

Table 1: Study characteristics of included papers

#	Authors	Year of publication	Study location	Recruitment	Study population or characteristics	Sample size	Age (mean, range, SD)	Gender	Study design
1	Bai, Yao, Duan, Sun & Niu	2022	China	Participants were purposefully recruited from middle and high schools in different regions of China	Middle and high school students	725	Mean age 15.390 years old (SD = 1.641) Range not reported	Male 53.5% Female 46.5%	Cross sectional survey design
2	Si & Lee	2022	South Korea	N/A Secondary analysis of national data set	Fourth grade school children	1367	Not reported	Male 50.8% Female 49.2%	Cross sectional (secondary analysis)
3	Bickham, Moukalled, Inyart & Zlokower	2021	USA	Participants were purposefully recruited from three public middle schools in New England, in which the curriculum was delivered	Seventh grade public school students in New England	163 (92 experiment; 71 control)	Mean age 12.16 years (SD=0.4)	Male 50.1% Female 49.9%	Quasi-experimental; control group
4	Livingstone, Mascheroni & Stoilova	2023	International	NA	Quantitative studies including 12-17-year-olds	34 studies	NA	NA	Systematic literature review
5	Tao, Reichert, Law & Rao	2022	Hong Kong	Participants were randomly sampled from 18 primary schools in Hong Kong	Third grade primary-school-aged children	736	Not reported	Male 48% Female 52%	Cross sectional survey design

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6	Vissenberg, d'Haenens & Livingstone	2022	International	NA	Quantitative and qualitative studies including secondary school students (12-18-year-olds)	30 studies			Systematic literature review
7	Jiang, Chen, Zhang & Zuo	2023	China	Random and quota sampling of 14 schools within the Suzhou region	Chinese primary, middle and high school students	2276	Range 7–18 years (Mean=12.28, SD=2.85).	52.9% male; 47.1% female	Cross sectional survey design
8	Ortega-Barón, González-Cabrera, Machimbarrena & Montiel	2021	Spain	Non-probability convenience sampling of 5 Spanish educational centres across three Spanish regions	Spanish adolescents	165 (120 experiment; 45 control)	Range 11-14 years (Mean=12.11, SD=0.89)	<i>Control group:</i> Male 44.4% Female 55.6% <i>Intervention group:</i> Male 35.8% Female 64.2%	Quasi-experimental; control group
9	Stodt, Wegmann & Brand	2016	Germany	Convenience sampling - recruitment through local advertisements, emails and social networking sites	German adolescents and young adults either attending school (40.1%), university/college (20.3%), trainee programs (16.3%) or in paid work (12.7%)	631	Range 14-29 years (Mean 19.86; SD=4.58)	Male 42.2% Female 57.8%	Cross sectional survey design
10	Stodt et al.	2018	Germany & China	Convenience sampling - recruitment through local advertisements, university emails and social networking sites	German and Chinese adolescents and young adults attending school (13.6%) university/college (65.8%), trainee programs (11.1%) or in paid work (9.5%)	821 (German=411; Chinese=410)	Range 16-30 years (Mean 20.71 years; SD=3.01) German: (Mean 20.7; SD 3.34; range 16-29)	Male 59.3% Female 40.7% German: Male 56% Female 44% Chinese: Male 51% Female 39%	Cross sectional survey design

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							Chinese: (Mean 20.7; SD 2.65; range 16-30)		
11	Throuvala, Griffiths, Rennoldson & Kuss	2019	International (UK)	NA	Studies including adolescents aged 11-17 years in a school environment	20 studies	NA	NA	Systematic literature review
12	Tso et al.	2022	Hong Kong	Children were randomly recruited from 18 primary schools and 14 secondary schools across HK (across 4 districts)	Children and adolescents (primary and secondary students)	1956	Range 7-18 years (Mean & SD not reported)	Male 48.3% Female 50.5% Not stated 1.5%	Cross sectional survey design
13	Magis-Weinberg, Munoz Lopez, Gys, Berger & Dahl	2023	Peru	Peruvian adolescents were recruited from two Innova Schools (a network of low-cost private schools)	Peruvian adolescents in 6 th through to 9 th grade	266 (Experiment 136; Control 130)	Range not reported Experiment: Mean=13.3; SD=1.14 Control: Mean =13.4 years: SD = 1.14	Experiment: female 52% Control: female 55%	
14	Keen, Blaszczynski & Anjoul	2017	International (USA)	NA	School students	19 studies	Range 10-18 years (Mean & SD not reported)	NA	Systematic literature review
15	Dowling et al.	2017	International (Australia)	NA	Children (0-12 years), teens (13-17 years) and young adults (18-25 years)	15 studies (reported across 23 articles)	Range 0-25 years	NA	Systematic literature review and meta-analysis
16	King	2018	International (Australia)	NA	Young people	Not stated	Not reported	NA	Literature review

Supplementary file (data extraction). Digital capability and gambling harm in young people.

#	Authors	Year of publication	Study location	Recruitment	Study population or characteristics	Sample size	Age (mean, range, SD)	Gender	Study design
17	Sharman, Butler & Roberts	2019	International (UK)	NA	Young people and adolescents	100 articles related to youth	For studies related to youth, participants were aged ≤19 years	NA	Systematic literature review
18	Oh, Ong & Loo	2017	International (Australia)	NA	Adolescents	17 studies	Not reported	NA	Literature review
19	Monreal-Bartolomé et al.	2023	International (Spain)	NA	High school and university students	32 studies	Range 12-25 years	NA	Systematic literature review
20	King et al.	2018	International	NA	9/13 quantitative studies focused on elementary or secondary student populations	Youth combined sample = 9395	Not reported	NA	Literature review

Table 2. Study Characteristics (continued) and key findings related to scoping review questions

#	Authors	Aims/objectives	Main findings related to scoping review questions	Source of funding/potential conflict of interest
1	Bai, Yao, Duan, Sun & Niu (2022)	<ol style="list-style-type: none"> To examine the correlations between deviant peer affiliation, tobacco and alcohol information exposure on social networking sites and adolescent tobacco and alcohol use To examine the potential protective role of digital literacy 	<ul style="list-style-type: none"> Digital literacy is negatively correlated with tobacco and alcohol use, i.e. higher digital literacy=lower tobacco and alcohol use Digital literacy was a moderating factor in social networking tobacco and alcohol information exposure and tobacco and alcohol use, i.e. with the improvement in individual digital literacy, the mediating effect of social networking site tobacco and alcohol information exposure on deviant peer affiliation and tobacco and alcohol use gradually weakened. 	<p>No conflicts of interest reported.</p> <p>Funding sources:</p> <ul style="list-style-type: none"> ○Fok Ying Tung Education Foundation ○The Fundamental Research Funds for the Central Universities ○The Collaborative Innovation Center of Assessment toward Basic Education Quality at Beijing Normal University ○The Education Sciences Planning Projects of Hubei Province ○The 2022 Graduate Student Science Enhancement Program of the Chinese Association for Science and Technology ○Graduate Education Innovation Funding at the Central China Normal University
2	Si & Lee (2022)	To investigate digital citizenship's moderating effects on a supportive school environment, parental pressure to achieve, academic stress, problematic digital media use, and happiness	<ul style="list-style-type: none"> In this study the authors defined digital citizenship as the "competencies that reflect desirable digital ethics and etiquette, as well as the ability to use digital technology" (p. 486). Digital citizenship significantly moderated the paths from problematic digital media use to happiness. Specifically, problematic digital media use had a significant positive effect on happiness in the low-digital citizenship group and a significant negative effect in the high-digital-citizenship group A supportive school environment was only a protective factor for problematic digital media use for children with high digital citizenship and not low digital citizenship, suggesting that digital citizenship is beneficial to young people 	<p>No conflicts of interest reported.</p> <p>Funding source: not reported.</p>

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3	Bickham, Moukalled, Inyart & Zlokower (2021)	<ol style="list-style-type: none"> 1. To determine the effectiveness of the Screenshots program (in school curriculum) in increasing participants' knowledge about key concepts of digital citizenship and in shifting beliefs and intended behaviours to align with prosocial and safe online interactions. 2. To examine whether the program has varying effects on males' and females' conflict and bullying resolution strategies 	<ul style="list-style-type: none"> • Screenshots was successful at improving participants' <i>knowledge</i> of online behaviours and healthy communication practices consistent with digital citizenship • There was limited evidence that participants changed their <i>beliefs</i> related to digital citizenship and prosocial/ safe online interactions • There was no evidence that participants changed their prosocial online behaviours 	<p>The curriculum was developed by Media Power Youth – emphasis on media literacy curricula that teach young people the skills to produce their own positive media messages and critically analyse and evaluate media. Two authors (Inyart and Zlokower) employed by MPY.</p> <p>Funding source: The Technology and Adolescent Mental Wellness program at the University of Wisconsin-Madison.</p>
4	Livingstone, Mascheroni & Stoilova (2023)	To examine the association of digital skills with tangible outcomes for 12-17-year-olds	<ul style="list-style-type: none"> • The review found a positive association between digital skills and <ol style="list-style-type: none"> (1) online opportunities (e.g. social engagement; gaming) (2) information benefits (e.g. better information seeking skills; greater evaluation skills) (3) orientation to technology (e.g. computer competence) • Specifically, digital skills were positively linked to online coping behaviours (e.g. privacy, deleting unwelcome messages, the ability to cope with cyberbullying) • Greater digital skills were linked (directly or indirectly) to greater exposure to online risks, although any link to harm was unclear 	<p>No conflicts of interest reported.</p> <p>Funding source: European Union's Horizon 2020 Research & Innovation Programme</p>

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5	Tao, Reichert, Law & Rao (2022)	To investigate the association between digital technology use and cyberbullying, and the extent to which digital literacy and parental mediation moderate these relationships among primary school-aged children.	<ul style="list-style-type: none"> Children's digital technology use (both for leisure activities and for schoolwork) was positively associated with cyberbullying experiences (both as perpetrator and victim). These positive associations were more pronounced among children with low levels of DL (only victims) 	<p>No conflicts of interest reported.</p> <p>Funding source: Research Grants Council of the Hong Kong Special Administrative Region, China.</p>
6	Vissenberg, d'Haenens & Livingstone (2022)	To examine the associations between young people's digital literacy, online resilience, and wellbeing in relation to online risks.	<ul style="list-style-type: none"> Digital literacy is positively (though weakly) inked to young people's wellbeing, i.e. more digitally skilled young people report higher levels of wellbeing compared to those with lower levels of digital literacy Digital literacy is positively associated with online risk experiences, i.e. children with more developed digital skills will likely encounter more risks online The authors explain that while DL does not protect young people from encountering risks, it <i>does</i> enable them to develop effective coping strategies (e.g. seeking social support, reporting problems, deleting harmful messages) when faced with risk (and hence may safeguard their psychological wellbeing). 	<p>No conflicts of interests reported.</p> <p>Funding source: not reported.</p>
7	Jiang, Chen, Zhang & Zuo (2023)	<ol style="list-style-type: none"> To investigate the links between Internet literacy, Internet use, and Internet addiction among Chinese youth and adolescents To investigate how different dimensions of Internet literacy influence Internet use among Chinese youth and adolescents. 	<ul style="list-style-type: none"> The internet literacy scale used in this study included multiple sub-dimensions (technical knowledge and skills; awareness and cognition of the internet; internet interactions; autonomous learning on the internet; and internet self-management). The authors conceptualise critical internet literacy as the last two components (i.e. autonomous learning and internet self-management). The relationship between internet literacy and internet addiction is complex. As for Internet literacy, internet-related knowledge and skills positively and significantly influenced the likelihood of internet addiction. By contrast, autonomous learning on the internet (analysing useful information on websites) and internet self-management skills (e.g. being able to control how much time spent online) negatively and significantly influenced the likelihood of Internet addiction. 	<p>No conflicts of interest reported.</p> <p>Funding source: National Social Science Foundation of China and Tsinghua Lab Research Program on Computational Communication and Intelligent Media.</p>

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8	Ortega-Barón, González-Cabrera, Machimbarrena & Montiel (2021)	<p>To assess the effectiveness of the Safety.net program in a pilot sample of adolescents.</p> <p>This program seeks to prevent eight Internet risks</p> <ul style="list-style-type: none"> • Cyberbullying • Sexting • online grooming • cyber dating abuse • problematic Internet use • nomophobia • internet gaming disorder • online gambling disorder. 	<ul style="list-style-type: none"> • The <i>Safety.net</i> program comprises 16 sessions and 4 modules (digital skills; relational risks; dysfunctional risks; and change of attitudes and cognitions). • The intervention group demonstrated improvements compared to the control group concerning <i>online grooming, problematic Internet use, Internet gaming disorder, and nomophobia</i>. • No program effects were found concerning online gambling disorder, but the authors hypothesise this may be linked to participant age (primarily under 14 years of age); when gambling prevalence is minimal. Still, there were promising results related to problematic internet use and internet gaming disorder. The program buffered both of these problematic behaviours. 	<p>No conflicts of interest reported.</p> <p>Funding source: the Ministry of Economy, Industry and Competitiveness of Spain grant and the International University of la Rioja</p>
9	Stodt, Wegmann & Brand (2016)	To investigate the roles of age, conscientiousness, and internet literacy on internet addiction and participation in cyberbullying	<p>The relationship between internet literacy and internet addiction is complex and depends on the specific dimension of IL. As for Internet literacy:</p> <ul style="list-style-type: none"> • individuals who indicated positive attitudes towards online communication tools and the creation of new online content are more likely to experience internet addiction and cyberbullying (either perpetrator [active] or victim [passive]) • the ability to control one's personal online behaviour is beneficial for preventing dysfunctional internet use and its possible negative outcomes. 	<p>No conflicts of interest reported.</p> <p>Funding source: not reported.</p>
10	Stodt et al. (2018)	To examine whether personality factors, cognitions and specific internet literacy competencies influence internet use disorder tendencies amongst German and Chinese samples, and to conduct a cultural comparison.	<ul style="list-style-type: none"> • Specific domains of Internet literacy positively or negatively influence internet use disorder amongst Asian and German samples. • E.g. in China higher reflective skills were correlated with higher IUD symptoms, but not in Germany. • Conversely, in the German sample, higher self-regulative skills correlated with lower IUD scores. 	<p>No conflicts of interest reported. Funding source: not reported.</p>

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11	Throuvala, Griffiths, Rennoldson & Kuss (2019)	To identify school-based prevention programs for adolescent internet addiction and examine program effectiveness	<ul style="list-style-type: none"> • There were mixed outcomes with regards to program effectiveness for adolescent internet use and gaming, and difficulties comparing studies due to the diversity of internet addiction/gaming assessment tools used and several methodological limitations in study design. • However, in consideration of the scoping review question, there were some psychosocial competencies that emerged as protective factors (i.e. were likely to reduce the likelihood of internet addiction), namely self-control, critical evaluation skills and problem-solving skills. 	<p>No conflicts of interest reported.</p> <p>Funding source: not reported.</p>
12	Tso et al. (2022)	To investigate the effects of digital competence on young people's risk of gaming addiction	<ul style="list-style-type: none"> • Children and adolescents who were more digitally competent were less likely to develop gaming addiction and experience less cyberbullying behaviour, both as perpetrators and victims. • The association between digital competence and gaming addiction was stronger amongst school-aged children less than 12 years old, compared to adolescents • Digital competence was associated with better collaborative problem-solving skills • Digital competence mediated the relationship between device usage time and gaming addiction 	<p>No conflicts of interest reported</p> <p>Funding source: Research Grants Council of HKSAR Government</p>
13	Magis-Weinberg, Munoz Lopez, Gys, Berger & Dahl (2023)	To determine the preliminary effectiveness of a school-based intervention to promote digital citizenship in Peru.	<ul style="list-style-type: none"> • The Intervention group reported a slightly larger increase in the frequency of positive online experiences compared to the Control group (limited effect) • No significant effects were observed for other variables • There was limited evidence that the curriculum can promote online conflict resolution skills, or increase knowledge of digital citizenship concepts. 	<p>No conflicts of interest reported.</p> <p>Funding source: Carlos Rodriguez-Pastor (a Peruvian billionaire businessman and co-founder of Innova schools)</p>

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14	Keen, Blaszczynski & Anjoul (2017)	To report the outcome of studies empirically evaluating school gambling education programs across international jurisdictions	<ul style="list-style-type: none"> All programs that were reviewed included specific gambling-related content, whereas only six focused on other skills including coping, problem-solving and decision-making. Of these studies, some education programs demonstrated improvements in gambling-specific knowledge (e.g. misconceptions, gambling fallacies, odds etc.) Some gambling education programs also demonstrated improvements in young people's coping, self-monitoring, problem solving and decision-making skills where this was a focus, though the effects on gambling behaviour are difficult to discern More comprehensive programs tended to perform better in terms of outcomes, versus brief interventions 	<p>No conflicts of interest reported.</p> <p>Funding source: Industry links. Dooleys Lidcombe provided funding for the project (Australian hospitality/ social and entertainment club)</p>
15	Dowling et al. (2016)	To examine early risk and protective factors that are longitudinally associated with problem gambling	<ul style="list-style-type: none"> The analysis identified three significant protective factors in childhood, adolescence and young adulthood with small effect sizes; namely parental supervision, socio-economic status, and social problems 	<p>No conflicts of interest reported.</p> <p>Funding source: Ontario Problem Gambling Research Centre and Ministry of Health and Long-Term care.</p>
16	King (2018)	Several research questions addressed. One objective relevant to this scoping review was to investigate <i>protective factors</i> associated with exposure to gambling-like experiences through gaming.	<ul style="list-style-type: none"> A range of protective factors are reported in this review. They are classified as either personal characteristics (e.g. high self-esteem), parental factors (e.g. parenting monitoring), peer influences, or environmental factors (e.g. limited exposure). Digital capabilities or even broad critical thinking/decision making/problem solving skills are not cited. 	<p>No conflicts of interest reported.</p> <p>Funding source: Victorian Responsible Gambling Foundation</p>
17	Sharman, Butler and Roberts (2019)	To conduct a systematic overview of risk factors for disordered gambling related to several vulnerable groups, including young people and adolescents	<ul style="list-style-type: none"> A range of personal, interpersonal and environmental factors increase young people's vulnerability to gambling disorder, though none relate to social-emotional skills or digital capabilities/digital literacy. Like other research, this review highlights playing video games with simulated gambling as a risk factor for young people. 	<p>No conflicts of interest reported.</p> <p>Funding source: none.</p>

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18	Oh, Ong & Loo (2017)	To examine features of effective educational-based programs for adolescent problem gambling prevention	<ul style="list-style-type: none"> • Programs which focus on gambling literacy show consistent program effects in increasing knowledge and correcting misconceptions about gambling, though these effects do not translate to behavioural change. • The authors call for more comprehensive programs that also address social and environmental factors that influence youth gambling, and more rigorous program evaluation. 	No conflicts of interest reported. Funding source: none.
19	Monreal-Bartolomé et al. (2023)	To provide best practice recommendations for the prevention of disordered gambling in adolescents and young adults.	<ul style="list-style-type: none"> • It is difficult to ascertain the efficacy of the programs and their impact on gambling behaviour in the long term given methodological flaws and high variability across the included studies • Programs were generally effective in the short-term by improving gambling-related knowledge and shifting attitudes related to gambling, though only some studies demonstrated changes in the frequency and severity of gambling behaviours, but in most studies follow up assessments were not performed. • Some studies also demonstrated improvements in broader skills related to self-awareness and problem-solving • No mention of digital capabilities/digital literacy 	No conflicts of interest reported. Funding source: none.

#	Authors	Aims/objectives	Main findings related to scoping review questions	Source of funding/potential conflict of interest
20	King et al. (2018)	To summarise quantitative research evidence related to prevention strategies for internet gaming disorder and related health conditions (e.g. Internet addiction) across international jurisdictions	<ul style="list-style-type: none"> • Psycho-education prevention approaches tended to focus on building students' understanding of problematic internet use and building a range of skills related to stress management, self-control, social relationships, and time management • In their discussion of policy implications for universal prevention programs, <i>digital literacy courses</i> are cited as a university prevention strategy, to "increase productive or goal-directed internet use" though there is no discussion of their effectiveness • In their discussion of policy implications for selective prevention programs, the authors suggest that school based educational programs should include a focus on <i>teaching healthy internet use</i>. There are some signs of effectiveness, though the empirical findings pertaining to selective prevention are somewhat mixed and warrant further investigation. 	<p>No conflicts of interest reported.</p> <p>Funding source: World Health Organization.</p>