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REVIEW

# An integrative review of coping related to problematic computer use in adolescence

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**Abstract**
*Objectives* Problematic computer use is the use of computer technology that may be health-endangering and may cause immediate or later negative physical or psychological health outcomes or disturb well-being in users. The main purpose of this study was to review current empirical research on coping strategies which adolescents apply in the context of problematic computer use and the coping-relevant impacts of problematic computer use.
*Methods* An integrative review of empirical studies using the Web of Science, Google Scholar, reference lists and forward tracking was conducted. Of the 404 articles identified, 28 peer-reviewed, full-text articles that directly addressed coping in relation to problematic Internet use, computer overuse and cyberbullying were included in the review.
*Results* This review identified the structure of specific coping strategies related to problematic computer use as well as the general patterns of relationships between reviewed instances of problematic computer use, situational coping and dispositional coping.
*Conclusions* Instrumental action and talking with others were the most frequent strategies used by adolescents to cope with cyberbullying. The structure of the coping strategies related to problematic Internet use and computer overuse is highly differentiated, revealing a new and promising area for future research.

**Keywords** Computer use · Coping · Adolescence · Adolescents · Resilience

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## Introduction

Despite the advantages that the Internet and computers bring to today's young generation, health-endangering aspects of frequent computer use have also been reported by scholars during the last two decades. Frequent computer use has been associated with both negative physical and psychological health outcomes (e.g. Hakala et al. 2006; Brenner 1997; Subrahmanyam et al. 2001; Iannotti et al. 2009; Nuutinen et al. 2014). Nevertheless, the frequency of computer use is still increasing, especially in children, adolescents and young adults (Tran and Ciccarelli 2012; Subrahmanyam et al. 2000; Hakala et al. 2006; Witt et al. 2011). For this reason, it is imperative to think about effective ways of recognising, preventing and reducing the negative health outcomes of computer use in the young generation.

When attempting to explore the negative physical and psychological health outcomes of computer use, various kinds of health-endangering computer uses may be observed. Problematic computer use is the use of computer

technology that may be health-endangering and may cause immediate or later negative physical or psychological health outcomes or disturb well-being in users. It covers plenty of areas, for example, (1) dependence on contact with computers or other computer-related technology, causing an excessive portion of time each day being spent in interaction with computers or other computer-related technology, for example, Internet addiction, heavy computer use, computer overuse (e.g. Hetzel-Riggin and Pritchard 2011), (2) maladaptive cognitions associated with computer use, for example, obsessive thoughts about computer use (e.g. Davis 2001), (3) stress or negative emotional states experienced when person is using a computer or imagining future computer use, for example, technophobia, technostress, computer anxiety (e.g. Wilfong 2006) and (4) negative communication, threatening and bullying via the online virtual environment, for example, cyberbullying (e.g. Callaghan et al. 2015; Spears et al. 2015).

Adolescents' and university students' use of computers and electronic communication far exceed computer use in adults (Kuntsche et al. 2009). For this reason, more and more recent studies have been interested in computer addictions or problematic Internet use in youth (e.g. Hetzel-Riggin and Pritchard 2011; Rasmussen et al. 2015; Velezmoro et al. 2010). High dependency on the Internet may even be a risk factor for thoughts about committing suicide in the future. Adolescent Internet addicts had suicide ideation four times higher than non-addicts in a study by Kim et al. (2006).

Overuse of computers, Internet addiction (Chou 2001) or exposure of the body to electromagnetic fields (Röösli 2008) cause serious negative health outcomes, especially in the long-term perspective. Subrahmanyam et al. (2000) reviewed the effects of home computer use on children's physical, cognitive and social development. Frequent computer use and playing computer games were associated with an increased risk of obesity, hand injuries, the triggering of epileptic seizures, changes in heart rate, feelings of loneliness, depression and decreased family communication. Playing violent computer games was linked to aggressive thoughts, hostility and less pro-social behaviour.

Blehm et al. (2005) pointed out a variety of ocular symptoms related to computer use. Computer vision syndrome covers eye strain, tired eyes, irritation, redness, blurred vision and double vision. Special attention was also given to neck pain relating to computer use (see Green 2008 for a review). Also, the sedentary behaviour that accompanies computer use has a secondary impact in the form of lack of physical activity, which represents a negative factor influencing, for example, increased risk of obesity (Escobar-Chaves and Anderson 2008).

The question is how are children, adolescents and young adults able to cope with modern computer technologies in a healthy manner (Brod 1982; Riedl 2012)? Ways of coping, or coping strategies, are recognisable action types, hence, the behaviours, cognitions and perceptions people engage in when actually contending with stress (Skinner et al. 2003). They represent sets of basic adaptive processes that intervene between the stress and its psychological, social and physiological outcomes. Effective coping has positive short-term effects on the resolution of the stressor as well as long-term effects on mental and physical well-being (Skinner et al. 2003).

Individual coping strategies are described in the comprehensive review of Skinner et al. (2003). The authors provided a category system that covers all of the coping strategies investigated in previous research. They started with 400 lower order ways of coping (Table 3; Skinner et al. 2003), and the analysis resulted in a category system including 12 higher order families of coping strategies: problem-solving, information seeking, helplessness, escape, self-reliance, support seeking, delegation, isolation, accommodation, negotiation, submission, opposition (Figure 4; Skinner et al. 2003). Each of these higher order families includes three or four specific coping strategies. Forty-one specific coping strategies were specified in this conceptual study. It is beyond the scope of the present study to describe all of the coping strategies here, but the reader may find their detailed characteristics in the study of Skinner et al. (2003).

Coping skills are tightly inter-related with the resilience of the individual. Resilience is a key factor for successfully facing many health-endangering factors accompanying the period of adolescence (e.g. Veselska et al. 2009). Effective coping represents one of the factors supporting high adolescent resilience (Fergus and Zimmerman 2005) and consequently also positive adolescent adjustment and development.

Aside from coping with actual stressors, or "situational coping" (Rovira et al. 2005; Carver and Scheier 1994), there are also more general dispositions to react in particular ways when encountering a stressful life event. These dispositions are called dispositional coping (Carver and Scheier 1994). Current empirical findings indicate that dispositional coping strategies are predictors of Internet addictions (Milani et al. 2009) and problematic Internet use (Hetzel-Riggin and Pritchard 2011).

Despite the significance of coping skills for the resilience and health of the young generation, to our knowledge no review on coping related to the various aspects of problematic computer use has yet been published. Therefore, the main task of the present review is to summarise the existing knowledge on coping strategies which adolescents apply in the context of problematic

computer use and, further, the coping-relevant impacts of problematic computer use. We will focus our attention on instances where computers represent a direct source of stress perceived by adolescents consciously as well as on the relationship of problematic computer use with the dispositional coping skills of adolescents. In other words, we will explore coping in the context of problematic computer use, including outcomes of computer use that are perceived as stressful, but also the coping-relevant impacts of computer use working without awareness. The main goal of the present integrative review is to bring together results from different fields of research and to integrate them into a coherent and comprehensible framework. Such integration of knowledge aims to provide the principal groundwork for the development and implementation of effective public health interventions for the future.

## Methods

The initial literature search was completed in March 2014. Manuscripts published between 2000 and 2014 were accessed via the Web of Science and Google Scholar electronic databases. Recently published reviews related to coping with various aspects of problematic computer use were scanned in the preparatory and conceptual phases of this review. This initial search was focused on the current state of the art, and the purpose of this initial search was also to verify if the field chosen for the present review is not currently being covered by any other review paper. Based on this preparatory search, peer-reviewed literature providing empirical evidence from January 2000 to March 2014 was retrieved using a standard search strategy based on the keywords: coping, computer use, Internet use, technostress, technophobia, cyber-specific coping, screen-based, sedentary behaviour, cyberbullying, computer anxiety. More specifically, a series of individual searches was conducted using various combinations of three or four keywords from the above-mentioned list with logic operator "AND".

A total of 404 articles were identified, and the titles and abstracts were scanned for relevance. The first degree of article filtration was based on the titles and publication type. Meeting abstracts were excluded in this phase. Further, abstracts from relevant articles were analyzed as a second degree of filtration. The search was primarily focused on empirical studies involving adolescents or university/college students. Articles that did not directly address coping or consequences for coping correlates in any aspect of computer use were excluded. One article was excluded due to its insufficiently described methods. Taken together, the selection criteria for inclusion of studies were:

- Publication type = peer-reviewed, empirical research papers with adequate methods.
- Year of publication = from 2000 to March 2014.
- Population sample = adolescents or university/college students.
- Presence of variables relevant to the scope of the review.

Tracking reference trees "forward" and "back" was conducted in the next phase of the review process. This means that reference lists of the retrieved manuscripts were scanned for relevant sources and these sources were later retrieved. "Forward" tracking was conducted with the "Times cited" tool provided by the Web of Science. The retrieved manuscripts were searched for on the Web of Science and studies that cited them were scanned for relevance using the "Times cited" tool. The relevant sources were then retrieved. There were no additional inclusion or exclusion criteria due to the limited number of articles that addressed this topic.

## Results

### Overview of the literature

There are limited numbers of published articles discussing the interrelations of computer use and coping skills (Fig. 1). Information from the same study that was reported in more than one publication was treated as one observation. The outcomes were classified into three categories: computer use and dispositional coping skills, coping and cyberbullying, and coping with computer anxiety. These categories were not created on a pre-determined conceptual framework but were allowed to emerge from the data in the course of review procedure. The main results within each category are presented in the following sections.

### Computer use and dispositional coping skills

The relationships between Internet use and coping styles preferably used by adolescents were investigated by nine studies (Hetzel-Riggin and Pritchard 2011; Li et al. 2009, 2010; Milani et al. 2009; Gemmill and Peterson 2006; Deatherage et al. 2014; Smith et al. 2007; Baker and Moore 2008; Mitchell et al. 2009; Table 1).

Three studies found correlations between Problematic Internet Use (PIU), which imply items like overuse, problems with family or friends, problems with daily obligations, problems related to interactions with people online, upset or concern about own Internet use and online behavioural concerns (Mitchell et al. 2009), and coping

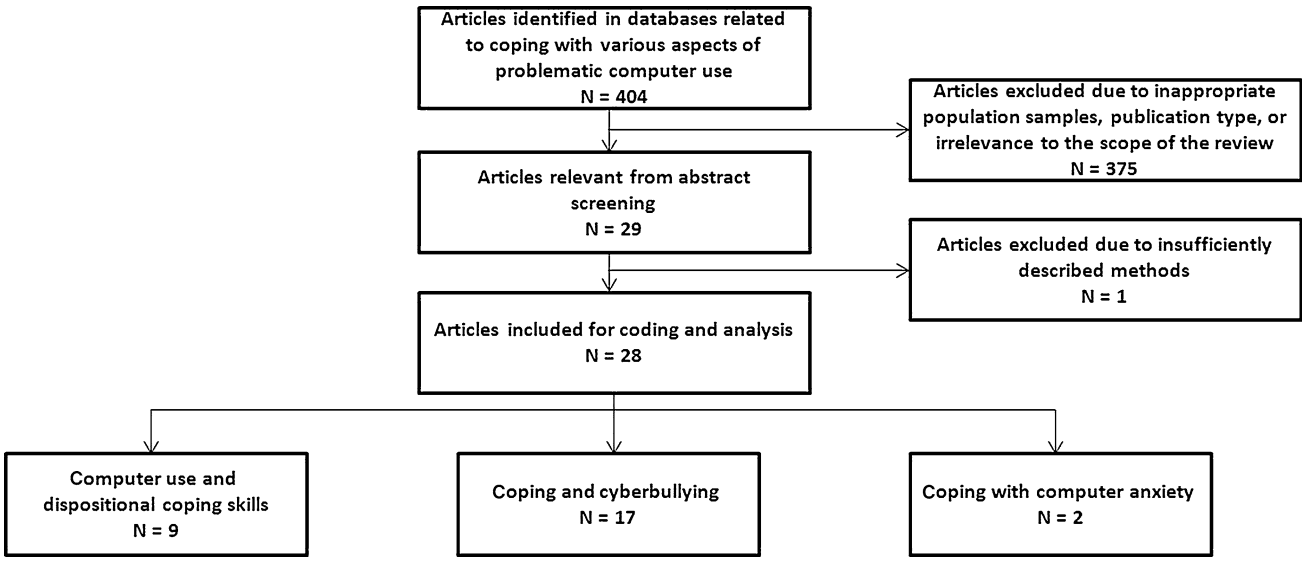


**Fig. 1** The database search strategy and data management

**Table 1** Main findings involving computer use and dispositional coping skills [Australia (2004–2007), China (2007–2009), Italy (2008), Turkey (2014), United Kingdom (2007), USA (2005–2013)]

| Study | Target population | Number of participants | Main findings |
|---|---|---|---|
| Baker and More (2008) | Young new Myspace.com users | 134 | Blogging was associated with dispositional coping style |
| Deatherage et al. (2014) | University students | 267 | Use of Internet for coping enhanced experience of stress |
| Gemmill and Peterson (2006) | University students | 299 | Use of technology for coping enhanced experience of stress |
| Hetzel-Riggin and Pritchard (2011) | University students | 425 | Dispositional coping style enhanced the risk of PIU |
| Li et al. (2009) | University students | 654 | Dispositional coping style correlated with PIU |
| Li et al. (2010) | University students | 660 | High effortful control enhanced maladaptive cognitions |
| Milani et al. (2009) | Adolescents | 98 | Dispositional coping style enhanced the risk of PIU |
| Mitchell et al. (2009) | University students | 563 | Dispositional coping was associated with problematic online experiences |
| Smith et al. (2007) | University students | 179 | No relationship between subjective computer experience and dispositional coping style |

styles, especially the avoidant coping style (Hetzel-Riggin and Pritchard 2011; Li et al. 2009; Milani et al. 2009).

Hetzel-Riggin and Pritchard (2011) investigated the role of psychological distress, body esteem and coping style in predicting problematic Internet use (PIU). Wishful thinking was associated with an increased PIU in men and an increased focusing on the positive (emotional coping). Decreased use of tension reduction (emotional coping) was associated with PIU in women. All three of these coping styles can be considered emotional coping styles.

The relationship between PIU, interpersonal relationships and coping strategies were also investigated in the study of Milani et al. (2009). They examined preferred cognitive strategies for coping with problematic situations using four subscales: active coping strategy, support, avoidant and distract coping strategy. The avoidant coping strategy was a negative predictor and the active coping strategy was a positive predictor of Internet addiction. They concluded that "adolescents with poor interpersonal relationship and a predisposition for adopting an avoidance coping strategy are at a greater risk of developing PIU" (Milani et al. 2009, p. 683).

PIU and its relationship to coping style and stressful life events were examined in the study of Li et al. (2009). They found significant correlation between stressful life events, avoidant coping and PIU and that coping style is a mediator between stressful life events and PIU. Students with higher PIU scores used more avoidant coping styles and less

problem-solving styles than students in the non-PIU group (non-problematic Internet users).

Tension reduction behaviour (emotion-focused coping strategy) was examined in relation to the index of problematic online experiences (I-POE) in the study of Mitchell et al. (2009). Their I-POE was used in the study of Deatherage et al. (2014), which examined coping styles and their association with perceived stress. Avoidant-emotional coping was positively and active-emotional coping was negatively associated with perceived stress and time since stressful adverse life events occurred. Problem-focused coping was not associated with perceived stress. This means that students using the Internet for coping and using an avoidant coping strategy experienced higher levels of stress than those who use the Internet for enhancing their lives.

Coping style and its relationship with computer experience was also explored in the study of Smith et al. (2007), but this time it was used rather for evidence of validity of the instrument they had developed. Smith et al. (2007) developed the subjective computer experience scale (SCES) and tested the validity of the SCES by negligible correlations between the SCES and MBSS (Miller behavioural style scale, Miller 1987), which measures dispositional coping style and classifies individuals according their coping style as monitors and blunters. They found no relationship between subjective computer experience dimensions and dispositional coping style.

Blogging could be considered as a special kind of Internet use, and its association with coping styles was investigated in the study of Baker and Moore (2008). Bloggers used more self-blame and venting, and they felt themselves to be more stressed than non-bloggers.

Coping is implicitly considered in the research of Li et al. (2010), which examined the relationship of temperamental effortful control, maladaptive cognitions, stressful life events and their impact on problematic Internet use. Those with high levels of effortful control developed maladaptive cognitions about the Internet and its role in managing stress and their negative emotions less likely, because they could use more positive coping styles.

The Internet represents a source of stress, but it can be also used for coping with stress. For example, Gemmill and Peterson (2006) assessed perceived stress and its relation to use of technology, disruptions from technology and the extent to which it occupied time. Using technology for communication to cope with stress was a predictor of perceived stress and problems with disruptions.

As seen above, coping strategies relating to problematic computer use are highly differentiated, and it is hard to make generalizations. The differentiation of these strategies, however, pointed to the complexity of the phenomena. Problematic computer use actually covers many areas and aspects. For these, it is not surprising that researchers used high amount of instruments to access the different domains of problematic computer use.

## Coping and cyberbullying

As coping measures, seven studies used open-ended questioning (Aricak et al. 2008; Dehue et al. 2008; Juvonen and Gross 2008; Price and Dalgleish 2010; Riebel et al. 2009; Schenk and Fremouw 2012; Soldatova and Zotova 2013), five studies used self-reports focusing on coping with cyberbullying (Accordino and Accordino 2011; Machmutow et al. 2012; Spitzberg and Hoobler 2002; Völlink et al. 2013a, b; Wachs et al. 2012), three studies used self-reports focusing on relation of cyberbullying with general dispositional coping skills (Hetzel-Riggin and Pritchard 2011; Lodge and Frydenberg 2007; Palladino et al. 2012) and two studies had qualitative designs (Parris et al. 2012; Šléglová and Černá 2011; see Table 2 for details). First of all, we will focus our attention on studies that provided their participants with the possibility of describing any ways of coping with cyberbullying.

Six studies used questions (Aricak et al. 2008; Dehue et al. 2008; Juvonen and Gross 2008; Price and Dalgleish 2010; Riebel et al. 2009; Schenk and Fremouw 2012) and one study (Soldatova and Zotova 2013) used quantitative face-to-face interviews, so it shares the principle of open-ended questioning with the above-mentioned quantitative studies. The occurrences of various coping strategies with cyberbullying reporting by participants are summarised in Table 3. Talking with various non-relative others was reported in all seven studies as well as problem solving via some types of instrumental actions, such as block the unwanted message, change username, or switch off the computer. Also, aggression to, direct confrontation, bargaining with the provoker and escape tendencies using behavioural avoidance were quite common. Adolescents and university students only rarely reported maladaptive coping strategies like rumination, helplessness, blame self-, or social-withdrawal.

Three studies using self-reports provided their participants with a broad range of general coping strategies with cyberbullying (Machmutow et al. 2012; Völlink et al. 2013a, b; Wachs et al. 2012). One self-report study was focused more specifically on social support-seeking strategies (Accordino and Accordino 2011), which is reasonable, because social support positively influences adolescent health and life satisfaction (e.g. Abel et al. 2011; Kolarcik et al. 2012). Machmutow et al. (2012) employed a list of 14 specific coping strategies with cyberbullying based on previous adolescents' reports of successful coping strategies for cyberbullying. For the clearer analytical purposes of this review, these strategies

**Table 2** Characteristics of empirical studies focused on coping in relation to cyberbullying (Australia [2006–2009], Czech Republic [2010], Germany [2007–2011], Italy [2010–2011], Russia [2012], Switzerland [2010–2011], The Netherlands [2006], Turkey [2006], United Kingdom [2012], USA [2001–2011])

| Study | Target population | Number of participants | Measurement of coping with cyberbullying | Dispositional coping measurement |
|---|---|---|---|---|
| Accordino and Accordino (2011) | Adolescents | 124 | Self-report | ✗ |
| Aricak et al. (2008) | Adolescents | 269 | Open-ended | ✗ |
| Dehue et al. (2008) | Children | 1211 | Open-ended | ✗ |
| Juvonen and Gross (2008) | Adolescents | 1454 | Open-ended | ✗ |
| Lodge and Frydenberg (2007) | Adolescents | 652 | ✗ | Self-report |
| Machmutow et al. (2012) | Adolescents | 835 | Self-report | ✗ |
| Palladino et al. (2012) | Adolescents | 375 | ✗ | Self-report |
| Parris et al. (2012) | Adolescents | 20 | Qualitative | ✗ |
| Price and Dalgleish (2010) | Adolescents | 548 | Open-ended | ✗ |
| Riebel et al. (2009) | Adolescents | 1987 | Open-ended | ✗ |
| Schenk and Fremouw (2012) | University students | 856 | Open-ended | ✗ |
| Šléglová and Černá (2011) | Adolescents | 15 | Qualitative | ✗ |
| Soldatova and Zotova (2013) | Children and adolescents | 1025 | Interviews | ✗ |
| Spitzberg and Hoobler (2002) | University students | 235 | Self-report | ✗ |
| Völlink et al. (2013a, b) | Adolescents | 325 | Self-report | Self-report |
| Wachs et al. (2012) | Adolescents | 518 | Self-report | ✗ |

✗ Not measured in the particular study

are re-sorted in terms of higher order coping categories proposed by Skinner et al. (2003) as support seeking (distant advice + close support), self-reliance (assertiveness), helplessness and opposition (retaliation). Machmutow et al. (2012) found that frequently cyberbullied adolescents were disposed to use opposition and partly support seeking (only close support) more often than other coping strategies to cope with cyberbullying. Cyber victimisation was more strongly associated with depressive symptoms when students reported low levels of social support. Therefore, it seems that higher levels of social support buffer in part the negative impact of cyber victimisation.

Similarly, Wachs et al. (2012) transformed the initial 11 self-reported items referring to coping with cyberbullying to three general dimensions: cognitive-technical coping, aggressive coping and helpless coping. Adolescents with aggressive coping were less likely to be cyberbullied, whereas adolescents with cognitive-technical coping strategies were more likely to be a victim of cyberbullying.

The study of Völlink et al. (2013a) brought interesting findings about the relations between coping with cyberbullying and the dispositional coping strategies of early adolescents. General avoidance coping, general coping through emotional expression and general depressive coping all correlated positively with cyberbullying-specific depressive coping. The more cyberbullying victims employed depressive or avoidance coping or coping through emotional expression in daily life, the more they used depressive coping to deal with cyberbullying. Further, seeking social support as a means of coping with cyberbullying was significantly related to optimistic coping and palliative coping. Thus, the more the victims use optimistic or palliative coping to deal with daily stress, the more they are inclined to seek social support for coping with cyberbullying.

When measuring dispositional coping skills, Palladino et al. (2012) found that a decrease in disposition to use avoidance predicted a greater reduction in cyber victimisation. On the other hand, problem solving was found to be a mediator of the positive change in cyber victimisation. Based on coping dispositions, Lodge and Frydenberg (2007) identified two high-risk groups of adolescents that were more prone to experience cyberbullying behaviours. This was the case of girls using the apprehensive and avoidant style of coping and boys using active seeking of relaxing diversions and the apprehensive style of coping.

This subsection shows various aspects of coping with cyberbullying. When summarizing the results of studies with open-ended questions, participants reported coping by instrumental action and talking with others in all of the studies (see Table 3). Instrumental action is a behavioural activity focused on problem solving (Skinner et al. 2003). This frequently reported strategy is likely to be an effective way of coping with cyberbullying, because of its problem-oriented character. It is also apparent that adolescents want to share the problem of being cyberbullied with others via

**Table 3** Occurrences of coping strategies in reaction to cyberbullying reported by participants in studies with open-ended questions [Australia (2009), Germany (2007), Russia (2012), The Netherlands (2006), Turkey (2006), USA (2005–2011)]

| Family of coping | Aricak et al. (2008) | Dehue et al. (2008) | Juvonen and Gross (2008) | Price and Dalgleish (2010) | Riebel et al. (2009) | Schenk and Fremouw (2012) | Soldatova and Zotova (2013) |
|---|---|---|---|---|---|---|---|
| Problem-solving | | | | | | | |
| Instrumental action | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Escape | | | | | | | |
| Behavioural avoidance | ✗ | ✗ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Wishful thinking | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✔ |
| Substance use | ✗ | ✗ | ✗ | ✗ | ✗ | ✔ | ✗ |
| Opposition | | | | | | | |
| Aggression | ✗ | ✔ | ✗ | ✔ | ✔ | ✔ | ✗ |
| Direct confrontation | ✔ | ✗ | ✗ | ✔ | ✔ | ✗ | ✗ |
| Negotiation | | | | | | | |
| Bargaining | ✔ | ✗ | ✗ | ✗ | ✔ | ✗ | ✔ |
| Support seeking | | | | | | | |
| Family communication | ✔ | ✔ | ✗ | ✔ | ✗ | ✗ | ✗ |
| Talking with others | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Isolation | | | | | | | |
| Social withdrawal | ✗ | ✗ | ✗ | ✗ | ✗ | ✔ | ✗ |
| Accommodation | | | | | | | |
| Ignore problem | ✔ | ✔ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Acceptance | ✗ | ✗ | ✗ | ✔ | ✗ | ✗ | ✗ |
| Helplessness | | | | | | | |
| Confusion | ✗ | ✗ | ✗ | ✗ | ✔ | ✗ | ✗ |
| Self-reliance | | | | | | | |
| Emotional expression | ✗ | ✗ | ✗ | ✗ | ✔ | ✗ | ✗ |
| Submission | | | | | | | |
| Rumination | ✗ | ✗ | ✗ | ✗ | ✔ | ✗ | ✗ |
| Blame self | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✔ |

✔ Reported by participants of the particular study

✗ Not reported by participants of the particular study

communication. Other frequently reported strategies were behavioural avoidance and aggression (reported in 4 studies, see Table 3).

### Coping with computer anxiety

Some older studies focused on coping and computer anxiety (e.g. Bowers and Bowers 1996), but only two contemporary studies have explored the relationship between computer anxiety and coping in youth after 2000. Thorpe and Brosnan (2007) compared people with a spider phobia, computer anxiety and non-anxious people. Computer anxiety was dependent on beliefs in coping ability, and social, performance and test anxiety were related to computer anxiety and avoidance. Respondents with computer anxiety used avoidance more than non-anxious respondents but less than arachnophobic respondents. This is supported, for example, by the research of Brosnan et al. (2012), who found that students with pathological levels of Internet anxiety decreased their Internet usage during first academic year.

## Discussion

The present study reviewed empirical studies focusing on coping in the context of problematic computer use in adolescents and young adults. It covers issues involving heavy computer use, overuse, PIU, computer anxiety and cyberbullying. The reviewed empirical findings revealed some general patterns of relationships between reviewed instances of problematic computer use, situational coping and personal dispositions to use specific coping style, called dispositional coping. The results indicated the

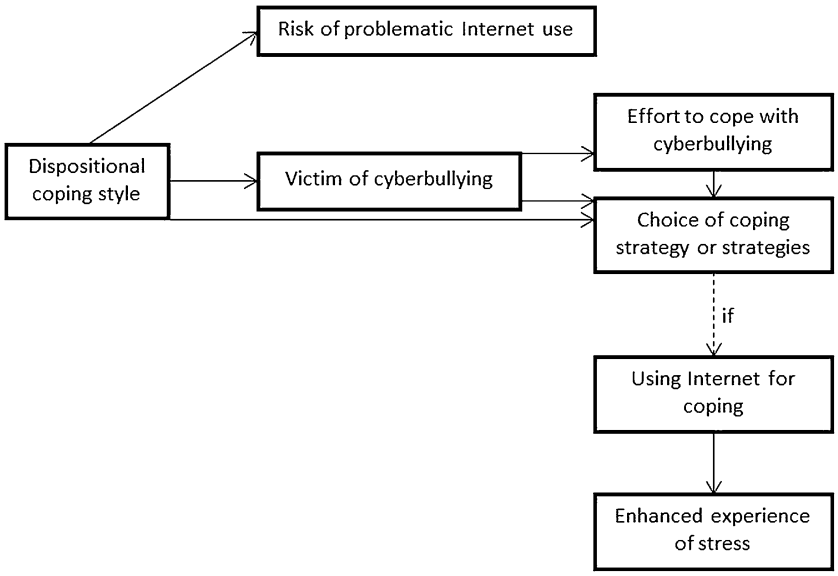


**Fig. 2** Model of relationships between problematic computer use, situational coping and dispositional coping

following types of relationships, (1) personal dispositional coping style predicts the risk of PIU (Milani et al. 2009), (2) the use of computer-related technology for coping with stress enhances the experience of stress (Gemmill and Peterson 2006; Deatherage et al. 2014), (3) personal dispositions to use some kind of coping style influence the risk of cyber victimisation (e.g. Lodge and Frydenberg 2007; Palladino et al. 2012), (4) the experience of being cyberbullied stimulates the situational coping effort, i.e. the effort to cope with being cyberbullied (e.g. Aricak et al. 2008), (5) the experience of being cyberbullied influences the subsequent structure of coping, i.e. which coping strategies one applies to cope with being cyberbullied (Völlink et al. 2013a), (6) personal dispositions to use some kind of coping style influence situational coping with being cyberbullied (Völlink et al. 2013a), (7) computer anxiety influences personal dispositions to use some kind of coping style (Thorpe and Brosnan 2007), (8) subjective beliefs about one's own coping ability influence the experience of computer anxiety (Thorpe and Brosnan 2007). Some of these causal patterns are depicted in Fig. 2 for illustrative demonstration of various relationships.

It is necessary to say that some types of relationships have been only rarely studied by previous empirical research and their approvals need further empirical evidence and verifications. For this reason, the results of this review are suggested to be a starting point for further investigation and theoretical discussions. Extracting the above-outlined general patterns of relationships is a first attempt to connect various instances of problematic computer use with coping processes. Therefore, a broader contextual embedding into stress and coping theory on one hand and into health psychology theory on the other hand is needed for the future. Such theoretical developments would require a detailed and extensive elaboration that is far above the main focus of the present review, but it would be stimulating for some follow-up studies.

When turning our attention to coping-relevant impacts of health-endangering computer use, the present review enriches the field by revealing the general structure of specific coping strategies related to problematic computer use. The presentation of most of these strategies is organised around two main subsections, "Coping and cyberbullying" and "Computer use and dispositional coping skills". The specific coping strategies that occurred in these subsections are considered to be elements of the general structure of coping relating to problematic computer use.

The results presented in the subsection "Coping and cyberbullying" indicate that some coping strategies are used more often than others (see Table 3). Participants reported coping by instrumental action and talking with others in all of the studies focused on cyberbullying, based on open-ended questioning (Aricak et al. 2008; Dehue et al. 2008; Juvonen and Gross 2008; Price and Dalgleish 2010; Riebel et al. 2009; Schenk and Fremouw 2012; Soldatova and Zotova 2013). Also, behavioural avoidance and aggression were quite commonly used to cope with cyberbullying (Dehue et al. 2008; Juvonen and Gross 2008; Price and Dalgleish 2010; Riebel et al. 2009; Schenk and Fremouw 2012; Soldatova and Zotova 2013). However, these results do not inform us about the effectiveness of the reported strategies for coping with cyberbullying. Coping strategies may be used, but the stress related to being cyberbullied may remain or be even strengthened via maladaptive cognitive efforts which are related to psychological malfunctioning (Hampel and Petermann 2006).

When searching for the effectiveness of coping strategies to reduce stress, the meta-analysis of Penley et al.

(2002) may be helpful for interpreting the results of the present review in the context of health psychology. Penley et al. (2002) conducted a meta-analysis determining how different coping strategies are associated with health outcomes. In the present review, the avoidant coping style has been associated with higher levels of PIU, perceived stress and a higher risk of Internet addiction and cyber victimisation. Penley et al. (2002) pointed out that using the escape-avoidance strategy was negatively correlated with psychological health outcomes and not significantly correlated with physical health outcomes. These results support the hypothesis that the avoidant coping style is not effective for reducing stress related to cyberbullying or PIU.

On the other hand, problem-solving may be assumed to be an effective strategy for reducing or preventing cyber victimisation as well as PIU and Internet addiction. Interestingly, the meta-analysis of Penley et al. (2002) did not reveal either a positive or negative correlation with health outcomes. The authors explained this surprising result as being due to insufficient statistical power to detect the small correlation between this strategy and health outcomes. They also pointed out that the adaptive or maladaptive nature of problem-solving may depend on the situational context.

When turning attention to the subsection "Computer use and dispositional coping skills", one can see that the structure of coping strategies related to PIU and computer overuse is highly differentiated. Different coping strategies occurred in the reviewed empirical studies, and they also played various roles in the study designs. Avoidant coping, wishful thinking, focusing on the positive and decreased use of tension reduction were predictors of PIU or Internet addiction (Hetzel-Riggin and Pritchard 2011; Li et al. 2009; Milani et al. 2009). On the other hand, active coping was a positive predictor of Internet addiction (Milani et al. 2009). In a comparison of bloggers and non-bloggers, bloggers used more self-blame and venting and felt themselves to be more stressed than non-bloggers (Baker and Moore 2008). Participants with high levels of effortful control were less likely to develop maladaptive cognitions about the Internet and its role in managing stress and their negative emotions, because they could use more positive coping styles (Li et al. 2010). As seen above, almost each study in this subsection was focused on slightly different aspects of problematic computer use. The high differentiation of coping strategies in their results as well as the total number of studies reviewed in the present study indicate that this field is a developing research area enabling plenty of new, promising issues for future research. Results of the present review indicate that coping in the context of problematic computer use is a very complex phenomenon that is still not sufficiently covered by current research.

The structure of coping strategies related to outcomes of problematic computer use provided by the present study may be useful for clinical psychologists and counsellors treating computer addicts or Internet addicts. The information taken together in the present review brings better insight into computer and Internet addictions and their relation to the coping skills of adolescents. For example, some of coping styles were reported to be predictors of PIU. This means that people using particular coping strategies could develop PIU more likely than others. It seems that especially emotional and avoidant coping styles are predictors of perceived stress and PIU (Hetzel-Riggin and Pritchard 2011; Li et al. 2009; Milani et al. 2009; Deatherage et al. 2014; Smith et al. 2007). These findings are very important, because they may help clinicians identify clients that are more prone to cope ineffectively with stress related to their Internet addictions. Focusing on personal coping styles may therefore be of crucial significance for therapeutic treatment dealing with negative health outcomes related to problematic computer use.

### Recommendations for public health intervention

The general focus in interventions on cyberbullying should be given to the implementation of training programmes, for example, within the primary and secondary school curricula. These training programmes would include the active involvement of pupils, who could practise deciding how to behave under certain situations, for example, when being cyberbullied. The training should involve pupils actively, for example, using non-standard educational approaches, rather than passive reception of information.

The prevention of Internet addictions and computer overuse should be based on creating new opportunities for the greater involvement of children, adolescents and their parents in leisure-time activities that do not include computer use. The everyday frequency of computer use needs special attention, because Internet addictions and computer overuse are dependent on total time spent in front of the computer.

### Gaps and future research

Actually, there are several unexplored fields that can be inspiring for future research. For example, although computer anger has been already discussed by Wilfong (2006), no study has yet focused on coping with computer anger or on the interrelation of computer anger with dispositional coping skills. Similarly, despite the importance of the problem, there are still only a few studies on coping with computer anxiety (Bowers and Bowers 1996; Thorpe and Brosnan 2007; Brosnan et al. 2012).

Furthermore, there is no research focused explicitly on coping with physical stressors elicited by computers, such as electromagnetic fields and so on. However, it is

important to point out that such stressors are difficult to approach empirically, because effects of these influences work outside of consciousness. Individuals may experience the secondary symptoms elicited by these stressors like subjective feelings of exhaustion, irritation or depressive moods, but they are often not able to link these negative health outcomes with computer use.

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## References

Abel T, Fuhr DC, Bisegger C, Ackermann S, The European Kidscreen Group (2011) Money is not enough: exploring the impact of social and cultural resources on youth health. Scand J Public Health 39(6 Suppl):57–61. doi:10.1177/1403494810378924

Accordino DB, Accordino MP (2011) An exploratory study of face-to-face and cyberbullying in sixth grade students. Am Second Educ 40(1):14–30

Aricak T, Siyahhan S, Uzunhasanoglu A, Saribeyoglu S, Ciplak S, Yilmaz N, Memmedov C (2008) Cyberbullying among Turkish Adolescents. Cyberpsychol Behav 11(3):253–261. doi:10.1089/cpb.2007.0016

Baker JR, Moore SM (2008) Distress, coping, and blogging: comparing new myspace users by their intention to blog. Cyberpsychol Behav 11(1):81–85. doi:10.1089/cpb.2007.9930

Blehm C, Vishnu S, Khattak A, Mitra S, Yee RW (2005) Computer vision syndrome: a review. Surv Ophthalmol 50(3):253–262. doi:10.1016/j.survophthal.2005.02.008

Bowers DA, Bowers VM (1996) Assessing and coping with computer anxiety in the social science classroom. Soc Sci Comput Rev 14(4):439–443. doi:10.1177/089443939601400406

Brenner V (1997) Psychology of computer use: XLVII. Parameters of internet use, abuse and addiction: the first 90 days of the internet usage survey. Psychol Rep 80:879–882. doi:10.2466/pr0.1997.80.3.879

Brod C (1982) Managing technostress: optimizing the use of computer technology. Pers J 61(10):753–757

Brosnan M, Joiner R, Gavin J, Crook C, Maras P, Guiller J, Scott AJ (2012) The impact of pathological levels of internet-related anxiety on internet usage. J Educ Comput Res 46(4):341–356. doi:10.2190/EC.46.4.b

Callaghan M, Kelly C, Molcho M (2015) Exploring traditional and cyberbullying among Irish adolescents. Int J Public Health. doi:10.1007/s00038-014-0638-7

Carver CS, Scheier MF (1994) Situational coping and coping dispositions in a stressful transaction. J Pers Soc Psych 66:184–195

Chou C (2001) Internet heavy use and addiction among Taiwanese college students: an online interview study. Cyberpsychol Behav 4(5):573–585

Davis RA (2001) A cognitive-behavioral model of pathological internet use. Comput Hum Behav 17:187–195

Deatherage S, Servaty-Seib HL, Aksoz I (2014) Stress, coping, and internet use of college students. J Am Coll Health 62(1):40–46. doi:10.1080/07448481.2013.843536

Dehue F, Bolman C, Völlink T (2008) Cyberbullying: youngsters' experiences and parental perception. Cyberpsychol Behav 11(2):217–223. doi:10.1089/cpb.2007.0008

Escobar-Chaves SL, Anderson CA (2008) Media and risky behaviors. Future Child 18(1):147–180

Fergus S, Zimmerman MA (2005) Adolescent resilience: a framework for understanding healthy development in the face of risk. Annu Rev Publ Health 26(1):399–419. doi:10.1146/annurev.publhealth.26.021304.144357

Gemmill EL, Peterson M (2006) Technology use among college students: implications for student affairs professionals. J Stud Aff Res Pract 43(2):482–502. doi:10.2202/1949-6605.1640

Green BN (2008) A literature review of neck pain associated with computer use: public health implications. J Can Chiropr Assoc 52(3):161–167

Hakala PT, Rimpelä AH, Saarni LA, Salminen JJ (2006) Frequent computer-related activities increase the risk of neck–shoulder and low back pain in adolescents. Eur J Public Health 16(5):536–541. doi:10.1093/eurpub/ckl025

Hampel P, Petermann F (2006) Perceived stress, coping, and adjustment in adolescents. J Adolesc Health 38(4):409–415. doi:10.1016/j.jadohealth.2005.02.014

Hetzel-Riggin MD, Pritchard JR (2011) Predicting problematic internet use in men and women: the contributions of psychological distress, coping style, and body esteem. Cyberpsychol Behav Soc Netw 14(9):519–525. doi:10.1089/cyber.2010.0314

Iannotti RJ, Janssen I, Haug E, Kololo H, Annaheim B, Borraccino A (2009) Interrelationships of adolescent physical activity, screen-based sedentary behaviour, and social and psychological health. Int J Public Health 54(2):191–198. doi:10.1007/s00038-009-5410-z

Juvonen J, Gross EF (2008) Extending the school grounds?—bullying experiences in cyberspace. J School Health 78(9):496–505. doi:10.1111/j.1746-1561.2008.00335.x

Kim K, Ryu E, Chon MY, Yeun EJ, Choi SY, Seo JS, Nam BW (2006) Internet addiction in Korean adolescents and its relation to depression and suicidal ideation: a questionnaire survey. Int J Nurs Stud 43(2):185–192. doi:10.1016/j.ijnurstu.2005.02.005

Kolarcik P, Geckova AM, Reijneveld SA, van Dijk JP (2012) Social support, hopelessness and life satisfaction among Roma and non-Roma adolescents in Slovakia. Int J Public Health 57(6):905–913. doi:10.1007/s00038-012-0413-6

Kuntsche E, Simons-Morton B, Bogt T, Queija IS, Tinoco VM et al (2009) Electronic media communication with friends from 2002 to 2006 and links to face-to-face contacts in adolescence: an HBSC study in 31 European and North American countries and regions. Int J Public Health 54(S2):243–250. doi:10.1007/s00038-009-5416-6

Li H, Wang J, Wang L (2009) A survey on the generalized problematic internet use in Chinese college students and its relations to stressful life events and coping style. Int J Ment Health Addict 7(2):333–346. doi:10.1007/s11469-008-9162-4

Li D, Zhang W, Li X, Zhen S, Wang Y (2010) Stressful life events and problematic internet use by adolescent females and males: a mediated moderation model. Comput Hum Behav 26(5):1199–1207. doi:10.1016/j.chb.2010.03.031

Lodge J, Frydenberg E (2007) Cyber-bullying in Australian schools: profiles of adolescent coping and insights for school practitioners. Aust Educ Dev Psychol 24(1):45–58

Machmutow K, Perren S, Sticca F, Alsaker FD (2012) Peer victimisation and depressive symptoms: can specific coping strategies buffer the negative impact of cybervictimisation? Emot Behav Diffic 17(3–4):403–420. doi:10.1080/13632752.2012.704310

Milani L, Osualdella D, Di Blasio P (2009) quality of interpersonal relationships and problematic internet use in adolescence. Cyberpsychol Behav 12(6):681–684. doi:10.1089/cpb.2009.0071

Miller SM (1987) Monitoring and blunting: validation of a questionnaire to assess styles of information seeking under threat. J Pers Soc Psychol 52(2):345–353. doi:10.1037/0022-3514.52.2.345

Mitchell KJ, Sabina C, Finkelhor D, Wells M (2009) Index of problematic online experiences: item characteristics and correlation with negative symptomatology. Cyberpsychol Behav 12(6):707–711. doi:10.1089/cpb.2008.0317

Nuutinen T, Roos E, Ray C, Villberg J, Välimaa R et al (2014) Computer use, sleep duration and health symptoms: a cross-sectional study of 15-year olds in three countries. Int J Public Health 59(4):619–628. doi:10.1007/s00038-014-0561-y

Palladino BE, Nocentini A, Menesini E (2012) Online and offline peer led models against bullying and cyberbullying. Psicothema 24(4):634–639

Parris L, Varjas K, Meyers J, Cutts H (2012) High school students' perceptions of coping with cyberbullying. Youth Soc 44(2):284–306. doi:10.1177/0044118X11398881

Penley JA, Tomaka J, Wiebe JS (2002) The association of coping to physical and psychological health outcomes: a meta-analytic review. J Behav Med 25(6):551–603

Price M, Dalgleish J (2010) Cyberbullying experiences, impacts and coping strategies as described by Australian young people. Youth Stud Aust 29(2):51–59

Rasmussen M, Meilstrup CR, Bendtsen P, Pedersen TP, Nielsen L, Madsen KR, Holstein BE (2015) Perceived problems with computer gaming and Internet use are associated with poorer social relations in adolescence. Int J Public Health. doi:10.1007/s00038-014-0633-z

Riebel J, Jäger RS, Fischer UC (2009) Cyberbullying in Germany—an exploration of prevalence, overlapping with real life bullying and coping strategies. Psychol Sci Q 51(3):298–314

Riedl R (2012) On the biology of technostress: literature review and research agenda. ACM SIGMIS Database 44(1):18–55. doi:10.1145/2436239.2436242

Röösli M (2008) Radiofrequency electromagnetic field exposure and non-specific symptoms of ill health: a systematic review. Environ Res 107(2):277–287. doi:10.1016/j.envres.2008.02.003

Rovira T, Fernandez-Castro J, Edo S (2005) Antecedent and consequences of coping in the anticipatory stage of an exam: a longitudinal study emphasing the role of affect. Anx Stress Cop 18:209–225

Schenk AM, Fremouw WJ (2012) Prevalence, psychological impact, and coping of cyberbully victims among college students. J Sch Violence 11(1):21–37. doi:10.1080/15388220.2011.630310

Skinner EA, Edge K, Altman J, Sherwood H (2003) Searching for the structure of coping: a review and critique of category systems for classifying ways of coping. Psychol Bull 129(2):216–269. doi:10.1037/0033-2909.129.2.216

Šléglová V, Černá A (2011) Cyberbullying in adolescent victims: perception and coping. Cyberpsychol J Psychosoc Res Cyberspace 5(2):1–33

Smith B, Caputi P, Rawstorne P (2007) The development of a measure of subjective computer experience. Comput Hum Behav 23(1):127–145. doi:10.1016/j.chb.2004.04.001

Soldatova G, Zotova E (2013) Coping with online risks: the experience of russian schoolchildren. J Child Media 7(1):44–59. doi:10.1080/17482798.2012.739766

Spears BA, Taddeo CM, Daly AL, Stretton A, Karklins LT (2015) Cyberbullying, help-seeking and mental health in young Australians: implications for public health. Int J Public Health. doi:10.1007/s00038-014-0642-y

Spitzberg BH, Hoobler G (2002) Cyberstalking and the technologies of interpersonal terrorism. New Media Soc 4(1):71–92. doi:10.1177/14614440222226271

Subrahmanyam K, Kraut RE, Greenfield PM, Gross EF (2000) the impact of home computer use on children's activities and development. Futur Child 10(2):123–144

Subrahmanyam K, Greenfield P, Kraut R, Gross E (2001) The impact of computer use on children's and adolescents' development. J Appl Dev Psychol 22(1):7–30. doi:10.1016/S0193-3973(00)00063-0

Thorpe SJ, Brosnan MJ (2007) Does computer anxiety reach levels which conform to DSM IV criteria for specific phobia? Comput Hum Behav 23(3):1258–1272. doi:10.1016/j.chb.2004.12.006

Tran T, Ciccarelli M (2012) Primary school children's knowledge of, and attitudes towards, healthy computer use. Work J Prev Assess Rehabil 41(1 Suppl):863–868. doi:10.3233/WOR-2012-0255-863

Velezmoro R, Lacefield K, Roberti JW (2010) Perceived stress, sensation seeking, and college students' abuse of the internet. Comput Hum Behav 26(6):1526–1530. doi:10.1016/j.chb.2010.05.020

Veselska Z, Geckova AM, Orosova O, Gajdosova B, van Dijk JP, Reijneveld SA (2009) Self-esteem and resilience: the connection with risky behavior among adolescents. Addict Behav 34(3):287–291. doi:10.1016/j.addbeh.2008.11.005

Völlink T, Bolman CAW, Dehue F, Jacobs NCL (2013a) Coping with Cyberbullying: differences between victims, bully-victims and children not involved in bullying: coping with cyberbullying. J Community Appl Soc Psychol 23(1):7–24. doi:10.1002/casp.2142

Völlink T, Bolman CAW, Eppingbroek A, Dehue F (2013b) Emotion-focused coping worsens depressive feelings and health complaints in cyberbullied children. J Criminol 2013:1–10. doi:10.1155/2013/416976

Wachs S, Wolf KD, Pan CC (2012) Cybergrooming: risk factors, coping strategies and associations with cyberbullying. Psicothema 24(4):628–633

Wilfong JD (2006) Computer anxiety and anger: the impact of computer use, computer experience, and self-efficacy beliefs. Comput Hum Behav 22(6):1001–1011. doi:10.1016/j.chb.2004.03.020

Witt EA, Massman AJ, Jackson LA (2011) Trends in youth's videogame playing, overall computer use, and communication technology use: the impact of self-esteem and the Big Five personality factors. Comput Hum Behav 27(2):763–769. doi:10.1016/j.chb.2010.10.025