Effects of digital technology on adolescents' well-being: An integrative model (iMEW)

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Effects of digital technology on adolescents' well-being: An integrative model (iMEW)

CO:RE Short Report Series on Key Topics

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The CO:RE Project is a Coordination and Support Action within the Horizon 2020 framework, which aims to build an international knowledge base on the impact of technological transformations on children and youth. Part of the knowledge base is a series of short reports on relevant topics that provide an overview of the state of research. This part is coordinated by Veronika Kalmus (University of Tartu, Estonia).

For all reports, updates, insights, as well as full details of all CO:RE consortium members and CO:RE national partners throughout Europe and beyond, please visit **core-evidence.eu**.

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Contents

Key insights

- Adolescence is marked by biological, cognitive and social changes, during which several critical developmental tasks need to be fulfilled, including the formation of identity, sexuality, intimacy, and a value system. The successful achievement of developmental goals is related to better well-being and success in later tasks in life.
- Among others, adolescents use ICTs to experiment with the developmental tasks of this period. Therefore, the benefits and hindrances related to adolescents' use of ICTs should be considered to understand their development and well-being.
- This report proposes an **integrative developmental model of the effects of ICTs** on the well-being of adolescents (iMEW). The model:
    - offers a causal framework to examine adolescents' online activities (ICT usage) in relation to the **developmental tasks** of this period;
    - connects the impact of online activities with **short-term and long-term well-being** outcomes for adolescents;
    - follows an **integrative approach** synthesising theories from media and communication studies, developmental psychology, and health sciences.
- The iMEW offers a developmental perspective for understanding the factors related to the effects of ICTs on the well-being of adolescents. It intends to provide a conceptual framework for researchers to think about complex relationships between the variables from a developmental perspective.
- This report briefly summarises the conceptual framework of iMEW. For a detailed description of the model, we suggest reading our article in the *European Journal of Developmental Psychology* (Smahel et al., 2022).

Introduction

Adolescents use information and communication technologies (ICTs) for various purposes, including fulfilling developmental tasks related to this period in their lives, such as developing a sense of identity, managing sexuality, adopting a value system, and establishing stable peer relationships. However, they might also experience problematic online situations related to those tasks, such as exposure to vulgar, aggressive, and inappropriate sexual, racist or illegal content; or cyberbullying, offensive and aggressive comments or unwanted sexual requests (Smahel et al., 2014). The successful achievement of developmental goals is related to better well-being and success in later development (Havighurst, 1972). Since adolescents experiment with developmental tasks in the online environment (Subrahmanyam & Smahel, 2011), ICT usage should be considered to understand their development and well-being in today's highly digitalised world.

The purpose of this report is to introduce an integrative developmental model of the effects of ICTs on adolescents' well-being (iMEW). The model offers a causal framework to examine adolescents' online activities (ICTs usage) in relation to the developmental tasks of this period in their lives. In doing so, it connects the impact of online activities with short-term and long-term well-being outcomes for adolescents. For more details, we suggest reading our article in the *European Journal of Developmental Psychology* (Smahel et al., 2022). We used the definition of well-being suggested by the World Health Organization (WHO, 2001), which recognises three key dimensions: (a) physical well-being, consisting of health perception, the absence of disease, and physical functionality; (b) psychological well-being, which includes the presence of positive and the absence of negative affects; and (c) social well-being, which covers the quality of relationships with others, and includes social belonging, social acceptance, and social integration.

The model follows a developmental perspective and synthesises theories from media and communication studies, developmental psychology, and health sciences. The integrative approach facilitates a comprehensive understanding of the risks and opportunities of ICTs related to well-being of adolescents. It can also serve as a roadmap for researchers to think about complex relationships between the variables from a developmental perspective.

Although there are previous theories and models focusing on children's digital activities and well-being (e.g., EU Kids Online analytical model; Livingstone et al., 2018), there is currently a lack of theories that combine media-related and developmental perspectives to understand the well-being of adolescents.

Theories used in proposing iMEW

Differential Susceptibility to Media Effects Model

The Differential Susceptibility to Media Effects Model presents a framework from media psychology. The model shows how individual variables (e.g., traits, demographics, or social background) impact one's media use and its consequences (Valkenburg & Peter, 2013). The model suggests that media use (choices, frequency, activity/passivity, etc.) depends on three types of variables: dispositional (e.g., traits, skills, access to the media), developmental (e.g., age-related interests), and social variables (e.g., relationships, isolation, parental regulation, or peer norms).

Media use entails feelings, thoughts or behaviours, both immediately (e.g., distress, excitement, or relief) and over longer periods of time (sleep deprivation, social belonging, or happiness). The type of response depends on the individual variables. For instance, sexually explicit material may be in line with an adolescent's need to explore their own sexuality, yet involuntary exposure to this content may cause distress. Finally, the response impacts further media use, such as avoiding or preferring certain content. It also has an impact on the individual variables.

Problem Behaviour Theory

Problem Behaviour Theory is based in developmental psychology and identifies the risk and protective factors of a person's engagement in risky behaviours (e.g., early sexual activity, substance use; Jessor, 2014). Risk factors are variables that allow, facilitate or even motivate risky behaviours. They include, for instance, community, peer and parental tolerance towards the behaviour (e.g., underage drinking), accessibility of substances or content, or individual factors which may lead to the behaviour (such as depression, sensation seeking or boredom). On the other hand, the protective factors; for example, community, peer, parental and one's own intolerance towards risky behaviours, strict rules, or social support, mitigate the risks and promote healthy behaviour.

The model shows that risky behaviours tend to form clusters; that is, they co-occur due to various reasons. For instance, bullying and cyberbullying may co-occur as an offline and online version of the same behaviour, while risky driving may be a result of binge drinking with peers. Additionally, one risk factor (e.g., personality trait or peer group membership) may lead to various behaviours, and focusing on this factor may be vital in the prevention of such behaviours.

Health Belief Model

The Health Belief Model is a framework from health psychology focusing on preventing health risks and promoting well-being (Champion & Skinner, 2008). The model describes one's thoughts, motivations and will to act related to avoiding risks and promoting well-being. According to the Health Belief Model, people evaluate the costs and benefits of each action. They are most ready to act when the threat is severe and seems very likely. Also, it is helpful if the target behaviour is easy or associated with tangible benefits.

The model provides a background for designing interventions focused on risky, although pleasant behaviour (e.g., binge eating) or promoting healthy, although inconvenient behaviour (e.g, using stairs instead of elevators).

Ecological Systems Theory

Ecological Systems Theory is a developmental framework. It approaches human development as a process nested in several layers, or systems, that influence each other and the individual (Bronfenbrenner, 1977). The microsystem includes people and institutions that directly affect individuals, like family or school. The mesosystem identifies the interactions between these groups; for example, the relationship between one's parents and peers. The exosystem conceptualises any direct impact on the mesosystem that indirectly influences the individual in the centre; for example, the situation at a parent's job may indirectly influence the child. The overarching factors above and beyond these systems constitute the macrosystem and the chronosystem, which include geography, culture, economy, or historical changes and events.

The Integrative Model of ICTs Effects on Adolescents' Well-being (iMEW)

This section introduces the new integrative model – iMEW– which conceptualises the effects of ICTs on adolescents' well-being (see Figure 1; Smahel et al., 2022). The model was developed from the structure of the Differential Susceptibility to Media Effects Model and was enriched by the aforementioned theories. It captures the developmental tasks of adolescence and connects them with the well-being of adolescents. In iMEW, offline risky and protective factors, as suggested in Problem Behavior Theory, are expanded to the online environment.

We also combined them with outcomes related to adolescents' well-being. We utilised the Health Belief Model to account for the cognitive and voluntary processes associated with preventing risks and promoting well-being. We added the culture-level specification to define susceptibility to using ICTs that roughly corresponded to the macrosystem in Ecological Systems Theory.

Description of the model

- The first box (on left) in Figure 1 represents susceptibility variables. It includes individual-, social- and culture-level variables. We added developmental tasks in the background to emphasise their influence on each level of the susceptibility variables.
- The middle box shows online activities. The four dimensions of online activities involve: (1) online interaction and content consumption (i.e., active vs. passive use); (2) risks (e.g., cyberbullying) and opportunities (e.g., learning from quality online sources); (3) secure vs. (non)secure activity (i.e., measures taken to prevent possible online risks); (4) online activities related to developmental tasks (e.g., reading about sexuality or religion).
- The last box specifies ICTs effects on well-being (physical, psychological, and social). The effects of online activities on well-being can be short-term (e.g., feeling happy at the moment) and long-term (e.g., happiness in the long run). Therefore, it is useful to differentiate them in the model.

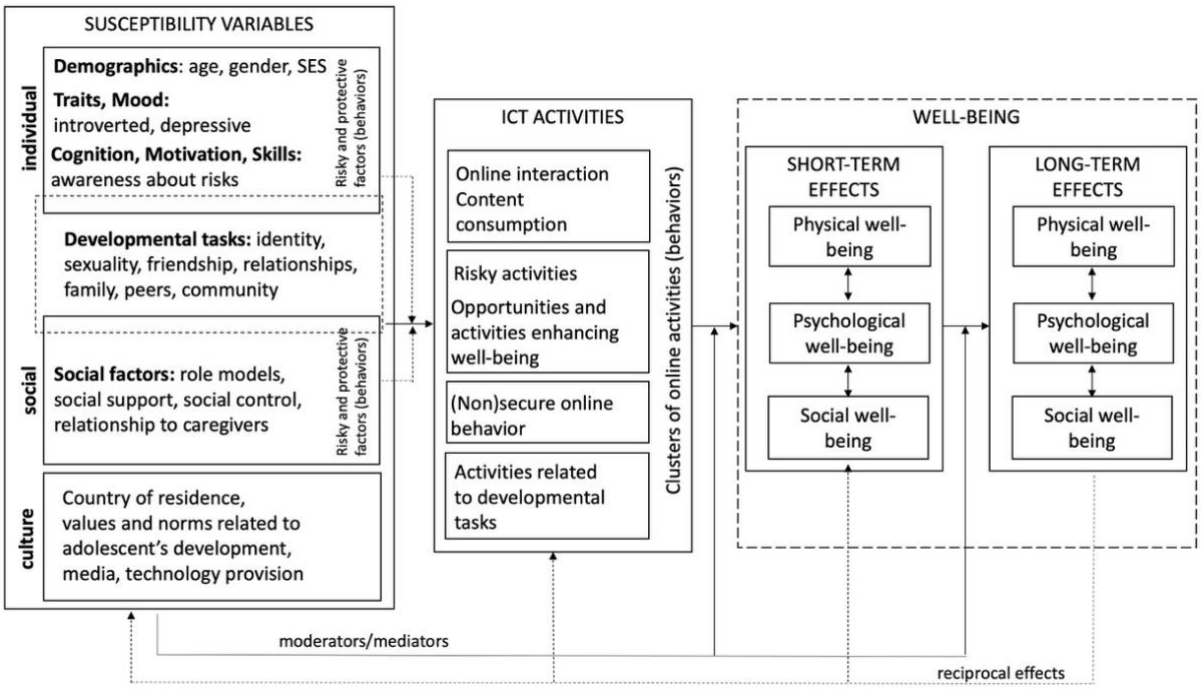

Figure 1: The conceptual Integrative Model of ICTs Effects on adolescents' Well-being (iMEW) (from Smahel et al., 2022)

Note: The list of specific variables that we mention in the boxes are only examples and not exhaustive.

- iMEW is conceptualised to depict causal relationships. Hence, susceptibility variables impact adolescents' online activities, affecting their short- and long-term well-being.

Empirical evidence of the iMEW model

In this section, we provide examples of how iMEW can be used in ICT research and that illustrate the relationships between the variables. We also offer research evidence when available.

One of the developmental tasks of adolescence is to manage sexuality. Using iMEW, a possible susceptibility variable (box 1) for managing sexuality would be the personal sense of sexual identity at the individual level. The quality of intimate relationships can be considered at the social level, and cultural norms and expectations related to sexuality at the culture level. The individual-, social-, and culture-level susceptibility variables predict adolescents' online activities (box 2) in iMEW.

Previous studies argued that seeking online information about sexuality is part of sexual identity exploration in adolescence (Craig & McInroy, 2014; DeHaan et al., 2013). These studies have shown that these behaviours were more commonly reported among adolescents with non-heterosexual orientation than those with heterosexual orientation (Livingstone & Mason, 2015). Using the developmental perspective of iMEW, these findings might indicate that seeking online information about sexuality could be especially significant for the sexual identity development of non-heterosexual adolescents.

In iMEW, susceptibility variables may interact to explain engagement in online activities. For instance, a previous study showed that searching online about sexuality was more pronounced for non-heterosexual adolescents who reported a lack of information resources and privacy concerns (Mitchell et al., 2014). Therefore, searching online about sexuality might be especially critical to fulfilling the developmental task of sexual identity formation in non-heterosexual adolescents related to their sexual minority status.

As in Problem Behavior Theory, we propose that risk and protective factors can be identified for adolescents' risky online behaviours. For instance, the same susceptibility variables (e.g., adolescents' emotional problems) explained various online risky behaviours (e.g., sexting, cyberbullying, excessive internet use, and exposure to sexual materials) in a previous study (Gassó et al., 2019). Other variables (e.g., quality of family relations), on the other hand, were identified as protective factors when the online risk was high (Kvardova et al., 2021). Identifying susceptibility variables that explain various risky online behaviours in a similar way offers practical implications in research on ICTs.

Online activities (box 2) are connected with short-term and long-term effects on well-being (box 3). Seeking online information about sexuality might help adolescents normalise their concerns about sexuality in the short term (e.g., Basinger et al., 2021) and help them develop a value system relating to their sexuality in the long term.

Susceptibility variables may interact with the type of online activities, impacting the short-term and long-term effects. A previous study showed that cyberbullying experiences (perpetration and victimisation) differed between adolescent girls and boys (Festl & Quandt, 2016). The difference was related to the patterns of internet use and online behaviours. For girls, more intensive online social activities, including meeting strangers online, were related to cyberbullying involvement, whereas for boys, this was associated with exposure to antisocial media content.

The short-term and long-term effects may differ or even contradict each other. For example, meeting strangers online may be associated with positive social well-being in the short term as it facilitates forming intimate relationships (Bryce & Fraser, 2014). However, it may be related to adverse long-term effects due to possible harm (e.g., cyberbullying perpetration) and privacy violations (Gámez-Guadix et al., 2016). We propose that the susceptibility variables consolidate the link between short- and long-term effects. For instance, the short-term negative impact of being exposed to cyberbullying might be countered by protective factors such as strong peer relationships or parental mediation in the long term (e.g., Wright, 2018).

Following a negative experience of using ICTs (e.g., exposure to sexually explicit material), adolescents may adapt their online activities (e.g., installing software to prevent access to such material). The same encounter (exposure to sexually explicit material) may also impact their value system regarding sexuality (e.g., intention to engage in casual sex; Tseng et al.,

2021). Therefore, we expect that the impact of ICT usage on well-being may have a reciprocal influence on the online activities of adolescents and susceptibility variables.

Recommendations on how to use iMEW in research

- iMEW is an integrative theoretical model to test the effects of ICTs on adolescents' well-being. In practice, researchers can use the whole model to test their hypothesis or adapt parts of the model to answer research questions.
- We differentiated the susceptibility variables for clarity (individual-, social- and culture-level; box 1). Researchers can determine the susceptibility variables using the iMEW framework in relation to their research goals. Therefore, the model provides a flexible conceptual framework for forming research questions and interpreting findings.
- We structured the online activities in iMEW (box 2) to highlight that certain online activities cluster together. However, the classification depends heavily on the specific research question and outcome. Seeking online educational material on sexuality can be classified under content consumption if the research is related to determining the type of online information sought by adolescents. When the research aims to determine the negative and positive effects of the same activity on the well-being of adolescents, it can be categorised under the *risky activities vs. opportunities* dimension. However, online activities should be specified and adapted in line with the relevant research questions. This model cannot provide all categorisations of online activities.
- When using the risky activities and opportunities dimension of online activities, we urge researchers to pay attention to the specific research question they ask and the specific outcomes they measure. For instance, seeking online educational material about sexuality can simultaneously be associated with benefits and harms. It can fulfil the information needs of the adolescents and normalise their experiences, thereby enhancing their well-being. Nevertheless, such content may be equally harmful when adolescents encounter sexually explicit material during their search. Therefore, depending on the outcome of their interest, a particular online activity can be classified as a risk or as an opportunity to improve well-being.
- Secure vs. (non)secure dimension of online activities is based on the Health Belief Model, which focuses on cognitive and voluntary processes associated with preventing risks and promoting well-being (Champion & Skinner, 2008). This dimension captures adolescents' preventive behaviours in the online environment that may impact their well-being.
- Individual characteristics, including adolescents' (digital) skills and motivation for engaging in a particular online activity, are tightly related to how they approach that activity, and potentially impact the outcome (Cino et al., 2022).
- Although iMEW is a model that describes causal relationships, the research evidence regarding the integrated theories is based mainly on cross-sectional study designs. Therefore, longitudinal and experimental study designs are desirable. The current classification of online activities is narrow. Future research can contribute to developing this part of the model.

A research example depicting the use of iMEW

Seeking online information about health can have ambiguous effects on adolescent well-being. While it can provide answers to questions that can be perceived as sensitive or embarrassing (Wartella et al., 2016), the search can also lead to information that may result in decreased well-being; for example, worries about one's own condition (Singh & Brown, 2016). We used the iMEW framework to identify variables that determine whether health-related social media use increases or decreases well-being. Analysing the data from 2,500 Czech adolescents (50% girls) aged 11 to 16 years, we focused on the association between health-related social media use and Covid-19 anxiety.

Health-related social media use involves interacting with or creating content related to topics such as illnesses, exercising, or mental health. Covid-19 anxiety is shown to impact one's short-term well-being (e.g., sleeping or eating disturbances), in reaction to media exposure related to Covid-19 (Lee, 2020). In line with iMEW, we studied the association between health-related social media use and Covid-19 anxiety in the context of several individual variables: health anxiety, perceived eHealth literacy, and experience with Covid-19.

Health anxiety is a trait that reflects worries about one's health and excessive attention to bodily symptoms. Health-anxious people are

more likely to seek health-related content and be disturbed afterwards (Singh & Brown, 2016). Using the iMEW framework, we expected that health anxiety would determine health-related social media use (predictive role) and intensify its association with Covid-19 anxiety (moderating role). Our data supported this claim. Notably, health-anxious adolescents were more likely to use health-related media. Also, higher health anxiety intensified the negative impact of health-related media use on Covid-19 anxiety.

Perceived eHealth literacy presents a person's belief about their competency to seek health information online; for example, to efficiently seek health-related information online and recognise its quality. This belief helps the user feel competent and enables health-related internet use (Chang et al., 2015; Gulec et al., 2022). In our study, higher perceived eHealth literacy was associated with higher frequency of health-related social media use.

Experience with Covid-19 presents a social-level variable. Presumably, knowing someone who has had Covid-19 may impact health-related social media use as well as Covid-19 anxiety and that this effect can differ based on the severity of this experience. Contrary to our expectations, the experience had only a very weak impact on both variables, likely due to the pandemic situation, which was very optimistic during the data collection, among other factors. This finding underlines the need to choose social- and culture-level variables carefully, as their relevance may evolve over time.

The iMEW framework has proven useful in designing our study, for example, in finding relevant individual variables. Still, a thorough literature review was needed to determine which individual variables would predict health-related social media use. The iMEW framework helped us to consider the interactions between individual variables and how they may impact the association between health-related social media use and well-being.

Conclusion

In this report, we presented an integrative theoretical model to examine the effects of ICTs on adolescents' well-being. For this purpose, iMEW integrated theories from media and communication studies, developmental psychology, and health sciences. The model allows for a developmental perspective in understanding the risks and opportunities of ICTs related to the well-being of adolescents. It provides a conceptual framework for forming research questions and interpreting findings.

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