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Cyberbullying Perpetration: A Meta-Analysis of Gender Differences

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Abstract: A total of 39 articles, which reported cyberbullying behaviors from both male and female respondents, were meta-analyzed to examine if gender difference existed in cyberbullying perpetration. From these 39 empirical studies, a total of 100 effect sizes were collected, each representing a reported gender difference in certain types of cyberbullying behaviors. Random-effects meta-regression models were used in data analysis. Despite some inconsistencies across the individual empirical studies, a statistically significant gender difference emerged, indicating that more males were involved in cyberbullying perpetration behaviors than females. Moderator analysis showed that the gender difference was not consistent across the levels of several study features (e.g., modality of cyberbullying, regions of samples). It was also revealed that some methodological issues (e.g., measurement of cyberbullying behaviors, self-report rather than behavioral data) remain obvious challenges for researchers in this area. Caution is warranted, because those studies that were rated as having poor study quality showed a larger than average effect size for gender difference in cyberbullying behaviors. Implications and future research directions are discussed.

Keywords: Bully, cyberbullying, gender, meta-analysis, effect size

Introduction

The Internet has increasingly permeated into all aspects of the society in the past two decades, and it has been bringing tremendous benefits to all walks of life. However, this medium, with its convenience and transformational changes to the society, may sometimes function as a double-edged sword, by creating opportunities for the dark side of human behaviors to flourish. One such dark-side human behavior is cyberbullying perpetration. Cyberbullying, as an emerging phenomenon, is becoming a prominent social issue that is receiving more attention from the society in general, and from social science researchers in particular. Relevant research concerning cyberbullying has examined various relevant issues and topics, including possible correlates for cyberbullying behavior (e.g., Ak, Özdemir, & Kuzucu, 2015; Dilmac, 2009) and psychological impact of cyberbullying (Bonanno & Hymel, 2013; Reed, Nugent, & Cooper, 2015), etc. For instance, Cross et al. (2015) pointed out a range of factors at the levels of the individual, family, peers, and the community may interact with cyberbullying. Among the studies on cyberbullying, a focal question is about the relationship between gender and cyberbullying (e.g., Li, 2006, 2007; Wang, Iannotti, & Luk, 2012).

In this paper, we systematically review the past research on gender and cyberbullying, with the focus on the empirical findings about the possible gender group difference in cyberbullying perpetration. It should be noted, our study differs greatly from recent meta-analyses on the same topic (e.g., Barlett & Coyne, 2014; Kowalski, Giumetti, Schroeder, & Lattanner, 2014) in three aspects. First, prior meta-analyses only retained one effect size

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from one study if the study reported multiple effect sizes. As such, the loss of information could compromise statistical power and bias research results. In contrast, we used all relevant reported effect sizes in individual studies, and furthermore employed robust variance estimation method to account for the dependency of effect sizes (Hedges, Tipton, & Johnson, 2010). Second, we differentiated cyberbullying perpetration from cyber-victimization, and focused on perpetration in the current study (cf., Guo, 2016). In contrast, it is unclear whether prior meta-analyses distinguished the two measures. Furthermore, gender may correlate with cyberbullying perpetration and cyber-victimization in different manners (Lapidot-Lefler & Dolev-Cohen, 2015). Third, we coded more study features than prior analyses by incorporating both objective and subjective features (e.g., quality of a study). As Selkie et al. (2016) reported, most studies on cyberbullying scored poorly on their quality of design, implementation, and presentation.

Our general goal is to provide a quantitative summary of the research findings about gender and cyberbullying, and to provide an assessment about how measurement and operationalization of cyberbullying could have moderated such findings. After reviewing the relevant literature, we describe our meta-analysis research procedures, present the analysis findings from the collection of the empirical studies, provide discussions on the implications of the findings, and finally, suggest research directions for future cyberbullying research.

Literature review

Conceptualization of cyberbullying

Although research on cyberbullying has been growing rapidly, conceptualization of what constitutes cyberbullying is no easy task. Gahagan, Vaterlaus, and Frost (2016) criticized that researchers often use the same terminology of cyberbullying, but define it differently and hence may study different phenomena. In general, researchers agree that cyberbullying is a form of aggression, and involves the use of the Internet and the related new technologies. To date, the most frequently cited definition of cyberbullying is from Smith et al. (2008), "an aggressive, intentional act carried out by a group or individual, *using electronic forms of contact*, repeatedly and over time against a victim who cannot easily defend him- or herself" (p. 376). It should be noted the definition is derived from the concept of traditional bullying, which features aggressive, intentional, and repetitive acts against relatively powerless victims (Olweus, 2012). Indeed, researchers have been debating about the commonalities and distinctions between traditional bullying and cyberbullying. According to Smith et al.'s definition, the only difference between traditional bullying and cyberbullying is whether bullying involves the usage of electronic media. That, however, may not fully account for the conceptual nuances between the two different forms of bullying. As Bayraktar, Machackova, Dedkova, Cerna, and Ševčíková (2015) summarized, cyberbullying differs from traditional bullying in many aspects (e.g., cyberbullying in general is more indirect and involves minimal physical strength).

Barlett and Gentile (2012) compared cyberbullying with traditional bullying, and stressed that the distinctions include a power imbalance between an aggressor and its victim in traditional bullying, a lack of visibility of the aggressor in the cyberspace, and the different types of behaviors that the cyberspace allows. Menesini and Nocentini (2009) commented on the complex nature of cyberbullying and criticized the lack of rigor in defining cyberbullying under the framework of traditional bullying. Compared to traditional bullying, cyberbullying may not involve the imbalance of power, and may not have the characteristic of repetitiveness as defined for traditional bullying, either. Such a criticism was also echoed by Pieschl, Porsch, Kahl, and Klockenbusch (2013), arguing against using the characteristics (e.g., imbalance of power, repetition, intention to harm, etc.) of traditional bullying to define cyberbullying, even though these two forms of bullying (traditional bullying and cyberbullying) do overlap in certain aspects. As such, the authors proposed to distinguish cyberbullying from alternative terms such as online harassment or attacks.

Previous research has considered the conceptual structure of cyberbullying from different perspectives. Griezel, Craven, Yeung, and Finger (2008) empirically examined the factor structure of the measures for traditional bullying and cyberbullying, and observed that traditional bullying mainly consisted of physical, verbal, and social dimensions, whereas cyberbullying mainly consisted of visual and text dimensions. Abeele and Cock (2013) reviewed past research and noticed two different modes of cyberbullying: direct cyberbullying in which the victim is directly involved (e.g., sending insulting message directly to the victim) and indirect or relational cyberbullying (e.g., gossiping behind the back). In their study of cyberbullying via mobile phone, they differentiated three forms of bullying: gossiping, using voice calls or text messages to intentionally bully, and making a picture or video to hurt another. Qing (2015) further pointed out that the new forms of technologies (e.g., gaming) would pose further challenges to defining cyberbullying. And, inconsistencies in research may lead to wrong estimation of the prevalence of cyberbullying.

Measurement of cyberbullying

In addition to the challenges in defining cyberbullying, researchers also encounter issues in measuring cyberbullying. As Menesini and Nocentini (2009) noted, there was a severe lack of attention to measurement issues in the cyberbullying research. Some example measurement issues include the usage of global or unique questions for measurement, different understanding of this construct (i.e., cyberbullying) by different populations, and the difficulty in clearly defining the phenomenon because of the fast change of technologies. Similarly, Griezel, Craven, Yeung, and Finger (2008) called attention to the nature of cyberbullying, as well as the paucity of psychometrically sound tools to measure the construct. They summarized the main methodological issues plaguing cyberbullying research: atheoretical approaches, small sample sizes, use of single-item measures, and psychometrically inadequate assessment instruments. Recently, Lund and Ross (2016) called for more research on cyberbullying by employing samples targeting certain demographic groups such as non-white or sexual minority people.

In research practice, researchers often measure cyberbullying by asking respondents about their relevant online activities. Dehue, Bolman, and Vollink (2008), for instance, enumerated several patterns of cyberbullying, including bullying by MSN, hacking, e-mail, name-calling, gossiping, and ignoring. Such a classification, however, is not based on a theoretical conceptualization of cyberbullying. In a similar fashion, Willard (2007) listed eight forms of cyberbullying, including flaming, harassment, denigration, impersonation, outing, trickery, exclusion, and cyberstalking. Pieschl et al. (2013), however, pointed out the deficiency of using media types to classify cyberbullying because of the rapid convergence of different types of media. They argued that it was more reasonable to use representational code (for example, verbal code in the forms of written or spoken text) vs. visual code (in the forms of pictures and videos) to categorize cyberbullying, rather than to use software applications (e.g., email, chatroom, webpage) for this purpose.

A cursory review of the extant research indicates that in many studies (e.g., Ackers, 2012), a single item was used to measure cyberbullying. Most of those single items were created in an *ad hoc* fashion for a specific study. Pieschl et al. (2013) observed that the prevalence rate of cyberbullying was lower when respondents reported their cyberbullying experiences corresponding to a short period of recall time (e.g., one month vs. past several years), or when cyberbullying was assessed by a single item with direct reference to cyberbullying. Psychometrically, multiple-item measures have clear advantages over single-item measures. For instance, multiple-item measures tend to be more precise, and hence they are more likely to detect fine differences of the targeted attribute. Multiple-item measures will be less affected by random measurement error; as a result, they tend to be more reliable and tend to have higher degree of measurement validity (Nunnally, 1978).

Olweus (2012) reviewed published cyberbullying research, and suggested that researchers pay more attention to the definition and measurement of cyberbullying. Specifically, researchers need to make sure that they are studying the same phenomenon, and use similar measurement criteria (e.g., response alternatives, time frame for response). Empirical evidence for the role of defining and measuring cyberbullying is provided by Ybarra, Boyd, Korchmaros, and Oppenheim (2012), who examined whether offering a definition of bullying and using the term "bully" directly would make any difference in respondents' report of bullying experience. The authors constructed four scenarios: definition+the word "bully", definition−only, "bully"−only, and neither the definition nor the word "bully". Research participants were randomly assigned into one of the four scenarios. Results indicated that using the word or definition did influence the reported prevalence of bullying. In other words, the way to define and operationalize cyberbullying could potentially influence the research outcomes on issues such as gender and cyberbullying. Furthermore, Olweus cautioned that, without clear definition and rigorous measurement of cyberbullying, it would be unlikely that researchers would produce comparable and meaningful empirical findings on cyberbullying.

Gender and cyberbullying

Dehue (2013) noted that extant research on cyberbullying mostly focused on demographic factors such as gender, age, and prevalence of bullying. Indeed, gender difference has been widely examined in both cyberbullying and traditional bullying research. In traditional bullying, gender patterns have been evident over time: boys were more likely to get involved in bullying than girls in general, and in direct physical bullying in particular.

Compared to research on traditional bullying, however, cyberbullying research has shown inconsistent findings regarding gender differences (Wong, Cheung, Xiao, & Chan, 2015). A large amount of research has shown that males are more likely than females to be engaged in cyberbullying. For example, studies from the United Kingdom (Smith et al., 2008), the United States (Wang, Iannotti, & Luk, 2012), and Canada (Li, 2007) reported boys being overrepresented as cyberbullies. The study by Barlett and Gentile (2012) involved several hundred college students in the U.S., and identified a positive correlation between cyberbullying frequency and gender, with males showing higher frequency of being engaged in cyberbullying. More recently, Forssell (2016) found that men were more likely to be exposed to cyberbullying than were women in working life.

However, in contrast to the aforementioned cases, other studies did not report any gender differences in cyberbullying (Balakrishnan, 2015; Bonanno & Hymel, 2013; Smith et al., 2008). As Griezel et al. (2008) pointed out, the cyberbullying literature was plagued by inconsistent findings on gender differences. To tackle this issue, it is important, among other things, to design and use psychometrically sound instruments to assess the cyberbullying behavior. For instance, Abeele and Cock (2013) surveyed 264 high-school students in Belgium, and found that males were more likely to be involved in direct bullying, rather than using such means as voice call or picture/video, whereas females were more likely to gossip via voice call or SMS. The findings suggested that the forms or patterns of cyberbullying would make a difference in the likelihood that one would be engaged in cyberbullying behavior. By surveying a large sample of public school students in Sweden, Beckman, Hagquist and Hellström (2012) reported no statistically significant gender differences (0.7% of boys vs. 0.8% of girls) in the involvement in cyberbullying behaviors.

Although cyberbullying is increasingly being recognized as a societal issue, there are many unanswered questions concerning gender differences in cyberbullying behaviors. More solid research findings about any gender differences, or lack thereof, in cyberbullying would allow researchers and practitioners to assess the different types and levels of cyberbullying involvement by male and female students. Better knowledge in this regard will help researchers and practitioners in designing and planning more effective preventive work and intervention, thus enhancing students' mental and emotional health, as well as helping them to become better citizens in the long term.

Meta-analysis

Glass (1976) characterized meta-analysis as "the analysis of analyses…, statistical studies of a large collection of analysis results from individual studies for the purpose of integrating the findings" (p. 3). Under the meta-analytic approach, a researcher uses a systematic approach to quantitatively synthesize the seemingly inconsistent findings from different individual studies. Essential in meta-analysis is the accumulation of effect sizes, which can be described as "a metric of the magnitude of a result that is independent of scale of measurement and sample size" (Shaver, 1991, p. 87), from individual studies. Also important in meta-analysis is the exploration for potential factors (i.e., study features or characteristics) that could have contributed to the inconsistencies of the findings across individual studies (Shih & Fan, 2009).

In summary, it remains unclear whether any meaningful gender differences exist in cyberbullying behaviors. Moreover, as discussed earlier, issues such as the lack of clear conceptualization and the lack of quality measures for cyberbullying might have compromised the quality of research findings in this area. The primary purpose of this study is to provide a quantitative synthesis of the high-quality empirical studies on the issue of gender differences in cyberbullying. In this study we focus on the following main research questions:
1. Is there a gender group difference in cyberbullying behaviors as reported in the previous empirical studies?
2. What are the study features (e.g., quality of study, modality of cyberbullying behaviors) that could have partially explained the inconsistencies in the findings concerning the gender group differences in cyberbullying behaviors across individual studies in the literature?

Research methods

Article search

We used the databases of *PsycInfo*, *EBSCO*, and *ERIC* for literature research. *Google Scholar* was also used to locate any additional articles not included in those databases. Major keywords used for the search include *cyberbullying, cyberbully, electronic bullying, cyber-victimization, cybervictimization, online bullying, online aggression,* and *Internet bullying*. The search covered articles published before March 1st of 2015, and yielded a total of 1580 entries. Only articles published in English were considered for the meta-analysis. Because the focus of the current study is on the relationship between gender and cyberbullying, we then examined these entries and identified those that included gender/sex in the articles. This reduced our search results to 883 articles.

We considered the following criteria while deciding whether to include an article for meta-analysis. First, the study must report empirical findings on cyberbullying behaviors of gender groups. As such, those studies of qualitative nature were excluded. Second, we differentiated cyberbullying from cyber-victimization. In other words, being a bully in cyberspace is different from being a target of cyberbullying, though these two phenomena could be related with each other. Here, our focus is on the potential difference of gender groups' engagement in cyberbullying others. Therefore, articles that only reported findings on cyber-victimization were excluded. Third, we only included articles that provided sufficient information for us to obtain an effect size for gender group difference in cyberbullying behaviors. Based on these criteria discussed above, a final sample of 39 usable empirical research articles was included for our meta-analysis. Some articles produced more than one effect size, which is a common phenomenon in the practice of meta-analysis (Fan & Chen, 2001). As a result, the final sample of 39 research articles had a total of 100 effect sizes of gender difference in cyberbullying. The appendix provides the complete list of these 39 articles used in this meta-analysis, and some descriptive information relevant for this meta-analysis. We also checked publication bias by creating funnel plot (see Figure 1), and the funnel plot did not show a clear sign for that bias (Rothstein, 2008).

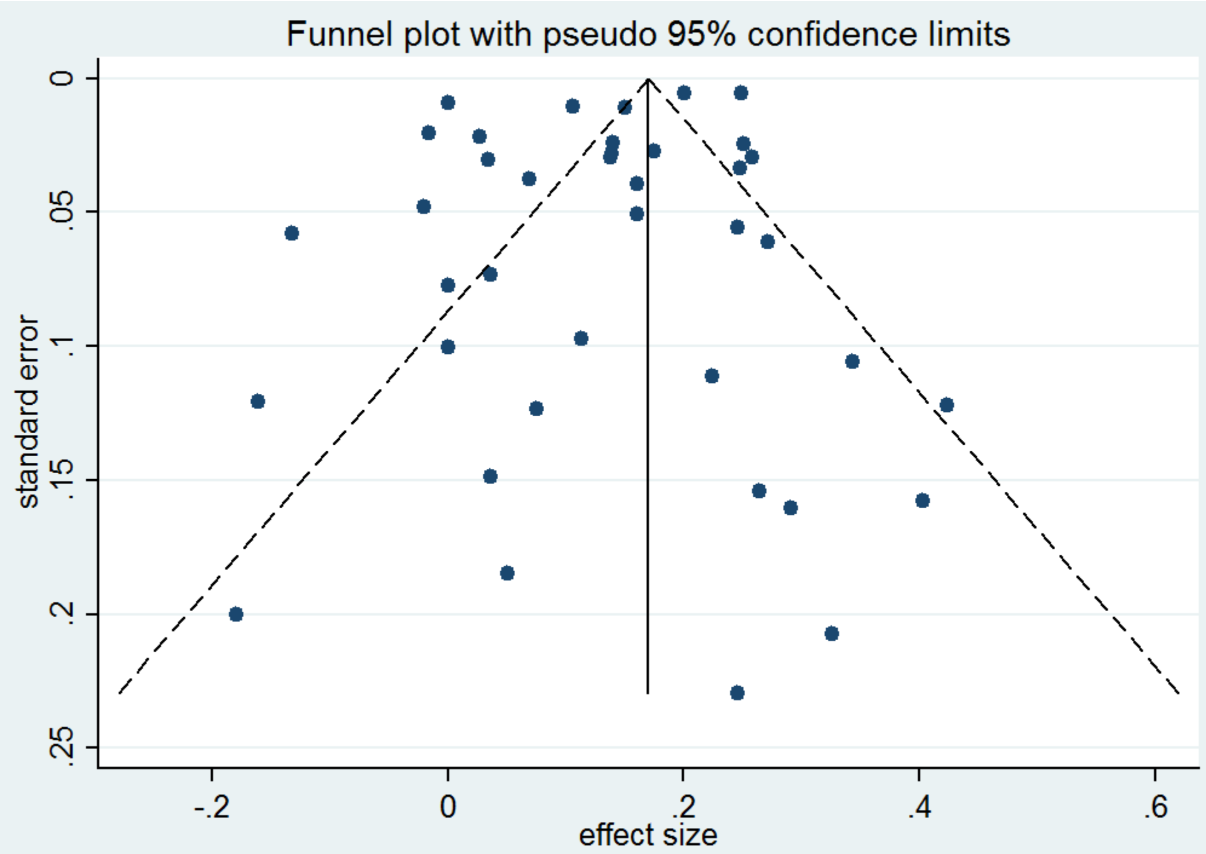

Figure 1. Funnel plot of standard error by effect size of the relationship between gender and cyberbullying perpetration ($N = 95$, one outlier with standard error > .4 was removed).

Coding for study features

As discussed above, it is important in a meta-analysis study that the researcher explores the potential study characteristics that could have accounted for the inconsistencies across the individual studies. In this meta-analysis, we considered multiple study features that could be useful for explaining the observed inconsistencies across the individual studies, as described below.

Region of Sampling. Gender differences in cyberbullying behaviors could potentially be related to cultures, because cultural norms and expectations may influence the behaviors of gender groups. Because of this consideration, we were interested in capturing such potential influence when possible. For this purpose, we used the region of the study sample as a rough proxy for different cultures. More specifically, we had three levels for this study feature variable: North America, Europe/Australia, and Asia.

Modality of Cyberbullying. It has been a thorny issue to define and capture the nature of cyberbullying. Griezel et al. (2008) identified two modalities or dimensions (i.e., text vs. visual) of cyberbullying, and provided psychometric support for these dimensions. Later, Pieschl et al. (2013) further discussed that a classification of text vs. visual, rather than using the features of traditional bullying, can better reflect the essence of cyberbullying. Because usage of new technologies is a key feature of cyberbullying, it would be of interest to see whether the modality feature of a study is related to the gender-cyberbullying relationship. As Tokunaga (2010) pointed out, more research should be directed toward the qualities of new technologies, which may moderate cyberbullying relationships.

Representativeness of Sampling. As discussed earlier, cyberbullying research has been criticized for its small sample sizes. Moreover, a survey of extant research studies reveals that a large portion of the studies employed convenience samples, particularly with student participants. Sample representativeness could influence the generalizability of research findings, which may provide evidence for the need of intervention strategies for some target populations (Slonje, Smith, & Frisen, 2013). In this meta-analysis, we examined whether representativeness of sampling as used in cyberbullying studies could have moderated the gender differences in cyberbullying as reported in different empirical studies.

Cyberbullying Scale Type. Tokunaga (2010) criticized that some studies relied on simple yes/no binary scales, which might fail to capture the complex nature of cyberbullying. Other studies employed self-created or adapted Likert-type scales for cyberbullying measurement (Berne et al., 2013). Therefore, it is of interest to study whether using different types of scales in the cyberbullying studies, specifically dichotomous vs. Likert scales, makes a difference in cyberbullying research findings concerning gender differences.

Cyberbullying Scale Wording. Berne et al. (2013) reviewed 44 instruments adopted in the previous studies of cyberbullying, and found that about half of them did use the word cyberbullying. Ybarra et al. (2012) reported that whether the term "bully" itself appears in measurement might affect the research outcomes on cyberbullying. Considering the fact that researchers often use the word "bully" or "cyberbully" in their instruments, which may not be clearly explained, we are interested in understanding whether the use of such a key term in measurement may have any impact on the research outcomes.

Reporting Time Frame. Past research has not been consistent in providing respondents a time frame for recalling their cyberbullying experiences. This inconsistency across the studies could potentially complicate research findings. For instance, Pieschl et al. (2013) found that the reported cyberbullying experience was less under a shorter recall time frame as compared to a longer one. Also, it is not uncommon at all in the past research that no recall time frame was specified. In the present study, we examined whether it would make any difference on the research outcomes concerning gender difference in cyberbullying when a study specified a time frame for recall of cyberbullying experiences.

Directness of Cyberbullying. Slonje et al. (2013) emphasized the need to differentiate different types or actions of cyberbullying. To date, there is no consensus about how to categorize different actions and behaviors of cyberbullying. Despite this, one promising perspective is to differentiate between the direct (e.g., insulting in sending direct emails to the victim) and the indirect (e.g., gossiping behind the back of the victim) cyberbullying behaviors (Abeele & Cock, 2013), and to consider their potential differences and implications. Because of this consideration, we classified the cyberbullying behaviors reported in the empirical studies as direct, indirect, or unspecified.

Quality of Study. The study quality for cyberbullying in the literature varied a great deal. Kowalski, Giumetti, Schroeder, and Lattanner (2014) reviewed past research, and pointed out that a host of factors (e.g., instrument reliability and validity, sample size, response instruction) could influence the quality of cyberbullying research. For instance, some research studies relied on (used, adapted, or modified) existing measures of cyberbullying that had been used in prior research, and had been psychometrically evaluated for their quality. On the other hand, many studies (e.g., Abeele & Cock, 2013) used *ad hoc* and self-created measures, which had little evidence of the psychometric quality of the measures. Furthermore, many of these measures only involved a single item/question for measuring cyberbullying, or directly used the term cyberbullying or bullying without any further elaborations in the response instruction, which could potentially distort respondents' understanding and responses (Barlett & Coyne, 2014). All these potential measurement issues make it unlikely that such measures could have high level of psychometric quality for measuring cyberbullying. Other factors, such as small sample size and lack of theoretical underpinning (Griezel et al., 2008) could also undermine the quality of a study.

To evaluate the potential effect of the study quality on the research outcome of gender differences in cyberbullying research, we systematically evaluated and rated the quality of each study, focusing especially on survey design and instrument quality for cyberbullying in each study. Bennett et al. (2011) provided a detailed discussion on factors crucial for the quality of survey research, such as sample size calculation, verbal anchoring of instrument, instrument pretesting, instrument reliability and validity, and standardized instruction. Because all the analyzed empirical studies relied on self-report survey data, the factors as discussed in Bennett et al. (2011) were used as the major criteria for assessing the quality of each study. Two researchers rated the quality of each study independently, and reached a satisfactory level of inter-rater reliability (*Krippendorff's alpha* = .91). We followed the computing procedure of reliability as described by Freelon (2013), and any remaining discrepancy of rating was resolved through further discussion between the two researchers.

In addition to the study variables described above, we also recorded some basic information about each study, such as author names, publication year, sample size, and average age of the study participants. Table 1 presents the coded variables and study features, as well as the levels under each coded variable (study feature) in this meta-analysis.

Table 1
Coding Scheme for Meta-Analysis of Cyberbullying

Coding scheme for meta-analysis of cyberbullying perpetration
1. Study ID: 1–39
2. Authors
3. Publication year: year when the research article was published; ranging from 2008 to 2014
4. Region of sampling:
1) North America
2) Europe/Australia
3) Asia
5. Modality of cyberbullying
1) text
2) visual
3) unspecified
6. Representativeness of sampling
1) random/representative sampling
2) non-random sampling
7. Cyberbullying scale type
1) Likert scale (anchor points specified)
2) binary: yes/or question
8. Reporting time frame
1) specified
2) unspecified
9. Directness of cyberbullying
1) Direct (victim is directly involved, e.g., threatening with email)
2) Indirect (behind the back, e.g., rumor)
3) Unspecified
10. Quality of Study
1) Excellent: Sample size calculation, instrument pretesting, instrument reliability and validity, specified behavior and channel, standardized instruction, verbal anchoring
2) Satisfactory: some of the above
3) Poor: most information mentioned in option 1 is missing
11. Cyberbullying scale wording
1) Used the term "cyberbully" or "bully" in measurement items
2) Did not use the term "cyberbully" or "bully" in measurement items

Meta-analysis procedures

Accumulation of Effect Sizes from Individual Studies. As discussed elsewhere in the relevant research literature (e.g., Glass, McGaw, & Smith, 1981), due to the arbitrariness of measurement scales associated with different measures used in different studies, for the purpose of quantitatively synthesizing the research literature on a phenomenon (e.g., gender difference in cyberbullying behaviors), a scale-free index (i.e., effect size measure) is needed. In this study, we used Cohen's *d* as the effect size to quantify the gender group difference in cyberbullying behaviors. Cohen's *d* from each study was based on the relevant statistical information from each article as shown below:

$$d = \frac{\bar{y}_m - \bar{y}_f}{\hat{\sigma}_{pooled}}, \quad (1)$$

where

$$\hat{\sigma}_{pooled} = \sqrt{\frac{(n_m - 1)s_m^2 + (n_f - 1)s_f^2}{n_m + n_f}}, \quad (2)$$

The symbols $n_{m,f}$, $\bar{y}_{m,f}$ and $s^2_{m,f}$ refer to the sample size, sample mean and sample variance of gender groups (male and female), respectively. Whenever possible, the original descriptive statistics of the gender groups on the cyberbullying measure (e.g., mean, standard deviation) were used for obtaining Cohen's *d*. If such information was not available in a study, but information in some other forms (e.g., inferential statistics from a *t*-test, proportions of male and female respondents on a binary question for cyberbullying, χ^2 test statistic) would allow us to derive Cohen's *d* mathematically, we followed the conversion procedures as documented in the meta-analysis literature to derive Cohen's *d*. Specifically, we did the following conversions in this meta-analysis.

Proportions of Male vs. Female Groups. A large portion of the studies reported dichotomous data (i.e., cyberbullying vs. no cyberbullying) for male and female respondents. There are several different approaches for transforming dichotomous proportion data to Cohen's *d*, such as probit transformation and arcsine transformation (see Lipsey & Wilson, 2001). Simulation studies indicated that the probit transformation yields less bias as compared to other transformations, especially when sample sizes vary considerably. The transformation formula for proportional data is presented below in Equation 3 (Lipsey & Wilson, 2001):

$$d = probit(p_m) - probit(p_f), \qquad (3)$$

where $p_{m,f}$ denotes the proportions of male and female groups who confirmed their cyberbullying behaviors.

Correlation between gender and cyberbullying. When cyberbullying was measured with Likert-type scales, some studies reported correlation coefficients between gender and the reported cyberbullying. In this case, we transformed the correlation coefficient to Cohen's *d* as shown in Equation 4 (Lipsey & Wilson, 2001):

$$d = \frac{r}{\sqrt{(1-r^2)(p(1-p))}}, \qquad (4)$$

where *r* is the correlation coefficient between gender and cyberbullying, and *p* denotes the proportion of one gender group (either male or female) in the sample.

F-Test or t-Test Statistics. Some studies only reported group-comparison statistics (e.g., *t*-test statistic, *F*-test statistic) without reporting the basic descriptive statistics such as group means and standard deviations. In this case, we used the following to transform the test statistics (*t*-test, *F*-test) into Cohen's *d* (Lipsey & Wilson, 2001):

$$d = t\sqrt{\frac{n_1 + n_2}{n_1 n_2}} \qquad (5)$$

$$d = \sqrt{\frac{F(n_1 + n_2)}{n_1 n_2}}, \qquad (6)$$

where n_1 and n_2 are the sample sizes for each gender group.

Analysis Strategies. Because a majority of the selected studies contribute multiple effect sizes, which are mostly based on the same sample – including all the effect sizes, violates the assumption of statistical independence (Lipsey & Wilson, 2001). To better use the information from all effect sizes, we employed the robust variance estimation method to analyze the dependent effect sizes (Hedges, Tipton, & Johnson, 2010).

We reason that existing research on gender and cyberbullying demonstrates significant between-studies variances, rather than representing a set number of studies aiming to estimate a true effect size. As such, a random-effects meta-regression model would be more suitable to summarize the effect sizes and inspect potential moderators. The RobustMeta SPSS macro was utilized to conduct robust meta-regression analysis (Tanner-Smith & Tipton, in press).

Averaging Effect Sizes. For each study feature, which had significant moderating effect on the outcome variable, we computed the average effect size for each level of the feature. For instance, for the study feature variable of "directness of cyberbullying", we computed the average effect sizes for "direct", "indirect", and "unspecified" conditions, respectively. We weighted each effect size by the inverse of its variance of the point estimate (Card, 2012). Such weighted average effect sizes for the levels of a study feature will provide practical insight into the moderating effect of a specific study feature.

Results

General description

On the whole, most existing research on cyberbullying is conducted via traditional or online surveys. Very few studies have adopted a rigorous theoretical rationale. In that regard, theories on gender differences have not been well integrated into this line of research. Also, most studies simply adapted traditional bullying measures or used self-created items to assess cyberbullying. A total of 62% percent of the studies did not report reliability information. There was very little information in these studies about measurement validity of the used instruments.

Effects of study features

Table 2 presents the information about the effects of study features on the variation of the dependent variable. The τ^2 for the null model is .049, whereas the τ^2 for the predictor model is .044. In other words, adding the moderations reduced the unexplained variance by about 10 percent. Overall, the study features coded in this meta-analysis accounted for about 10% of the total variance of the Cohen' *d* from the individual studies. Four coded study features (i.e., "region of sampling", "wording of scale", "modality of cyberbullying", and "directness of cyberbullying") accounted for statistically significant portions of the variance in Cohen's *d* across the studies.

Table 2
Random-Effect Meta-Regression Model

	Beta	*S.E.*	95% *C.I.*
Null Model (τ^2 = .049)			
Intercept	.232***	.036	[.161, .304]
Predictor Model (τ^2 = .044)			
Intercept	1.067**	.380	[.312, 1.822]
Representativeness of sampling	.077	.069	[−.060, .213]
Cyberbullying scale wording	.169*	.070	[.030, .308]
Region of sampling	.118***	.029	[.061, .175]
Cyberbullying scale type	−.011	.062	[−.134, .112]
Modality of cyberbullying	−.096*	.037	[−.170, −.022]
Directness of cyberbullying	−.073*	.037	[−.147, −.000]
Quality of study	.060	.041	[−.020, .140]
Reporting time frame	.058	.061	[−.062, .179]
Total variance explained	10.21%		

*$p < .05$, **$p < .01$, ***$p < .001$

Average effect sizes

To understand how the study features may have contributed to the inconsistencies in the observed gender differences in cyberbullying across different individual studies, we averaged effect sizes for the levels of each study feature (Table 2). These descriptive averages of the effect sizes are presented in Table 3. The overall effect size for the gender difference in cyberbullying is $d_{weighted} \approx 0.23$ (while the unweighted effect size is $d_{unweighted} \approx 0.24$). As discussed by Cohen (1988), this overall effect size of the gender difference could be characterized as representing a "small" effect in social and behavioral science research. This overall effect suggests that, despite all the inconsistencies across the individual studies on gender difference in cyberbullying, in general, males reported more cyberbullying behaviors than females.

The breakdown analysis for the statistically significant study features presented in Table 3 revealed how several study features "moderated" the observed gender difference in cyberbullying behaviors across individual studies. From those studies in which the term "bully" or "cyberbully" was not directly used in measurement items, the average effect size ($\bar{d}$ = .26) was statistically higher than that from the studies in which the term "bully" or "cyberbully" were used ($\bar{d}$ = .13). The study feature of "region of sampling" turned out to be the strongest moderator for the observed gender difference in cyberbullying across individual studies. Studies involving Asian samples reported the largest gender difference in cyberbullying behaviors ($\bar{d}$ = .41), followed by the studies in which samples in North America were used ($\bar{d}$ = .18), while the studies involving European samples showed no gender difference in cyberbullying behaviors ($\bar{d}$ = −.03).

For the study feature of "Modality" (i.e., the medium used in cyberbullying behavior as documented in a study, e.g., text vs. visual), the studies that clearly specified "text" or "visual" cyberbullying behaviors showed larger effect sizes than those with unspecified modality. More specifically, average effect sizes (i.e., gender differences) from those studies with the textual modality ($\overline{d}$ = .26) and those with the visual modality ($\overline{d}$ = .22) were statistically higher than that from the studies with unspecified modality ($\overline{d}$ = .01). For the study feature of "Directness of Cyberbullying", the average effect sizes of gender difference from the studies with direct cyberbullying ($\overline{d}$ = .21) and indirect cyberbullying ($\overline{d}$ = .34) were statistically higher than that from the studies where this was not specified ($\overline{d}$ = .02) in the study.

Table 3
Average Effect Sizes for Gender Difference in Cyberbullying under Five Study Features

Level of Study Features	Number of effect sizes k	Unweighted average effect sizes $d_{unweighted}$	Weighted average effect sizes $d_{weighted}$	Cumulative sample size across studies used to arrive at average effect size $\sum n_i$
Overall	100	.2372	.2320	129995
Cyberbullying Scale Wording				
used "bully"	29	.1047	.1280 A[a]	63338
did not use "bully"	71	.1359	.2616 B	66657
Region of Sampling				
North America	34	.1373	.1794 A	67743
Europe/Australia	37	.2125	−.0261 B	31551
Asia	29	.3859	.4083 C	30701
Modality of Cyberbullying				
text	42	.3373	.2635 A	46985
visual	15	.2716	.2186 A	38496
unspecified	43	.1275	.0050 B	44514
Directness of Cyberbullying				
direct	48	.2908	.2093 A	72834
indirect	15	.2932	.3388 A	17863
unspecified	37	.1451	.0217 B	39298

[a]Post hoc multiple comparison results. Means with different letters are statistically different from each other at .05 level, while means with the same letter are not.

Study-effect meta-analysis

For the study-effect meta-analysis, where each study only contributed one effect size (averaged across multiple effect sizes from the same study), we analyzed the data by using a random-effect model approach. To assess the heterogeneity of the effect sizes across the studies, we used the *Q* statistic to evaluate the null hypothesis of homogeneity of effect sizes versus the alternate hypothesis of heterogeneity of effect sizes across the studies (Hedges, 1982). For our data, the heterogeneity statistic was statistically significant (Q = 44380.84, df = 38, p < .001) and the I^2 index was about 99%, both indicating considerable heterogeneity among the effect sizes collected from the individual studies. For the sake of simplicity, we used a graphic approach, "forest plot" (Hedges & Olkin, 1985; Lewis & Clarke, 2001), to present a summary of this study-effect meta-analysis, similar to Shih and Fan (2007, 2009).

Figure 2 presents the forest plot from this random-effect analysis. In Figure 2, thirty-nine "random" effect sizes, each from one study, were used. The studies presented in this forest plot were ordered by the direction of effect the magnitudes of effect sizes. The effect size representing gender difference in cyberbullying behaviors was represented by a black dot, with the horizontal line that extends from the black dot in both directions representing the 95% confidence interval limits for the "effect" (i.e., gender difference in cyberbullying behaviors). The solid vertical line represents "no effect", i.e., no gender difference in cyberbullying perpetration. The studies that reported males having more cyberbullying perpetration than the females fell on the right side of the "no effect" vertical line, while the studies that reported males having less cyberbullying perpetration than females fell on the left side of the "no effect" vertical line.

When a study's confidence interval (the short horizontal line around each black dot) covered the "no effect" vertical line, it indicated that the gender difference in cyberbullying behaviors as reported in that study was statistically non-significant. It is noted that the confidence intervals of the effect sizes for gender difference in cyberbullying from different studies showed considerable variations. For example, the estimate for gender difference in cyberbullying behaviors as reported from Erdur-Baker (2010) had wide confidence intervals (i.e., low precision), while the estimate from Dehue et al. (2008) had very narrow confidence intervals (i.e., high precision). Such variation of the confidence interval widths provided information about the different precisions for the reported gender differences in cyberbullying behaviors from different studies.

In Figure 2, the overall gender difference in cyberbullying behaviors is represented by the dashed vertical line, which is 0.232, with the 95% confidence interval of [.161, .304]. The location of the dashed vertical line on the right side of the “no effect” line indicates higher level of male cyberbullying behaviors than that of females, when the inconsistencies across the thirty-nine individual studies are summarized through the random effect analysis approach. The 95% confidence interval [.161, .304] of this overall gender difference “effect” does not cover the “no effect” vertical line, suggesting that the overall gender difference (i.e., males reported more cyberbullying perpetration than females) is statistically significant. Moreover, the plot shows that a majority of the confidence intervals of the effect sizes do not cover the “no effect” vertical line, suggesting that the majority of the study effect sizes are statistically different from zero. The forest plot from this supplemental random-effect model analysis is in line with the previous conclusions that males reported more cyberbullying behaviors than females in general, despite some individual studies (e.g., Beckman, Hagquist & Hellström, 2012) reporting otherwise.

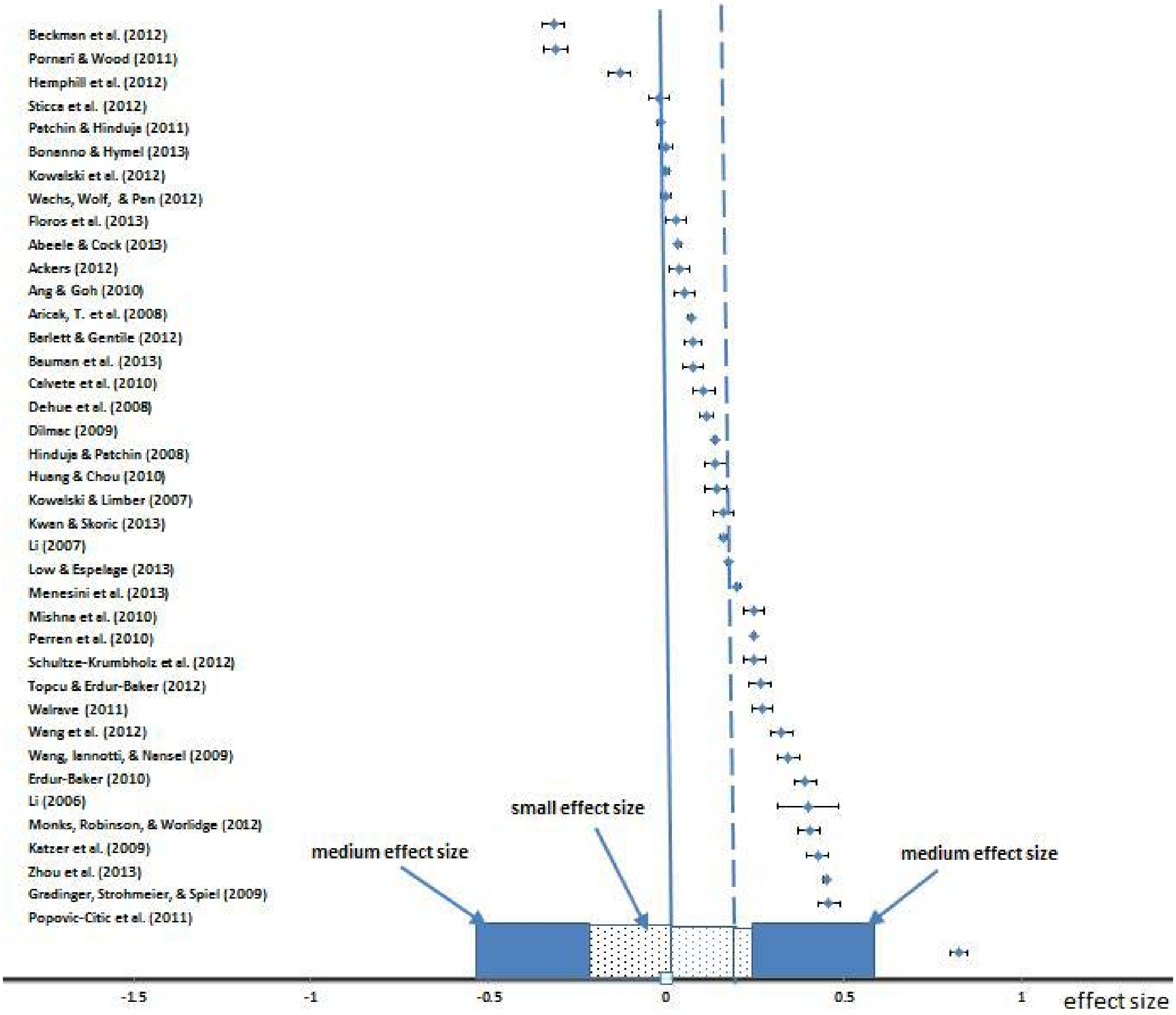

Figure 2. Forest plot of study effect sizes of the relationship between gender and cyberbullying perpetration (the dashed vertical line represents the averaged study effect size of 0.232, and the solid vertical line represents no gender difference in the reported cyberbullying perpetration).

Discussion

Our study has shown that in general, there was a difference in cyberbullying perpetration between the gender groups, and the males were more likely than females to be involved in cyberbullying, despite some conflicting research findings in the literature. A majority of the studies reported that males were more involved in bullying in the cyber environment, similar to what was observed in the traditional face-to-face environment.

Previous studies (e.g., Lucas & Sherry, 2004) indicated that gender difference existed in people's Internet habits and usage in general. For example, boys tended to play more online games involving fighting and violence, while girls were more active on social networking websites (Findahl, 2010). Boys had more access to aggressive cognitions, and they were more likely to associate their self-concept with aggression (Uhlmann & Swanson, 2004). These influences could lead to cyberbullying behaviors when they were involved in other online activities.

The overall gender difference in cyberbullying behaviors, however, was not large, and the variations of the effect sizes under certain study features (e.g., "modality of cyberbullying", "region of sampling") warrant further research to ensure the generalizability of the findings. In addition, some issues (e.g., cyberbullying measurement, study design quality) revealed in this quantitative synthesis demand the attention of the researchers in this field.

Gender differences across cultures

Our study showed that gender differences in cyberbullying behaviors varied across different regions (i.e., North America, Europe/Australia, and Asia), with the largest effect size of gender difference obtained from the Asian samples, followed by that of North American samples, and by the Europe/Australia samples showing almost no gender difference in cyberbullying perpetration. Such observed regional differences could be the result of cultural factors related to the psycho-social behaviors of males and females in different cultures. Barlett et al. (2014) discussed that cyberbullying should be conceptualized as a societal and cultural phenomenon. The findings in this study could be explained by the self-construal theory (Barlett et al., 2014). Although Asian cultures are characteristic of interdependent self-construal that would discourage bullying others, such a self-construal could be more deep-rooted in Asian females than in Asian males. Bergeron and Schneider (2005) discussed that cultures featuring collectivistic values, high moral discipline, a high level of egalitarian commitment, among others, showed lower levels of aggression than their counterparts. They also found that people in Australia and many European countries tend to be less aggressive than those in the United States. However, our findings suggested that such cultural influences may not be uniform or consistent for different subpopulations (e.g., males vs. females) in a particular culture. Particularly, in Asian countries, females could be more likely to conform to cultural norms and expectations than males, and hence are less likely to be involved in cyberbullying.

It should be noted that this study was about gender difference in cyberbullying perpetration, but not about cultural difference in cyberbullying behaviors. So the findings did not suggest that Asian samples (or males) exhibited more cyberbullying behaviors than samples from other regions, and neither did the findings suggest that the European/Australian samples (or males) exhibited less cyberbullying behaviors than samples from other regions. The findings only indicated that the *gender difference* in cyberbullying was the largest in the studies involving Asian samples, while the *gender difference* was the smallest in the studies involving Europe/Australian samples. There is no information in this study about *cultural* differences in cyberbullying behaviors.

Issues of measurement and design

Our study indicated that there are multiple conceptual and operational issues in cyberbullying research. Tokunaga (2010) reviewed 25 published studies, and concluded that current research on cyberbullying had several problems, including unresolved definition and measurement issues of the construct, a lack of theoretical underpinnings, excessive usage of cross-sectional data, and too much focus on simplistic issues. Similarly, our study suggested that issues related to measurement (e.g., if "bully" is explicitly used in a study, lack of commonly accepted measures for cyberbullying) and study quality (e.g., small sample size, lack of evidence for the psychometric quality of cyberbullying measurement) could lead to differences in research outcomes. A recent meta-analysis by Modecki, Minchin, Harbaugh, Guerra, and Runions (2014) revealed that use of the term "bully" in measurement produced lower reported prevalence rates for both traditional bullying and cyberbullying, and this was especially obvious for cyberbullying. The authors explained that the negative connotations associated with the term could deter some respondents from reporting their behaviors and experiences. Our study showed that usage of such specific terms could potentially confound the gender-cyberbullying relationship also.

It should be noted that a majority of published studies utilized questionnaires to measure behavior (e.g., disseminating online rumor, outing) pertaining to cyberbullying. Such a measure could suffer from social desirability bias or low validity. He and van de Vijve (2012) discussed three types of bias in cross-cultural research: construct bias, method bias, and item bias (differential item functioning). Without establishing equivalence of a construct and its measurement, any comparisons in meta-analysis should be cautioned (Hunter & Schmidt, 2007).

Especially noticeable is the finding that those studies that were rated as having poor study quality showed larger average effect size for gender difference in cyberbullying behaviors. Therefore, caution is warranted in interpreting the magnitude of the gender differences in cyberbullying behaviors as reported in previous primary studies, because such observed gender differences could have been unduly influenced by the lack of study quality.

Theoretical implications

Kowalski et al. (2014) commented that the nature of cyberbullying was complicated and this issue had been understudied. Our findings suggest that some nuances in self-reported cyberbullying behaviors (e.g., "modality of cyberbullying behaviors", "directness of cyberbullying behaviors") could lead to differences in the observed gender difference in the self-reported cyberbullying behaviors. On the other hand, some observed differences across the levels of "modality" and those of "directness" could also have been caused by measurement issues. When the "modality" or "directness" was not specified clearly, which was somewhat common in the collected studies, the respondents might not be able to distinguish among different types of cyberbullying behaviors clearly, and such a blanket assessment could have camouflaged some meaningful gender differences in cyberbullying behaviors.

Practical implications

Findings from the present meta-analysis have implications for designing and implementing interventions of cyberbullying in practice. First, the observed gender difference suggests the need for planning for targeted intervention, instead of treating adolescents as a whole. More specifically, when resources are limited, the priority of intervention should be given to the male population. For instance, Hamer and Konijn (2015) found exposure to antisocial media content contributed to the initial rates of cyberbullying behavior. As such, future studies may also look at whether males and females consume media content in different patterns, which may affect the incidence of cyberbullying. Second, such a gender-differentiated intervention strategy should be more relevant in Asian cultures than in western cultures. For instance, Pabian and Vandebosch (2016) discussed the role of social intelligence in regulating cyberbullying. Connecting culture with enhancing social intelligence would be a promising avenue to mitigate the initiation of cyberbullying. Bastiaensens et al. (2016) revealed the significant impact social norms exercise on cyberbullying. Social norms as a crucial component of culture, therefore, should be taken into account for designing interventions in Asian culture, too. Third, to identify those who are more likely to be involved in aggressive behavior (e.g., cyberbullying), researchers and practitioners should be more cautious about wording issues (e.g., using particular terms such as bully) in designing instruments of assessment.

Limitations and future directions

Like many other research studies, our study has its share of limitations. First, the present meta-analysis only included research studies published before 2015, because our literature search stopped at that time. Also, due to a variety of reasons, a limited number of publications in the searched databases were not available to us. In such a case, we tried to contact the authors directly, but very few responded. Future synthesis should expand to cover more recent publications, especially considering the fact that cyberbullying research is growing so rapidly in recent years.

Second, cyberbullying is typically viewed as a socially undesirable act. As such, social desirability of self-report responses could compromise the accuracy of measuring cyberbullying (Menesini & Nocentini, 2009). The effects of wording or measurement on the effect sizes, as identified in the present study, could be ascribed to social desirability too. Future research should disentangle the potential effect of social desirability from that of other moderators in examining the gender-cyberbullying relationship.

Third, additional potential moderators should be considered for analyzing the heterogeneity of effect sizes across the studies. For example, during the data collection stage, factors associated with survey environment/administration and confidentiality briefing could contribute to the variation of effect sizes. However, in most published studies, such information is either not provided or too sketchy, which makes it very difficult or impossible to consider such variables as potential moderators.

Fourth, for studying cyberbullying behaviors, simplistic approaches (e.g., self-report survey, cross-sectional and correlational design, convenience sample, etc.) are typically used. These simplistic approaches, together with the definition and measurement issues discussed previously, have contributed to the lack of research quality in this area. Pieschl et al. (2013) proposed that experimental design should be considered in studying cyberbullying, especially when researchers have questions about potential factors that may influence the research outcomes (e.g., should the word "bully" be used for measuring cyberbullying behaviors?). Due to its power for making causal inferences, experimental approaches could provide more insight in understanding cyberbullying behaviors and its prevalence.

Fifth, there appears to be a great heterogeneity involved in our collected data, which is in general consistent with prior reviews (e.g., Barlett & Coyne, 2014). In the future, a thorough psychometric meta-analysis of published studies could provide more insight into the nature of the heterogeneity. Also, more research is needed to explain the possible biological, sociological or psychological reasons for the gender differences in cyberbullying (Kowalski et al., 2014).

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(Complete list of the studies used for the meta-analysis is in Appendix A)

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Appendix A
Complete list of studies used in the meta-analysis

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Appendix B
Basic information about cyberbullying studies used in the meta-analysis

Study	Effect Size (Cohen's *d*)	S.E.	Confidence Interval	Sampling region	Average age	Education
Abeele & Cock (2013)	+.051	.015	[.021, .081]	Belgium	16.1	9–12th grade
Ackers (2012)	+.075	.012	[.051, .099]	U.K.	14.0	7–9th grade
Ang & Goh (2010)	+.264	.015	[.234, .294]	Singapore	14.9	middle/high school
Aricak, et al. (2008)	+.076	.015	[.047, .105]	Turkey	15.1	6–10th grade
Barlett & Gentile (2012)	+.391	.016	[.360, .422]	U.S.	19.4	college
Bauman et al. (2013)	+.175	.003	[.169, .181]	U.S.	16.5	9–12th grade
Beckman et al. (2012)	−.318	.016	[−.348, −.288]	Sweden	14.5	7–9th grade
Bonanno & Hymel (2013)	+.000	.010	[−.020, .020]	Canada	14.2	8–10th grade
Calvete et al. (2010)	+.139	.015	[.110, .169]	Spain	14.1	High school
Dehue et al. (2008)	+.248	.003	[.241, .255]	Netherlands	12.7	Primacy/secondary
Dilmac (2009)	+.272	.015	[.242, .302]	Turkey	19.3	college
Erdur-Baker (2010)	+.399	.044	[.313, .484]	Turkey	16.0	High school
Floros et al. (2013)	+.028	.015	[−.002, .057]	Greece	15.5	High school
Gradinger, Strohmeier, & Spiel (2009)	+.476	.006	[.464, .488]	Austria	15.6	9th grade
Hemphill et al. (2012)	−.132	.015	[−.162, −.102]	Australia	14.0	7–9th grade
Hinduja & Patchin (2008)	+.138	.003	[.132, .144]	U.S.	14.8	NA
Huang & Chou (2010)	+.037	.015	[.007, .067]	Taiwan	13.0	Junior/high
Katzer et al. (2009)	+.451	.004	[.443, .459]	Germany	14.1	Secondary
Kowalski & Limber (2007)	+.106	.015	[.076, .136]	U.S.	13.0	6–8th grade
Kowalski et al. (2012)	+.000	.004	[−.008, .008]	U.S.	15.2	12th grade
Kwan & Skoric (2013)	+.140	.015	[.111, .170]	Singapore	15.0	Secondary
Li (2006)	+.403	.016	[.372, .434]	Canada	14.0	7–9th grade
Li (2007)	+.246	.015	[.216, .276]	Canada	14.0	7–9th grade
Low & Espelage (2013)	+.161	.004	[.153, .169]	U.S.	13.9	Middle school
Menesini et al. (2013)	+.344	.016	[.313, .374]	Italy	15.6	High school
Mishna et al. (2010)	+.069	.004	[.062, .077]	Canada	12.0	6–7th grade
Monks, Robinson, & Worlidge (2012)	+.426	.016	[.395, .457]	England	9.0	Primary school
Patchin & Hinduja (2011)	−.016	.004	[−.024, −.008]	U.S.	12.8	6–8th grade
Perren et al. (2010)	+.324	.016	[.294, .355]	Switzerland	14.3	NA
Popovic-Citic et al. (2011)	+.824	.012	[.800, .848]	Serbia	13.2	Middle school
Pornari & Wood (2011)	−.311	.016	[−.341, −.281]	U.K.	12.8	Secondary school
Schultze-Krumbholz et al. (2012)	+.113	.010	[.093, .132]	Germany	13.4	7–10th grade
Sticca et al. (2012)	−.020	.015	[−.050, .010]	Switzerland	13.2	NA
Topcu & Erdur-Baker (2012)	+.160	.015	[.151, .170]	Turkey	16.7	NA
Wachs, Wolf, & Pan (2012)	+.000	.008	[−.029, .029]	Germany	13.0	6–10th grade
Walrave (2011)	+.034	.003	[.028, .040]	Belgium	15.1	Vocational school
Wang et al. (2012)	+.249	.015	[.219, .279]	U.S.	14.2	6–10th grade
Wang, Iannotti, & Nansel (2009)	+.201	.004	[.193, .209]	U.S.	14.3	6–10th grade
Zhou et al. (2013)	+.458	.016	[.427, .490]	China	15.9	10–12th grade