

Parental supervision and control of adolescents' problematic internet use: understanding and predicting adoption of parental control software

Kristin Stewart, Glen Brodowsky and Donald Sciglimpaglia

Abstract

Purpose – This paper aims to identify the factors that motivate parents to adopt internet monitoring software (aka parental control software [PCS]) to curb problematic internet usage and safeguard their children online. By doing so, the authors are able to curb problematic internet usage and keep children safe online.

Design/methodology/approach – An online survey was conducted using a representative sample of 330 parents in the USA with children ages 10 to 15. Results were analyzed using structural equation modeling.

Findings – This research combines two theories, namely, technology acceptance model (TAM) and protection motivation theory (PMT) to factors that motivate parents to adopt internet monitoring software to help their children. Perceived severity, perceived vulnerability from PMT and personal innovativeness (PI) from TAM, which is related to self-efficacy and the belief that future technologies will require less effort to adopt, are key factors that influence parents' perceived usefulness of PCS. Perceived usefulness and PI both positively predict parents' purchase intention for internet monitoring software.

Practical implications – The study establishes that there are personal, technology and situational factors that motivate the adoption of PCS. These determinants have implications for how marketers identify potential users and how they might improve the promotion of internet monitoring technologies.

Originality/value – The paper extends the application of the technology acceptance model and PMT to predict technology adoption aimed at helping others. Findings show that personal and perceptual factors motivate parents' adoption of internet monitoring software to curb problematic internet usage and keep children safe online. This paper is the first to combine the technology acceptance model and PMT to explain the adoption of software solutions to protect others online. By doing so, a more thorough account of parents' technology adoption to protect their children is offered.

Keywords Protection motivation theory, Technology adoption, Problematic internet use

Paper type Research paper

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Introduction

The advent of smartphone technology, as well as the ubiquity of the internet and the mass proliferation of social media, has led to growing parental concerns regarding a societal issue referred to as problematic internet use (PIU) by teens and younger adolescents (Eagle *et al.*, 2003). PIU is the “use of the internet that creates psychological, social, school and/or work difficulties in a person's life” (Beard and Wolf, 2001, p. 378). It has also gained behavioral scientists' attention worldwide (Griths, 1999; Caplan, 2002, 2003; Bleakley *et al.*, 2016; Twenge and Campbell, 2018). For parents, PIU is associated with the over-use of digital media and its associated negative consequences. Examples include maladaptive

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drive to use the internet for periods of time longer than intended or exposure to inappropriate content due to visitation of unmonitored internet forms and chat apps (Aboujaoude, 2010). Numerous studies have shown PIU to be associated with a wide range of problems for adolescents. These include (cyber)bullying, harassment, low self-esteem, poor grades, propensity to be easily bored, getting “in trouble,” attention deficit hyperactivity disorder, sleep disturbances and excessive daytime sleepiness, less favorable relations with parents, exposure to risky behaviors such as gambling, violence, pornography, blackmail and the disclosure of personal, private information (Nasaescu *et al.*, 2018; Rideout and Foehr, 2010; Bleakley *et al.*, 2016; Katz *et al.*, 2015; Rial *et al.*, 2018).

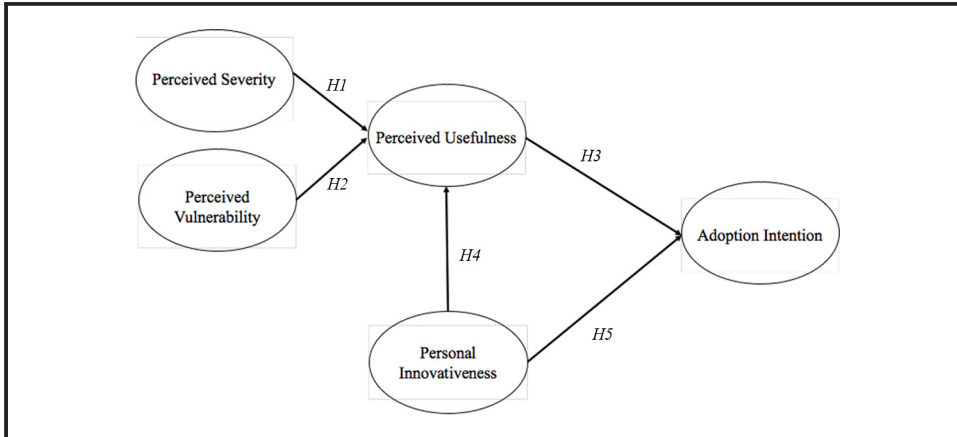
In psychology and human-computer interaction research, findings have outlined some antecedents of PIU. These include psychological (Caplan, 2006) and social factors, such as a higher frequency of parent conflicts and lower family functioning (Ko *et al.*, 2007; Wartberg *et al.*, 2017). Family factors have been given more attention in the past decade, however, more research is needed on how to foster counter PIU environments (Lam, 2015). Parents are faced with a large and growing threat of PIU. In the interest of protecting their children, they have a wide variety of tools to combat the threat, including many types of parental control software (PCS). The National Cybersecurity Alliance suggests that PCS programs are technological products that can be skillfully used to keep internet use among children safe and productive while simultaneously leaving parents assured. These PCS products allow parents to set controls on their children's internet use (Gómez *et al.*, 2017). There is a gap in extant research on how parents act as key decision-makers to protect their children from PIU.

This research addresses this gap by examining what motivates parents' decision to adopt PCS and whether some parents are better able to make the right choice than others. To address these questions, this research conducted a controlled, nationwide survey and used a structural equation model to combine two well-established theoretical frameworks investigating why parents might adopt PCS to mitigate PIU by their adolescent children. This research furthers our understanding of parent and young consumer behavior and contributes to marketing theory on technology adoption by examining a unique context in which technology is adopted to benefit another, i.e. a person other than the adopter. From protection motivation theory (PMT), we first consider contextual factors for adopting a new technology, which, in this case, is to protect their children from a serious threat to which they are vulnerable. Here, we use the term children with respect to the parent-child relationship. The children of interest in this study are young adolescents between the ages of 10 and 15. From the technology adoption model (TAM), we consider factors that address consumers' expectancies of PCS, namely, their perceptions of functionality and usefulness of. Finally, the model considers a key personal factor, self-efficacy and its influence on parents' likelihood of adopting PCS to address the problem of PIU. These theories are combined because together they allow us to understand more clearly what makes parents adopt or not adopt technology to deter PIU better than either could on their own. Implications are offered for both marketers and consumers.

Literature-based model development

This section includes several subsections corresponding to the various elements of the proposed model presented in Figure 1. The model combines PMT and TAM. PMT provides a useful framework for studying situations in which individuals are motivated to take action to protect themselves or others. The protective action in question is the adoption of a technological solution – PCS and PMT do not specifically consider technology-based protection. TAM is a widely used model for understanding how the nature of technologies, in terms of ease of use and perceived usefulness, affect adoption. However, TAM has rarely been used to study the adoption of technology to benefit someone other than the user.

Figure 1 The research model



The proposed model and the following discussion weave together elements of the two theoretical frameworks illustrating how they complement one another to present a richer understanding of why and how parents may choose to adopt PCS than each could accomplish separately. The first subsection introduces the extent and problems associated with PIU. This is followed by examples of PCS consumers might adopt to address PIU. Next, there is a discussion of parental motivations and the contextual elements that may lead parents to consider technical solutions to protect their children. This is framed note within PMT and introduces PMT-grounded research hypotheses about how the threat of PIU and the exposure of their children to its negative consequences affect how useful parents perceive PCS to be. The fourth subsection discusses the nature of the PCS framed within the TAM. It puts forth a hypothesis regarding how perceptions of the usefulness of PCS affect the likelihood of its adoption. The final section presents the literature and proposes hypotheses concerning parents' assessment of their own efficacy in using control software (based in PMT) that affects their perceptions of the ease of use the software that, according to TAM, ultimately leads to their decision to adopt it.

Problematic internet usage: definition, extent and related problems

Research addressing young consumers' internet and social media use is becoming increasingly important. [Twenge et al. \(2019\)](#), in an assessment of adolescents' media use from 1976 to 2016, note that those born after 1995 are the first to spend their entire adolescence in the "smartphone era." This generation (Gen Z – those born after 1997) also represents the largest population of future consumers ([Sterling, 2017](#)). These young consumers are increasingly spending more time online and less time interacting with their friends in person. [Clement \(2019\)](#) reported that, overall, adolescents are "very well-connected...and perform most of their online activities via mobile." She noted that 88% of American adolescents between the ages of 13–17 have regular access to laptop computers, while more than 93% have access to smartphones ([Clement, 2019](#)). Importantly, this is now a worldwide phenomenon as more and more households and adolescents globally gain access to digital technology.

These problems associated with internet use by adolescents are clearly accelerating. In their research, [Twenge et al. \(2019\)](#) found that digital media use has increased considerably, with the average American 12th grader in 2016 spending more than twice as much time online as in 2006. That study also suggests that time online, texting and using social media totaled nearly 6h a day by 2016. While only half of the 12th graders visited social media sites almost every day in 2008, 82% did so by 2016. Although this increased

connectivity has made the dissemination of information and entertainment more efficient, it has also caused dependencies on information acquisition's immediacy and the gratification such accessibility provides (Globokar, 2018). A combination of factors (psychological, social and familial) has led to "smartphone addiction" in adolescents and adults (Aslanbay *et al.*, 2009). These factors have given rise to the need for stringent supervision or regulation of use.

Greater (vs less) time spent with the internet has also been linked to adverse cognitive and mental outcomes. Data from the Adolescent Brain Cognitive Development study, a recent \$300m project financed by the US National Institutes of Health, showed that children who reported more than 2 h a day of screen time got lower scores on thinking and language tests (Carey, 2018). Also, MRI scans found significant physical differences in the brains of children who spent more than 7 h a day looking at screens compared with those who spent less time online. Studies have also shown that adolescents engaging in PIU also suffer from depression, anxiety, social withdrawal and, in extreme cases, suicidal ideation (Globokar, 2018; Alt and Boniel-Nissim, 2018; Heid, 2017). Indeed, Bisen and Deshpande (2018), in a comprehensive international meta-analysis, found addiction related to PIU to be as high as 8.4% worldwide and addiction to video gaming as high as 11.9%. PIU can affect the development of mental disorders (Blum-Ross and Livingstone, 2016), as many studies demonstrate a positive relationship between PIU and a decline in mental health (Rial *et al.*, 2018; Boniel-Nissim and Sasson, 2018).

As noted previously, research has identified many social issues found to be positively correlated with PIU. Though universal, these problems have been documented primarily among adolescent demographics. As an example, one contemporary problem is the phenomenon of "sexting," whereby an adolescent is asked to send a nude photo of herself or less commonly, himself. A meta-analysis on this topic found that 1 in 7 adolescents have sent sexts, 1 in 4 have received sexts and 1 in 8 have forwarded sexts without the consent of the person in the photo (Madigan *et al.*, 2018). The ramifications of requesting, sharing and possessing nude photos of minors can range from reputational damage and lowered self-esteem to criminal prosecution. The literature on sexting among youth shows that it is a predictor of sexual behavior and may be associated with other health outcomes and risky behaviors (Klettke *et al.*, 2019). Recently, as social isolation and device usage soared during the pandemic, the sharing of nude selfies and other sexually explicit messages among adolescents increased.

Parental control software for combating problematic internet use

PIU is a significant concern today, with cultural differences (De Morentin *et al.*, 2014) and demographics (Álvarez *et al.*, 2013) influencing parents' attitudes toward the regulation of children's internet use. However, some research suggests that with effective parental moderation (Shin, 2017) and the shrewd integration of technology, the effects of PIU can be mitigated or avoided altogether (Anderson, 2020). Indeed, Letheren *et al.* (2019) support the notion that technology can serve as an assistant and manager to which parents "delegate" their children's protection. Such software is functionally designed to protect children's online privacy while preventing them from accessing unsuitable content.

There are currently many popular software programs and apps that proactively monitor social networks for potential safety risks. Parents can use such products to monitor their children's browsing behavior as it alerts parents to what their children are doing online. Popular examples of software currently available for computers and smartphones include Bark, Net Nanny Parental Control, Norton Family, Kaspersky Safe Kids, Qustodio, OurPact, Screen Time, ESET Parental Control for Android and MM Guardian. While some software applications are free of charge, many have significant upfront and subscription costs. Adoption of such software solutions for parental monitoring is growing. According to a 2016 Pew Research report (Anderson, 2020), 39% of parents in the US reported using parental

controls for blocking, filtering or monitoring their teens' online activities, 16% used parental controls to restrict their teens' mobile phone use and 16% used monitoring tools on their teens' mobile phones to track their locations.

Adopting technology to protect others: protection motivation theory

Parents' attempted mediation of children's media use is a global phenomenon (Sun, 2009; Shin, 2017). Parents have become increasingly concerned about their children developing problematic conditions attributable to PIU and have begun to consider methods of reducing device usage or filtering the content their children can access. Adopting technology to protect one's children is an increasingly urgent issue today, driven by governmental agencies' warnings of spikes in cybercrimes (Sheng, 2020). Research suggests that with a balanced mediation strategy and the correct tools, parental monitoring of screen time can prove to be the most mutually beneficial experience for concerned parents and children whose development can be adversely impacted by exposure to inappropriate or even dangerous content and online behaviors. According to the American Academy of Pediatrics, the consensus among parents and medical professionals seems to be to limit children to about 1 to 2 h a day of leisure screen time, not counting time spent on schoolwork (Papas, 2020). It is hoped that by doing so, there will be a revitalization of "traditional" media/entertainment (e.g. books, outdoor activities and face-to-face interaction with peers) so that children will be socialized in a more balanced manner (Anderson, 2020).

PMT has been widely applied to contexts in which individuals are motivated to protect themselves and in contexts of individuals being motivated to take action to protect others. This makes PMT an appropriate framework for investigating why parents might take action to protect their children from PIU. Developing the model depicted in Figure 1 begins with contextual PMT-based hypotheses. These hypotheses describe how parents' perception of the context – the threats of PIU and the degree to which their children are vulnerable to it – coupled with their ability to act to protect their children influences their perceptions about how useful monitoring software PCS will be for mitigating the threat (Rodgers, 1983; Youn, 2005; Hwang *et al.*, 2017). According to PMT, both threat appraisal and coping appraisal positively predict protective action (Rodgers, 1975; Pechmann *et al.*, 2003). PMT proposes that people behave in ways to protect themselves and others based on the appraisal of threats and an appraisal of their ability to cope with those threats. According to PMT, individuals appraise threats first by perceiving a threat's severity and assessing their vulnerability to that threat.

The perceived severity of a threat (in the case of PIU, the perceived likelihood that a child will be exposed to something online they ought not to be) will influence the decision to enact protection behaviors (e.g. adopting parental controls) (Rodgers, 1983; Milne *et al.*, 2009). Hwang *et al.* (2017) found a positive relationship between perceived threat and parents restricting or setting rules for children's internet use. Thus, parents might consider the risk that their children will be negatively affected by being online. Some solutions, such as rule setting or moving the computer from a child's bedroom to a more central part of the house such as the living room are simple. While Hwang *et al.* (2017) demonstrate the role of PMT in predicting parental mediation of children's internet use, they did not account for the use of technology, and thus, technological factors. As children spend more time online – particularly with increases in online learning – the threat of PIU and their children's vulnerability to it increase as their own ability to regularly monitor their children's online activity decreases. If parents perceive the risk to be high (e.g. severe threat), they will be more likely to seek out PCS that they perceive will be useful to protect their children, leading to the first hypothesis:

H1. Perceived threat severity positively influences the perceived usefulness of PCS.

The second element of threat appraisal, perceived vulnerability, describes the extent to which parents perceive their children to be vulnerable to online threats (Rogers, 1983). Perceived vulnerability influences decisions about using protective behaviors (Prentice-Dunn and Rogers, 1986). Hwang *et al.* (2017) found a positive relationship between perceived vulnerability and parents restricting or setting rules for children's internet use. Thus, parents who report a high perceived vulnerability, saying it is likely children will be exposed to harmful things such as sexual content or predators, are more to take action to mitigate that threat. We propose that one such action is to seek out technological products such as PCS they perceive to be useful to protect their children, leading to the second hypothesis.

H2. Perceived vulnerability to PIU positively predicts the perceived usefulness of PCS.

The coping appraisal factors from PMT (efficacy and cost) that predict adopting a protective behavior are aligned with the concept of innovativeness (Schillewaert *et al.*, 2005; Sun *et al.*, 2010). To engage in innovative behavior, individuals must possess a strong sense of efficacy (a desire to intentionally make things happen through their own actions; Bandura, 2001). The concept of innovativeness is defined as the tendency to adopt new things earlier than most members of a social system (Rogers, 1995). One study finds that self-efficacy is positively associated with innovativeness (Ng and Lucianetti, 2016). When one has a greater level of innovativeness, she/he will possess greater self-efficacy in enacting protective behaviors. Those without such innovativeness may find it hard or effortful to adopt PCS to protect their children, which might color their perceptions of PCS' usefulness. Formally:

H3. Personal innovativeness (PI) positively affects the perceived usefulness (PU) of PCS.

PMT provides a sound theoretical framework for understanding parental motivations to seek out solutions they deem useful in helping them protect their children. However, PMT is a useful model for all manner of protective behaviors including and beyond, technological solutions. The TAM discussed in the next section specifically considers how increases in perceived usefulness influence decisions to adopt technologies.

Adoption of new technology: the technology adoption model

The technology acceptance model (TAM) is a robust and widely used theory (Mun *et al.*, 2006) that suggests external factors affect consumers' perceptions of the ease of use (PEU) and usefulness (PU) of a technology. PEU and PU have been identified as crucial predictors of the acceptance of many technologies (King and He, 2006). Past research has examined various external factors that affect PEU and PU. For example, the relevance of technology to a consumer's particular needs is one factor that has received attention in the literature.

According to TAM several external variables directly influence the PU of a technology (Davis, 1989, p. 320). For example, perceptions, norms and expectations can all influence PU. Within a TAM framework, perceived severity or vulnerability to threats might increase an individual's perception of the usefulness of a technological solution. The more seriously parents perceive the negative consequences resulting from children's unmonitored internet use, the more useful they will perceive the PCS to be for protecting the child. Also, the more vulnerable parents perceive their children to be to exposure, the more useful they will perceive the PCS to be for protecting the child. Thus, the relationships between perceived threat and vulnerability to perceived usefulness are common to both the PMT and TAM frameworks.

The next step in the model development links the PMT-based influences on perceived usefulness to the well-documented positive relationship between perceived usefulness and adoption intention of the TAM (Davis, 1989, p. 320). Perceived usefulness (PU) has been

shown to positively impact the adoption of new technologies in multiple contexts. These include the adoption of mobile banking apps (Raza *et al.*, 2017); wearable health-care technology (Zhang *et al.*, 2017); mobile online shopping (Sohn, 2017); online reviews (Racherla and Friske, 2012; Mican *et al.*, 2020); and driverless vehicle adoption (Diresehan and Can, 2020). The current study predicts a similar relationship between parents' perceptions the usefulness of PCS and their intentions to adopt such technological solutions. Formally:

H4. Perceived usefulness (PU) of PCS will positively influence adoption intention.

Early TAM studies have shown that perceived usefulness (PU) is a consistent and strong predictor of consumer adoption for various technologies (Davis, 1989; Subramanian, 1994). However, perceived ease of use is not as strong, as it is not always a consistent predictor of adoption (Subramanian, 1994; Perangi-angin *et al.*, 2016; Liébana-Cabanillas *et al.*, 2017; Ekonomi dan Manajemen, 2017). These studies share that the technology is intuitive or the task/situation that technology solves is complex or dangerous. Such is the case with parents adopting PCS to mitigate PIU of their children. This is such a complex and dangerous issue that perceived ease of use of the technology is likely irrelevant. Parents' decisions to protect their children with PCS is more likely to be affected by their own ability than how difficult the technology is to use. Consequently, perceived ease of use is not examined in this research. Instead, we examine the parents' own ability to cope *per se* by considering ease of use from the standpoint of their assessment of their own ability to use the PCS that links to the self-efficacy construct from PMT.

Parental characteristics affecting adoption of technological products

While the designer or marketer of a new technological product might believe that said product is easy to use, not every parent will perceive it to be so. Much depends upon personal factors such as the parent's efficacy using such products. Along with threat appraisal, PMT suggests coping appraisal plays a role in predicting protection behavior. Coping appraisal begins with consumers looking to minimize barriers or maximize the help from engaging an intervention (Prentice-Dunn and Rogers, 1986). Coping appraisal describes parents' beliefs that they can enact a recommended behavior to affect change (Prentice-Dunn and Rogers, 1986). For example, some individuals might have limited experience adopting technologies in the past. Thus, their ability to adopt PCS to protect their children will be low or the effort will be high. On the other hand, those who often adopt new technologies will have a greater ability to adopt PCS (e.g. one possesses the efficacy or experience to make the effort of adoption low). Self-efficacy will positively influence the likelihood of purchasing a PCS to protect one's child from PIU (McMath and Prentice-Dunn, 2005).

Intuitively, individual innovativeness should be related to the adoption of new technology. Midgley and Dowling (1978, 1993) defined individual innovativeness as the extent to which an individual can accept new knowledge and make innovative decisions. In their view, consumer innovativeness or "consumption of newness," is the tendency to buy new products more often and more quickly than other people. They suggest two measurable categories of individual innovativeness, namely, innate innovativeness that is related to personality traits and actualized innovativeness that is related to innovative behavior. The former is generalized personal inclination regarding innovation (Im *et al.*, 2003). The latter is defined as how quickly individuals accept innovative things. In a marketing context, actualized innovativeness is conceptualized as purchase intentions, attitudes toward a new product, the relative time of the adoption of new products and the number of new products owned (Lassar *et al.*, 2005). Zhang *et al.* (2020) applied this conceptualization in a recent study that assessed the relationship between innovativeness and the purchase of smart toys. That study verified the effect of perceived product innovativeness, consumer innovativeness and perceived value on consumers' purchase and adoption intention, which then leads to consumers' willingness to pay. Therefore, "consumer innovativeness" in this study represents individual innovativeness traits in the domain of new or smart technologies.

A protective behavior is more likely to be adopted when the effort to do so is lower. Innovative people will need less effort to adopt new technologies to protect their children. Studies have further demonstrated that innovativeness predicts adoption (Lin, 2006; Hirunyawipada and Paswan, 2006). For example, Donthu and Gilliland (1996) found that more innovative consumers were less risk-averse and more adventuresome in their willingness to conduct in-home shopping from various sources. Therefore, we propose:

H5. PI will positively predict intentions to adopt PCS.

Methodology

The research hypotheses, focal variables and definitions are summarized in Table 1. The study is based on an online multi-item questionnaire previously pretested on a sample of adults from the age range of 21 to 49 with one or more children aged 10 to 15. Though the TAM has widely accepted measures for assessing PU and PEU, modifications were made to fit this study's context, where limited research exists. This study's measures, reliability and validity are detailed in Table 2.

To assess perceived severity, we adapted measures from Pechmann *et al.* (2003) to fit the context of parents' protective behaviors toward their children. The severity question asked subjects to rate their concerns that their children's online use would have five adverse outcomes. To assess perceived vulnerability, we also adapted measures from Pechmann *et al.* (2003) to fit the context of parents' protective behaviors toward their children. The vulnerability question asked subjects about their concern that their children would personally be exposed to three negative experiences highly associated with PIU.

To assess perceived usefulness (PU), we adapted the scale from Hendrickson *et al.* (1993), where participants assess functionality and applications. We asked participants whether a technology product described to them possessed specific functionalities, including blocking objectionable content; monitoring/limiting a child's time online; tracking social media posts;

Table 1 Summary of study variables, scales, definitions and hypotheses

Variable	Item scaling	Definition	Hypotheses
Severity	Five six-point Likert scale – not at all concerned/ extremely concerned	The perceived degree of physical harm, psychological harm, social threats, economic harm, dangers to children from PIU	H1: Perceived severity of a threat will positively predict perceived usefulness of TPs
Vulnerability	Three six-point Likert scale – not at all concerned/ extremely concerned	The odds that PIU will occur in negative exposure to threat if performed or there is no modification of an existing behavioral disposition	H2: Perceived vulnerability to a threat will positively predict perceived usefulness of TPs
Usefulness	Six seven-point Likert scale – extremely likely/ extremely likely	The extent to which a person believes that using a particular system would enhance his or her task performance or functionality afforded by a technology so it might be used advantageously	H3: Perceive usefulness of TPs will positively predict parents' intention to purchase TPs
Innovativeness	Three five-point Likert scale – strongly disagree/ strongly agree	A tendency to adopt new things earlier than most members of a social system, in part because of the extent to which a person believes that using sees a technology as lacking effort to use (Davis, 1989)	H4: Personal innovativeness (PI) will positively predict parents perceived usefulness (PU) of TPs
Adoption Intentions	Seven-point Likert scale – extremely negative/ extremely positive Seven-point Likert scale – totally un-innovative/ extremely innovative 10-point Likert scale – 0% chance/100% chance	Consumers' evaluation of and intentions toward purchasing the product	H5: Personal innovativeness (PI) will positively predict intentions to purchase TPs

Table 2 CFA results, item reliability and validity

Item	Std. loading	t-value
<i>Vulnerability</i> $\alpha = 0.91 = AVE = 0.77$		
<i>How concerned you are about your child's online exposure to?</i>		
Sexually graphic material	0.94	21.28***
Contact with sexual predator	0.87	19.58***
Violent content	0.83	23.40***
<i>Severity</i> $\alpha = 0.93 AVE = 0.74$		
<i>How concerned are you about the consequences of your child's online activity?</i>		
It may decrease academic performance	0.86	20.94***
It may interfere with completing household chores	0.85	20.03***
It limits face-to-face time with peers	0.86	20.34***
Inhibits physical activity	0.86	20.43***
Decreases interaction and communication with family	0.87	20.04***
<i>Perceived usefulness</i> $\alpha = 0.91, AVE = 0.62$		
<i>If available, how likely would you be to use each of the features below?</i>		
Block objectionable content	0.77	15.35***
Monitor or limit child's time online	0.76	14.34***
Monitor social media posts	0.80	15.22***
Track people with whom child interacts	0.79	14.93***
Direct child to suitable sites	0.79	15.00***
Notify if your child shares personal information	0.81	15.35***
<i>Personal innovativeness</i> $\alpha = 0.89, AVE = 0.74$		
I am usually one of the first of my friends to buy products that involve new technology when they come out	0.82	19.42***
I usually buy high-tech products before my friends do	0.93	19.20***
I am usually one of the first of my friends to buy "new look" clothes when they come out	0.84	17.71***
<i>Adoption intention</i> $\alpha = 0.69, AVE = 0.67$		
How positive or negative is your reaction to this product?	0.87	14.44***
How innovative do you find this product to be?	0.81	14.43***
If available at what you consider to be a reasonable cost, how likely would you be to buy/subscribe to such a service if it were available today?	0.46	7.97***
Notes: CFA model fit: $\chi^2 = 330.80, (df = 160, p < 0.001)$. CFI = 0.96, TLI = 0.96, CMIN = 2.01, RMSEA = 0.057; *** = $p < 0.001$		

tracking people with whom the child interacts online; notifying parents if personal information is shared; and redirecting children to suitable sites. To assess ease of use through efficacy and effort perceptions, we assessed respondents' perceptions of themselves as technology innovators. Critical assumptions behind this choice are that self-efficacy is an antecedent of innovative behavior. A consequence of such innovative tendencies is that adopting technologies will be a familiar and less effortful endeavor. Two cognitive items and one conative item were combined with sufficient reliability. The measures were adapted from Venkatesh and Davis (2000).

Data collection

After pre-testing, an online survey was conducted using a representative sample of 330 parents in the US with children aged 10 to 15 years. The sampling focused on 330 parents who were accessed through an online research panel. Two procedures were taken to ensure participants were parents and that the online response was robust. First, participants were asked if they have children. Only those who selected yes continued with the study. Next, to account for common method variance, all measures were presented in random order, except the adoption intentions scales. These were presented last as the logical concluding action in the decision process.

Sample characteristics and preliminary results

The survey was conducted nationwide via Qualtrics Panels during July 2020. The sample was designed as a quota to yield at least 150 male parents and 150 female parents of children between 10 and 15 years of age. If the parent had more than one child in that age group, the survey asked for responses regarding the youngest child. A quota of 50 or more children in each of those age categories (10 to 15) was required. Finally, the quota sampling plan called for a minimum of 150 male children and 150 female children. A total of 330 valid responses meeting the quota were received when completed. Respondents were distributed across the country, including all five major geographical regions. Overall, the survey took approximately 9.8min on average to complete. [Table 3](#) describes the characteristics of the sample.

In total, the study sample encompasses a very diverse group of respondents representing a wide cross-section of parents with children in the target age group of 10 to 15. More than two-thirds were between the ages of 30–49. Nearly three-quarters of respondents reported living in two-parent households (married or civil union) and more than half reported working

Table 3 Summary of sample statistics

	N	(%)		N	(%)
<i>Gender</i>			<i>Number of children</i>		
Male	157	49.7	1	77	23.5
Female	159	50.3	2	128	39.0
<i>Age</i>			3	75	22.9
18–29	35	11.1	4+	55	13.7
30–39	100	31.6	<i>Ethnicity</i>		
40–49	119	37.7	Asian American	11	3.5
50 +	62	19.6	Native American	3	0.9
<i>Marital status</i>			Black/African American	35	11.1
Single	46	14.6	Hispanic/Latino	25	7.9
Married/civil union	232	73.4	White	241	76.3
Divorced/separated	31	9.8	<i>Education</i>		
Widowed	7	2.2	Non-high school grad	10	4.2
<i>Employment</i>			High school or equivalent	59	18.7
Full time >35 h/week	170	53.8	Some college	134	42.4
Part time, 35 h/week	40	12.7	Bachelor's degree	66	27.2
Not currently employed	106	33.5	Advanced degree	27	8.5
<i>Income</i>			<i>Full time adult at home</i>		
<US\$20,000	34	10.3	Yes	202	61.4
\$20,001–40,000	74	23.4	No	126	38.3
\$40,001–60,000	67	21.2	<i>Actively monitor online school performance</i>		
\$60,001–80,000	55	17.4	Yes	235	89.7
\$80,001–\$100,000	34	10.8	No	27	10.3
\$100,001–\$150,000	38	12.0	<i>Parent social media</i>		
>US\$150,000	14	4.4	<i>Child's social media</i>		
<i>Parent social media</i>			Facebook	204	65.6
Facebook	308	93.3	Instagram	194	62.4
Instagram	252	76.4	Pinterest	89	28.6
Pinterest	189	57.3	Youtube	284	91.3
Youtube	289	87.6	TikTok	193	62.1
TikTok	125	37.9	<i>Child's own tech</i>		
<i>Child access to family tech</i>			Smartphone	239	72.4
Family computer	104	31.5	Smartwatch	88	26.7
Family gaming console	92	27.9	Tablet	156	47.3
Family tablet	48	14.5	Gaming console	173	52.4
			Computer	142	43.0
			Television	129	39.1

outside the home more than 35 h per week. Two-thirds of the respondents indicated that there was an adult (parent or nanny) at home full time. The respondents were primarily middle-income, with nearly 75% reporting household incomes between US\$20,000 and \$100,000. More than 85% of respondents reported having between one and three children living at home. The sample, while diverse, was 76% White. Slightly more than one-third reported earning at least an undergraduate degree, while an additional 42% had completed some college post-high school. Nearly 30% of respondents were either foreign-born or had one or both parents who were.

Sample statistics regarding internet and mobile use were also captured and are detailed in Appendix A. These show that an adequate representation of the internet use of children was achieved. Of note, 30.3% of the sample reported their child typically spends 3–4 h a day engaging the internet. Only 30% of parents see this as an appropriate amount of time. Children in the sample have access to a wide range of technology. Approximately 72% of parents have a child who owns a smartphone. Children in the study were found to access a wide variety of internet and mobile devices. Indeed, parents in the sample reported that, on average, their children own 2.8 technology-based devices personally and combined with items that the family own has access to 4.6 items overall. Parents also reported that their child is an active user of social media, including YouTube (91.3%), Facebook (65.6%), Instagram (62.2%) and TikTok (62.1%). These percentages may be undercounted, as many parents may not know what social media their children are using. Nearly 9 of 10 parents in the study (89.7%) actively monitor their child's online school performance.

Results

The research hypotheses were tested using structural equation modeling (SEM) with AMOS (Byrne, 2013). Analysis followed a two-step procedure where the confirmatory factor analysis (CFA) preceded SEM. Model fit, validity and reliability are assessed using a range of statistics, including parameter estimates and fit indicators including comparative fit index (CFI), the Tucker Lewis Index (TLI), root mean square error of approximation (RMSEA) and normed chi-square (CMIN) (Bagozzi and Yi, 2012).

Step 1: CFA. The CFA model involving five constructs shows a good fit as reflected by the absolute, incremental and parsimony fit indexes with $\chi^2 = 330.80$ ($df = 160$, $p < 0.001$). CFI = 0.96, TLI = 0.96, CMIN = 2.01, RMSEA = 0.057. The measures reflect acceptable internal consistency and discriminant validity. Specifically, Cronbach's alphas are above 0.75 for all but one construct ($\alpha = 0.70$) with high inter-item correlations between (0.30 and 0.80)* for the items representing each construct within the model. All average variance extracted values are above 0.50 (see diagonal of Table 4).

Step 2: Structural model estimation. The structural model includes all five study constructs and five hypotheses (Table 5). The fit statistics for the structural model show acceptable fit (Hair et al., 2006) with values similar to the CFA ($\chi^2 = 339.79$, $df:162$, $p < 0.001$, CFI = 0.96, TLI = 0.96, CMIN = 2.10, RMSEA = 0.058).

The results provide support for all five of the research hypotheses. The results support *H1* and *H2* concerning the positive relationships between the perceived severity of the threat of PIU and the perceived vulnerability of one's children to that threat and the perceived usefulness of a technological product that mitigates that threat. The results also support *H3* that posits a positive relationship between the product's perceived usefulness and a parent's intention to adopt it. Finally, the results support *H4* and *H5* concerning the positive relationships between a parent's perceived level of PI and her perceived usefulness of such a product, as well as her intention to adopt it.

Further mediation analysis was conducted to test the significance of adding perceived usefulness as a mediator in this model constructed based on PMT. The indirect effect of perceived severity, perceived vulnerability and PI on adoption, through perceived

Table 4 Test of discriminant validity

	<i>Vulnerability</i>	<i>Severity</i>	<i>Innovativeness</i>	<i>Usefulness</i>	<i>Intention</i>
Vulnerability	0.88				
Severity	0.645	0.86			
Innovativeness	0.194	0.44	0.86		
Usefulness	0.396	0.449	0.301	0.79	
Adoption intention	0.372	0.454	0.303	0.678	0.76

Notes: NB: Diagonal values represent the square root of the AVE and below the diagonal are the pairwise correlations

Table 5 Results of CB SEM model fit

	<i>Standard regression weights</i>	<i>t-value</i>	<i>Significance</i>	<i>Supported</i>
<i>H1</i> Severity → usefulness	0.26	3.12	**	Supported
<i>H2</i> Vulnerability → usefulness	0.22	2.06	**	Supported
<i>H3</i> Usefulness → intention	0.63	10.2	***	Supported
<i>H4</i> Innovativeness → usefulness	0.15	2.3	*	Supported
<i>H5</i> Innovativeness → intention	0.16	2.97	**	Supported

Notes: *** = significant at $p < 0.001$, ** = significant at $p < 0.01$, * = significant and $p < 0.05$. Model fit $\chi^2 = 339.79$, (df : 162, $p < 0.001$), CFI = 0.96, TLI = 0.96, CMIN = 2.10, RMSEA = 0.58

usefulness, was calculated using 200 bootstrapping samples with a 95% Bias Corrected Confidence interval. According to the analysis in Table 6, perceived usefulness is a significant mediator for all three predictors.

Discussion

PIU is a real and growing problem for adolescents and their parents worldwide. The internet poses very specific challenges, both regarding the nature of risk and for those seeking to protect children and young people while supporting their online activities and privacy. This is the first study that we are aware of that examines the severity and potential consequences of PIU as seen by a representative nationwide sample of parents of the important demographic of 10- to 15-year-olds. Additionally, it is also the first study to investigate the potential for personal control software solutions that may be used to help parents address this problem.

One major contribution of this research is that it helps to identify those parents who are likely and those who are not likely to be adopters of PCS technology. The study shows that independent of demographic and socioeconomic factors, non-adopters are likely to be parents who lack innovativeness and who do not perceive threats or vulnerabilities of PIU, as they are less likely to perceive PCS as useful, and thus, they are ultimately less likely to adopt the technology. A second major contribution of this research is that it examined multiple factors that predict parents' adoption of internet monitoring technology to

Table 6 Test of mediation of PU using AMOS SEM

Variable	<i>Direct effect without mediator</i>	<i>Direct effect with mediator</i>	<i>Indirect effect</i>	<i>sig</i>	<i>LL</i>	<i>UL</i>
<i>Perceived Vulnerability</i>	0.038(0.524)	-0.043(0.440)	0.08	0.01	0.03	0.14
<i>Perceived Severity</i>	0.274(0.001)	0.186(0.002)	0.09	0.01	0.03	0.20
<i>Personal Innovativeness</i>	0.296(0.001)	0.237(0.001)	0.06	0.02	0.10	0.12

safeguard their children's online usage. In doing so, a more complete understanding is provided and new insights emerge.

A substantial body of prior research successfully used TAM and PMT to predict technology adoption to improve personal outcomes (King and He, 2006; Menard *et al.*, 2017). PMT has also proven helpful in predicting health-related intentions and behaviors (Floyd *et al.*, 2000; Milne *et al.*, 2000). However, few research studies have examined their efficacy in explaining software solutions' adoption to protect others. Thus, the current study suggests that TAM, when combined with PMT, may be applicable across a more comprehensive array of contexts beyond those in which it is traditionally used. Incorporating personal, social and environmental factors into the combined PMT/TAM model provides a more complete understanding.

Using a social cognitive perspective, we tie in two theories of behavior relevant for understanding what drives parents to adopt software to protect their children from PIU. Using a representative sample of parents in the US with children ages 10 to 15, the model presented integrates the TAM and PMT to predict intention to adopt PCS. Confirming hypotheses, perceived severity and perceived vulnerability positively predicted the perceived usefulness of a software program that would supervise children's online activity and direct them toward approved sites. Further, PI, which is related to self-efficacy and the belief that future technologies will require less effort to adopt, is positively related to perceived usefulness. In turn, perceived usefulness and PI positively predict parents' adoption for internet monitoring software.

The findings advance current research on technology adoption in several important ways. Problematic internet usage is linked to several negative life and health outcomes and there are genuine dangers for children with unrestricted internet access, including exposure to objectionable content and online predators (Rial *et al.*, 2018; Sheng, 2020). This research shows that parents are more likely to enact protective behaviors (intend to adopt monitoring technology) when they perceive PIU to present a severe threat to which their children are vulnerable. However, the perception of usefulness is a mediating factor. This mediation might explain the past disconnect between the perceived severity of the problem and actual adoption rates of software solutions (Ghosh *et al.*, 2018; Özgür, 2016). The threat appears first to inform utility judgments such that a more significant perceived threat influences consumers to possibly overestimate or enhance the perceived utility of technology related to the threat.

Appealing to parents' perceptions of threats only addresses one of this complex situation's factors. The environment (technology) must also be considered. Parents are concerned about the potential consequences of their children's online activity. PIU may hinder academic performance, inhibit physical activity and decrease interaction and communication with family members and peers. However, simply identifying a problem without being able to implement a solution is insufficient. Software developers must also direct efforts to address such software's functionality and usability and marketers must communicate the ease of use to bolster users' sense of self-efficacy. Thus, by understanding and examining the relationship between perceptual factors of the environment and technology, it may be possible to increase the adoption of technological solutions to help keep children safe online.

The second contribution lies in demonstrating the importance of personal factors predicting technology adoption to help others. One's innovativeness becomes a crucial factor driving the decision to act on behalf of another while also helping one's performance as a parent. PMT considers consumer's efficacy, though TAM focuses on the efficacy of the technology or its ease of use. This research extends prior theory on PIU and technology adoption by integrating personal factors of the technology user that might spill over or inform their perceptions of technology and likelihood to adopt it.

Societal implications

The major societal implications regarding the effects of PIU are two-fold. For parents, the desire is to protect their children from harmful content and from spending excessive amounts of time

online. For their children, there are potential psychological effects such as fear, pain, anxiety and developmental issues associated with teens/young adolescents falling prey to violent topics and unscrupulous sexual predators in the absence of parental guidance. Part of this issue is the content to which children may be exposed, such as sexually explicit, violent or politically objectionable material. Another issue is online bullying and potential contact with sexual predators. Finally, parents have concerns regarding the amount of time spent online, which negatively impacts interactions, academic performance and household activity.

However, parents use various approaches to deal with this issue including monitoring and supervision. Indeed, this study shows that the great majority of parents (89.7%) now actively monitor the child's online school performance. We also know from this study that these adolescents routinely access a wide array of social media sites including YouTube (91.3%), Facebook (65.6%), Instagram (62.4%) and TikTok (62.1%), that parents do not routinely access or monitor. Some parents may try to use restrictions on activities including a ban on e-mail, social media, chat rooms, instant messaging, online games and downloading content. However, realistically, such an approach is unlikely to be successful given the widespread proliferation and availability of mobile and internet connected devices that are available to children. Indeed, this study showed that the average child in the US aged 10 to 15 has a wide assortment of such devices from which to choose. This ranges from 72.4% who have their own smartphone to 43.0% with their own computer. In addition, many of them also have access to a family computer or tablet. As [Livingstone and Helsper \(2008\)](#) note, based on their study of parental regulation of children and teenagers' online activities, "[...] the simple assumption that introducing forms of parental mediation will reduce the risks young people encounter online, especially while protecting their opportunities, is misguided" (pp. 593). In addition, some parents (such as those in lower socio-economic environments) often lack internet and computer skills, compared to their children. Therefore, they are less able to consistently monitor and supervise usage and to explain their potential negative consequences. For these reasons, PCS has a great potential social benefit for addressing PIU if more widely adopted.

Managerial implications

Parents are concerned about their children's PIU with good reason. They worry about their children's vulnerability to online exposure to sexually graphic material, sexual predators and violent content. They are aware of deleterious consequences of such exposure to their children's academic performance, social interaction, completion of household chores and exercise. This has led to a significant market opportunity for PCS products. According to a 2016 Pew Research report (Anderson, 2020) noted earlier, 39% of parents in the US reported using parental controls for blocking, filtering or monitoring their teens' online activities, 16% used parental controls to restrict their teens' mobile phone use and 16% used monitoring tools on their teens' mobile phones to track their locations. However, concerns, worries and awareness do not necessarily lead parents to adopt high-tech net-monitoring solutions to protect their children. As the results of this study show, parental concerns about their children's vulnerability to such severe threats do inform how they perceive technology's usefulness in addressing the problems of PIU. According to the model, perceived usefulness does have a direct impact on adoption intention.

Software developers may offer technological solutions, but it is up to marketers to help parents see the usefulness of these solutions by connecting them directly to the threats presented. This finding does not suggest that marketers should use fear appeals. Instead, they might consider using statistical and educational material to frame the issue of PIU in product promotions that are showing exactly how these products mitigate the threat.

Further, the model shows that these products' functionality and utility are critical drivers of adoption intention. Thus, product design might use multi-attribute models to understand what features – in addition to the ones measured in this study – consumers find most useful. Messages focusing less on “bells and whistles” and more on usefulness and efficacy may

enhance perceived utility and, ultimately, adoption. Indeed, parents participating in the study responded very favorably to software concepts that could block objectionable content, monitor usage and time spent and notify them if their child's personal information is shared online. Thus, the development, improvement or promotion of reasonably priced software solutions to keep children safe online appears to be a viable business case.

No matter how effective a software product is, it will not be adopted if parents cannot use it. A parent's innovativeness, which is related to technological self-efficacy, is also an essential factor affecting the intention to adopt PCS. Companies should target marketing messages toward technology innovators and early adopters to enhance adoption. For example, the industry study noted earlier suggests that many parents are aware of the parental mobile/internet monitoring concept. Companies providing software solutions could work on increasing training and education for those who are less innovative. Helping parents realize the ease and low effort of adopting PCS can positively influence PU and adoption intention.

Children are not the only ultimate beneficiaries of internet monitoring software. Adopting parents also benefit from technology that enhances their ability to perform their duties to protect their children more effectively. Thus, marketing communications should also highlight the software benefits that make it easier for parents to monitor their children's online activity. To do this, companies could focus on the benefits of parental monitoring and control and highlight the simplicity of the user interface, compatibility across platforms or ease of installation. Focusing on these areas can increase the likelihood that parents will adopt their software solutions.

Limitations and future directions

As with any study, this research is not without its limitations. However, it points to promising future research directions that address these limitations. First, there are likely numerous other variables that affect parents' intention to adopt internet monitoring software. These variables are beyond the scope of the current work but can and should be considered in subsequent studies. First, perceived ease of use (PEU) was not directly measured in this study for the reasons described above in this article. However, future research can reinforce past studies' predicted link between innovativeness and PEU by including this measure. Second, though this research included various relevant threats parents perceived, cyberbullying was not one of them. In the study, the variable did not load on any factor and decreased the reliability of the vulnerability construct. One reason for this might be that parents do not put this in the same category as other threats. Third, in addition to the TAM and PMT, several other models may help predict adoption intention. For example, according to the theory of planned behavior, attitude, subjective norms and perceived behavioral control all affect intention (Ajzen, 1991). Further, the technology acceptance model has also been expanded to include trust and risk (Pavlou, 2003). Thus, future research could explore attitudes, subjective norms and behavioral control or trust and risk as they may affect parents' intention to adopt internet monitoring software.

Although this study sample was representative of parents in the US, this does not mean that the findings and conclusions would necessarily hold in an international sample. However, as noted earlier, PIU is a concern for parents worldwide. For example, according to a study conducted in Turkey by Özgür (2016), more than half of parents in that research stated that they did not have the technical knowledge to track their child's internet usage adequately and did not know, which internet tool to use. An interesting avenue for future research could involve investigating PCS adoption determinants across different countries, including exploring potential cultural moderators. For example, it would be interesting to examine differences along the individualism – collectivism dimension of culture, beliefs in personal freedom and privacy or access to technology and living situation affect the perceived usefulness of internet monitoring software. Finally, the current research does not directly address current software solutions' actual adoption rate. In an increasingly interconnected online world that functions non-stop, keeping children safe online is an important task for any society. Future studies must address the demand for

PCS and how to increase the adoption of internet monitoring software to allow future generations to benefit from all the positive experiences the internet offers while safeguarding them from the threats that lie just below the surface.

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