demonstrated to be relatively more likely in the case of a true null hypothesis than a false one (Lakens & Evers, 2014; Masicampo & Lalande, 2012). In all but one of the replications, the direction of the effect was opposite of the original study. Two of the replications found an effect size descriptively similar to the original study, with one of these in the opposite direction (-.21 to .24 vs. -.22); the remainder found effect sizes descriptively smaller than the original. Further, these descriptive differences were generally statistically significant: Five of the seven replications had effect sizes significantly smaller from the original study, as evidenced by 95% CIs for the difference in effect sizes that did not include zero. The point-estimate of the meta-analytic effect size was .09, 95% CI [-.01, .18], 95% PI [-.09, .26], \( p = .065 \). A forest plot is presented in Figure 2. The replication between-study variance showed limited evidence of heterogeneity statistics show considerable bias with small numbers of studies, so should be done with caution (Borenstein et al., 2009; von Hippel, 2015). We present heterogeneity statistics, but refrain from making conclusive interpretation.
heterogeneity, $Q(df=6) = 10.79, p = .095; T^2 = .006, 95\% CI [0, .09]; F^2 = 44.39\%, 95\% CI [0\%, 91.69\%]. The FSN was 5 studies.

**Self-Disclosure Safety**
Consistent with the original study’s findings, five of the seven replications found self-disclosure to be a significant predictor of perceptions that self-disclosure on Facebook was safer than in FTF interactions. Three of these five had effect sizes descriptively similar in size and direction as the original (-.28 to -.34 vs. -.31), and two had descriptively larger effect sizes (-.40 to -.45). However, these descriptive differences in magnitude were generally not statistically significant: Six of the seven replications had effect size differences from the original that were not significantly different from zero. The point-estimate of the meta-analytic effect size was $-.28, 95\% CI [-.40, -.15], 95\% PI [-.54, -.03], p < .001. The results are presented as a forest plot in Figure 3. The between-study variance showed some evidence of heterogeneity, $Q(df=6) = 18.69, p = .005; T^2 = .02, 95\% CI [0\%, 0.15]; F^2 = 44.39\%, 95\% CI [27.06\%, 94.69\%]. The FSN was 133 studies.

**Self-Disclosure Advantages**
Four of the seven replication studies were consistent with the original study and showed self-esteem to be a significant predictor of perceptions that Facebook provided opportunities to express the self, with all studies having 95\% CIs that include zero. The effect sizes were mostly smaller than the original, the summary effect size was about half of the original’s effect size, and the PI [.01, .14] showed that 95\% of future studies would find an effect size smaller than or equal to the average of the replications to the original were not significantly different from zero. The variance measures showed similar in size and direction as the original (-.28 to -.34 vs. -.31), and two had descriptively larger effect sizes (-.40 to -.45). However, these descriptive differences in magnitude were generally not statistically significant: Six of the seven replications had effect size differences from the original that were not significantly different from zero. The point-estimate of the meta-analytic effect size was $-.28, 95\% CI [-.40, -.15], 95\% PI [-.54, -.03], p < .001. A forest plot is presented in Figure 4. The variance measures showed little evidence of heterogeneity, $Q(df=6) = 5.81, p = .445; T^2 = 0, 95\% CI [0\%, 0.03]; F^2 = 6.08\%, 95\% CI [0\%, 79.94\%]. The FSN was 36 studies.

**Discussion**
The current study explored the results of a recent effort to replicate findings from Forest and Wood’s (2012, Study 1) study of self-esteem as a predictor of Facebook users’ perceptions of the site’s usefulness for self-expression, self-disclosure, and connection with others. The goal of the current research was to help better estimate the robustness of the original study’s effects, and we provide mixed evidence in favor of the original study’s findings and suggest the need for further testing.

The replications supported the original study’s finding that self-esteem was not a significant predictor of perceptions that Facebook provided opportunities to express the self, with all studies having 95\% CIs that include zero. The effect sizes were mostly smaller than the original, the summary effect size was about half of the original’s effect size, and the PI [.01, .14] showed that 95\% of future studies would find an effect size smaller than or equal to the average of the replications to the original were not significantly different from zero. The variance measures showed little evidence of heterogeneity, $Q(df=6) = 18.69, p = .005; T^2 = 44.39\%, 95\% CI [27.06\%, 94.69\%]. The FSN was 133 studies.
than the original study’s, all factors indicating the presence of publication bias in the original study. The PI came close to, but did not include, zero so it may be that there is an effect, but small enough to be difficult to detect. The FSN analysis, which indicated that only five unreported studies could reduce the results of the meta-analytic effect size $p$ value to nonsignificant, led us to be confident that future replications would find the same lack of an effect as our replications.

Another finding consistent with the original was that lower self-esteem was a significant predictor of perceiving Facebook as a safer place to self-disclose than FTF. Most of the replications found this result, although two of the seven studies had effects whose CIs included zero. The point estimate of the effect size in the replications (-.28) was close to the original (-.31). The 95% PI [-.40, -.15] indicated that future studies would be likely to find such an effect as well. These results also seemed to be somewhat robust, as indicated by a high FSN (133). We can conclude with some confidence that individuals with low self-esteem feel safer self-disclosing on Facebook than in FTF interactions, and that the size of this effect is considerable.

The replication studies were more mixed in their support of the original study’s finding that self-esteem was a predictor of the perception that Facebook is advantageous for self-disclosure over FTF. Only four of the seven replication studies showed such an effect, with the other three showing nonsignificant effects. All of the replications showed effects in the same direction as the original, but with widely varying and smaller effect sizes than the original (-.02 to -.30 vs. -.33), the latter finding consistent with the original study’s larger susceptibility to publication bias than replication studies. Nevertheless, the point-estimate of the effect size in the replications of -.16 was significantly different from zero, and the PI [-.24, -.08] indicated that future studies are likely to find such an effect. In addition, the moderately large FSN (36) indicated that the findings were relatively stable. Future studies seem likely to find that self-esteem would predict users’ perception that Facebook was more advantageous for self-disclosure than FTF, but the effect should be smaller in size than the original study’s finding.

The replication studies and their meta-analysis seem to contradict the original study’s findings that low self-esteem was a significant predictor of perceptions that Facebook has opportunities to connect with others. The summary estimate of the effect size was opposite in direction to the original in six of the seven replications and nonsignificant in all but one. However, the meta-analytic effect size was .09 and significantly different from zero. We believe that it will be unlikely that future studies will find an effect similar to the original, supported by the 95% PI of [-.07, .27], which includes zero. These findings also seemed somewhat unstable, as shown by the low FSN (11 studies).

In summary, this meta-analysis of the CREP replications of Forest and Wood’s Study 1 (2012) found that future researchers can be relatively confident of finding that low self-esteem predicts perceptions that Facebook is a safer and more advantageous place to self-disclose than FTF interactions. Our results also align with the original study’s finding that self-esteem does not relate to perceiving opportunities to express oneself on Facebook. However, we are less confident that self-esteem will be shown to predict perceptions of Facebook as having opportunities to connect with others, as the original study found.

**Implications of the Present Research**

When choosing what information to self-disclose, people engage in a benefits-risk analysis to maximize the benefits of self-disclosure (e.g., social support) and minimize the risks (e.g., vulnerability; Bazarova & Choi, 2014). Self-disclosures on Facebook can be made without some of the immediate indicators of disapproval present in FTF interactions, and thus increase the tendency to self-disclose (Hollenbaugh & Ferris, 2014). This perspective is supported by the present research. Our meta-analysis confirmed the original study’s findings, that, when compared with individuals high in self-esteem, those with low self-esteem saw Facebook as a safer and more advantageous way of self-disclosing relative to FTF interactions.

The present research also provides some support for social compensation theory (McKenna & Bargh, 2000; Wilson, Gosling, Graham, 2012). This theory suggests that, for those with lower self-esteem, the anxiety provoked by FTF interactions can be somewhat mitigated in online interactions. However, the CREP studies did not include a measure of FTF vs. online anxiety, making this an interesting direction for future research.

Eşiksu, Hoşoğlu, and Rasmussen (2017) recently suggested that social compensation theory might predict that those with lower self-esteem may use Facebook to express themselves and connect with others rather than the more anxiety-provoking
FTF. Their study found a significant negative relationship ($r = -0.11$) between self-esteem and using Facebook for acquaintance-related functions (e.g., being known by others and meeting new people), suggesting that those lower in self-esteem used Facebook for connection and expression. This finding runs contrary to the results of our meta-analysis, as our effect size estimates for connection and expression are positive but not significant, and are weak and inconsistent. This suggests a number of possibilities, one of which is that their findings may only generalize to Turkish university students, possibly due to a move in the United States and United Kingdom away from Facebook and toward Instagram and Snapchat among those 13–24 years olds (eMarketer, 2016, 2017). It is also possible that more collectivist cultures, like Turkey (Oyserman, Coon, & Kemmelmeier, 2002), with their emphasis on group-based self-perception, may prompt people to use Facebook for different reasons than those in individualist cultures. In more collectivist cultures, people with lower self-esteem may use Facebook to connect and express themselves to enhance their group membership. In contrast, in an individualist culture, with its emphasis on individual self-concept, people with greater self-esteem may see Facebook as a place to express their individual qualities and connect with other individuals. These hypotheses remain to be tested across cultures by future researchers.

Another possible explanation for our findings is that differences between the original and replication results might be related to changes in social media usage patterns from 2012 to 2016. By the time the replications occurred in 2016–17, both Snapchat and Instagram were among a new crop of social media outlets for US and UK participants that challenged Facebook as the preferred social networking site for the age cohort of the participants in this research (eMarketer, 2016, 2017). More specifically, among Facebook, Twitter, Instagram, and Snapchat, self-expression was recently found to be a significant predictor of usage only on Instagram and Snapchat among college-aged participants, and social interaction (connection in the terminology of Forest and Wood, 2012) was a greater motivation for use of Instagram and Snapchat than Facebook and Twitter (Alhabash & Ma, 2017). Participants in our replication studies might have been implicitly comparing Facebook usage to Snapchat and Instagram when rating its usefulness for self-expression and connection with others, whereas these platforms would not have been a consideration for participants in Forest and Wood’s (2012) study. Thus, future researchers should take into account changes in usage patterns among the platforms in designing research on social media usage, motivations, and intrapersonal benefits.

**Limitations and Caveats**

A major limitation in the present research is the relatively small sample of studies in the CREP project. Seven studies provide important data about the replicability of a finding, but severely limit the inferences we feel confident to draw from the data. For example, heterogeneity measures are known to be biased for meta-analysis involving small numbers of studies (Borenstein et al., 2009; von Hippel, 2015). Consequently, we are reluctant to draw conclusive inferences from the heterogeneity statistics.

Another impediment to drawing better conclusions relates to some of the variations in the studies. For example, not all studies posted analysis scripts or narratives to help us determine such things as missing data handling, composite score calculations, data exclusions, etc. Data were not always collected or stored consistently (e.g., race collected in some but not all studies; individual item-level data were not always stored). These issues indicate the need for more specific instructions for contributors that are specific to the study being replicated to ensure consistent data handling and documentation.

We are also hesitant to propose moderators of the effects observed in the replication studies even though we know there are methodological and procedural differences between the studies (i.e., in-person vs. online; individual participants vs. groups; wording on questionnaires; additional measures). Because each of these potential moderating factors occurred in only one or two of the seven replications, we chose not to explore these issues in more depth. Future researchers designing coordinated, large-scale replication studies may want to design controlled tests of some of these factors.

When comparing the effect sizes of the four outcome variables between the original study and the replication studies, we are constrained in our inference or conclusions by relatively wide CIs. This is primarily caused by the small sample size of the original study, as well as the rather small sample sizes of the replication studies. Generally, the sample sizes required for precision in comparing the difference in effect sizes will be larger than for judging simple significance. Future large-scale
replication attempts should consider increasing sample size to attain adequate power and precision for inferences to be made more confidently (see Anderson & Maxwell, 2017 for a comparison of sample size planning for replication studies).

Conclusion

The awareness that some, if not many, single-study results in psychology may not be replicable has spurred a new interest in replication studies. Although single-study replications can help lend confidence to our conclusions about the veracity of the replicated study, the use of larger-scale, multiple, independent replication attempts can provide more and higher quality data. These data can be aggregated and used to more accurately estimate the effect size likely to be found in future studies.

We are encouraged that the emerging meta-science methods being used by large scale replications such as the Reproducibility Project for Psychology, Many Labs, and CREP projects will begin to contribute to greater confidence in our conclusions from findings that are highly cited in our top journals. Replication is neither a silver bullet, nor is it insignificant. It has been called “the demarcation criterion between science and nonscience” (Braude, 1979, p. 2) and “the coin of truth.” (Braude, 1979, p. 19). It may not advance science by leaps and bounds, but “nonscience” (Braude, 1979, p. 2) and “the coin of science” (Braude, 1979, p. 39). It has been called “the demarcation criterion between science and nonscience” (Braude, 1979, p. 2) and “the coin of truth.” (Braude, 1979, p. 19).

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This manuscript qualifies for a replication badge; it replicates a study reported by Forest and Wood (2012).

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