International Journal of Evaluation and Research in Education (IJERE)
Vol. 13, No. 6, December 2024, pp. 4170~4188
ISSN: 2252-8822, DOI: 10.11591/ijere.v13i6.28418

Digital hygiene skills and cyberbullying reduction: a study among teenagers in Kazakhstan

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Article Info

Article history:

Received Aug 23, 2023
Revised May 22, 2024
Accepted Jun 21, 2024

Keywords:

Cyberbullying
Digital hygiene skills
Kazakhstan
Online safety
Structural equation modeling
Teenagers

ABSTRACT

Cyberbullying is a growing concern among teenagers, leading to adverse psychological and emotional consequences. To address this issue, this study aimed to identify the role of digital hygiene skills in reducing cyberbullying experiences among teenagers in Kazakhstan. A quantitative research approach was employed, and the data were collected using a questionnaire with items related to digital hygiene skills and cyberbullying experiences, which were measured on a 5-point Likert scale. A stratified random sample of 238 students from town and district middle schools in the Turkistan region participated in the study. The data were analyzed using partial least squares structural equation modeling with SmartPLS 4.0. The findings revealed that privacy protection, critical thinking, phishing and scam awareness, and digital footprint awareness were significant factors associated with reduced cyberbullying experiences. However, safe reporting, positive online behavior, and online etiquette did not significantly impact cyberbullying reduction. This study underscores the importance of promoting specific digital hygiene skills to create a safer and more supportive digital environment for teenagers. Policy recommendations are provided to enhance cyberbullying prevention efforts and foster a positive online culture.

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1. INTRODUCTION

Cyberbullying, a pervasive and distressing phenomenon in the digital era, involves the use of electronic communication platforms to intentionally harm, harass, or intimidate individuals, particularly teenagers, online. This modern form of aggression encompasses various harmful behaviors, including sending threatening messages, spreading rumors, sharing embarrassing content, and impersonating others to inflict emotional or psychological distress on victims [1], [2]. With the ever-increasing reliance on digital technology and social media among adolescents, cyberbullying has become a significant concern, posing serious implications for victims' mental health, well-being, and academic performance [3], [4].

Cyberbullying is a complex and multifaceted phenomenon that has been defined and studied by researchers in various disciplines. According to Hinduja and Patchin [5], cyberbullying refers to "willful and repeated harm inflicted through the use of computers, cell phones, and other electronic devices." It involves

aggressive behaviors such as sending threatening messages, spreading rumors, sharing explicit or harmful content, or impersonating others with the intent to harm, harass, or intimidate the victim. Similarly, Kowalski *et al.* [6] defined cyberbullying as "the use of electronic communication to bully a person, typically by sending messages of an intimidating or threatening nature." Notably, cyberbullying often occurs in online spaces, including social media platforms, instant messaging apps, and gaming communities, where perpetrators exploit the anonymity and vast reach of the internet to target and victimize individuals. The consequences of cyberbullying can be severe, leading to emotional distress, social withdrawal, and even suicide in extreme cases [7].

Cyberbullying takes various forms and can have severe consequences for its victims. One common example of cyberbullying is harassing messages, when individuals repeatedly send hurtful and offensive messages through social media platforms or messaging apps to target and harm a specific person [8]. Another prevalent form is the spread of online rumors and gossip, where false and malicious information is circulated about an individual with the intention of damaging their reputation and social standing [9]. Additionally, cyberbullying may involve exclusion and social isolation, where the perpetrator deliberately excludes the victim from online social groups, activities, or events, leading to feelings of loneliness and alienation [10]. Impersonation is another insidious form of cyberbullying, where individuals create fake profiles or accounts to masquerade as the victim and post inappropriate or embarrassing content on their behalf. Finally, cyberstalking, a more persistent and intrusive form of cyberbullying, involves relentless online monitoring of an individual's activities, often with the intent to gather personal information and use it to intimidate or threaten the victim [11].

The consequences of cyberbullying can be far-reaching and devastating. Emotionally, victims often experience increased levels of stress, anxiety, and depression due to the relentless online harassment they endure. These emotional effects can be particularly detrimental to the mental well-being of young individuals. Moreover, cyberbullying can have a significant impact on victims' academic performance as stress and emotional turmoil may lead to decreased concentration, absenteeism, and difficulty focusing on schoolwork. The social consequences of cyberbullying are equally concerning, as victims may withdraw from social interactions, both online and offline, to avoid further harm and embarrassment. Such social isolation can exacerbate the emotional distress experienced by victims, leading to a sense of helplessness and alienation [12], [13]. Albikawi [14] found high rates of depression, anxiety, low self-esteem, internet addiction, cyberbullying perpetration, and victimization among female nursing students in Saudi Arabia. Self-esteem and internet addiction predicted both cyberbullying and victimization. Wright and Wachs [15] revealed that social support from parents buffered depression associated with cyberbullying involvement across elementary, middle, high school, and university students, whereas friend support only buffered middle and high school students. Cyberbullying involvement positively predicted depression across age groups. Finally, Xia *et al.* [16] showed that cyberbullying victimization increased social anxiety in college students through increasing appearance anxiety and lowering self-esteem sequentially, with self-esteem's effect on social anxiety being stronger for females. Collectively, these studies highlight cyberbullying's negative mental health impacts, with some age and gender differences in risk factors.

Recognizing the serious and far-reaching consequences of cyberbullying, it is imperative that parents, educators, policymakers, and online platforms work collaboratively to combat this issue. Creating a safer digital environment for young individuals involves not only addressing instances of cyberbullying but also actively promoting digital literacy, empathy, and responsible online behavior [17]. By fostering a culture of respect and inclusivity in the digital space, we can create a healthier and more positive online environment that protects adolescents from cyberbullying and supports their overall well-being [18]. Preventing cyberbullying is crucial for teenagers, considering their vulnerability and developmental challenges during adolescence [19]. Cyberbullying can significantly impact a person's sense of self, self-esteem, and relationships, affecting their emotional well-being. As digital natives, teenagers are exposed to cyberbullying incidents on social media platforms and online forums, leading to potential mental health issues and academic difficulties. Cyberbullying can also disrupt social connections, causing feelings of isolation. To address this issue, promoting digital hygiene skills and cyberbullying prevention strategies is essential to create a culture of empathy and respect online. By fostering a supportive digital community, teenagers can navigate the online world safely, promoting their overall growth and well-being in the digital age.

Digital hygiene skills encompass a set of competencies and knowledge that empower individuals, particularly teenagers, to navigate the digital world safely, responsibly, and ethically. In the era of ever-evolving digital technology and ubiquitous internet access, possessing digital hygiene skills has become essential for young individuals to protect their online privacy, safeguard themselves from cyber threats, and engage in positive and respectful online interactions. By equipping teenagers with these vital skills, we can empower them to make informed decisions, avoid potential risks, and contribute positively to the digital community, fostering a safer and more responsible digital landscape for all users. Despite extensive research on cyberbullying and its impact on teenagers, there is still a research gap concerning the specific

identification and exploration of digital hygiene skills and their importance in cyberbullying reduction and prevention. The existing literature highlights individual digital hygiene skills relevant to teenagers, but a comprehensive framework encompassing all essential skills is lacking. Longitudinal studies correlating digital hygiene skills with cyberbullying incidence are needed to empirically validate their effectiveness. Considering the evolving digital landscape, research should investigate how these skills adapt to new technologies and contextual factors. Evaluating the impact of educational programs on cyberbullying reduction and considering intersectionality are crucial for inclusive preventive strategies. Long-term effects of digital hygiene skills on teenagers' online experiences and well-being also require investigation.

Addressing these research gaps can inform evidence-based preventive strategies and foster a safer digital environment for teenagers. Therefore, the objective of our study was to investigate the efficacy of digital hygiene skills in reducing cyberbullying among teenagers in Kazakhstan. We aimed to identify and understand the specific digital hygiene skills that are most effective in preventing cyberbullying incidents among this age group. By exploring the relationship between digital hygiene skills and cyberbullying experiences, our study seeks to contribute to the growing body of literature on cyberbullying prevention and provide evidence-based insights for policymakers, educators, and parents to develop targeted interventions and educational programs. To achieve our objective, our study addresses the following research questions:

i) How do teenagers describe their experiences of practicing digital hygiene skills and their value?
ii) How do digital hygiene skills help teenagers protect themselves against cyberbullying victimization? Which skills are most effective?
iii) What difficulties do teenagers face in improving their digital hygiene practices? What resources or support would facilitate this?

By addressing these research questions, our study aims to contribute to the understanding of the role of digital hygiene skills in cyberbullying prevention and provide actionable insights for stakeholders to foster a safer and more supportive digital environment for teenagers in Kazakhstan. Specifically, this study seeks to identify the most impactful skills that can be emphasized in educational initiatives and policies to reduce cyberbullying incidents. The findings will help guide decisions on resource allocation, curriculum design, and intervention strategies.

This study makes several significant contributions to the field of cyberbullying prevention and digital hygiene skill development among teenagers in Kazakhstan. First, by identifying and categorizing a comprehensive set of digital hygiene skills relevant to this age group, the study establishes a valuable framework that can guide policymakers, educators, and parents in designing targeted educational programs and interventions. Second, the empirical validation of the relationship between digital hygiene skills and cyberbullying experiences provides robust evidence of the effectiveness of these skills in reducing online harassment. This evidence-based approach enhances the credibility of cyberbullying prevention efforts and underscores the importance of fostering digital literacy among teenagers. Moreover, the study's examination of contextual factors influencing the impact of digital hygiene skills offers nuanced insights into tailoring preventive strategies to specific online settings and user demographics.

This study follows a systematic structure to investigate the relationship between digital hygiene skills and cyberbullying reduction among teenagers in Kazakhstan. Section 2 establishes the theoretical framework by developing hypotheses and proposing a conceptual framework that identifies the key digital hygiene skills relevant to the study. Section 3 outlines the methodology employed, including the sample, data collection process, and statistical analysis methods. Section 4 presents the results of the study, highlighting the empirical findings regarding the impact of digital hygiene skills on cyberbullying experiences. Section 5 combines the findings and discussion, delving into the implications of the study's results, including the contributions made to the field and policy recommendations for cyberbullying prevention. Finally, section 6 provides a comprehensive conclusion, encompassing the study's limitations and recommendations for future research, further strengthening the understanding of the significance of digital hygiene skills in mitigating cyberbullying incidents among teenagers in Kazakhstan.

2. THEORETICAL FRAMEWORK

Cybersecurity and digital hygiene skills represent two critical areas of research with important implications for understanding and addressing the growing problem of cyberbullying. Cybersecurity studies examine technological developments and vulnerabilities that have enabled emerging risks such as online harassment, aggression, and exploitation. Digital hygiene skills encompass the competencies required to navigate the digital sphere safely and responsibly. This study aims to build on these two bodies of knowledge by examining the relationship between digital hygiene skills and cyberbullying experiences among teenagers in Kazakhstan. The goal is to identify specific skills that can empower teenagers to protect themselves from cyberbullying risks. This section reviews literature from both domains, first discussing cybersecurity factors

that exacerbate cyberbullying and then exploring digital literacy skills that may help prevent it. The dual-focused conceptual foundation situates cyberbullying at the intersection of cybersecurity threats and deficits in digital competencies, providing context for this study's investigation of digital hygiene skills and their potential role in mitigating cyberbullying among teenagers.

2.1. Cyberbullying

Cyberbullying refers to the deliberate and repeated use of digital communication tools, such as social media, email, or messaging apps, to harass, intimidate, or harm others [20]. This includes various forms of online abuse, such as sending threatening messages, spreading rumors, or sharing hurtful content, which can have harmful effects on the mental and emotional well-being of the targeted individuals [21], [22]. Cyberbullying is a concerning issue in the digital age, particularly among teenagers and students [23]. Literature findings on cyberbullying have revealed its negative impact on victims, including increased levels of anxiety, depression, and social isolation [24]. Research also highlights the role of the digital environment and online behaviors in perpetuating cyberbullying incidents [25]. Adolescents who lack digital hygiene skills may be more vulnerable to cyberbullying, either as victims or perpetrators [26]. Hence, understanding the relationship between digital hygiene skills and cyberbullying is crucial in developing effective prevention strategies.

2.2. Digital hygiene skills

Digital hygiene skills are vital in equipping individuals, especially teenagers and students, with the necessary knowledge and abilities to navigate the digital world safely and responsibly. These skills encompass various aspects, each of which contributes to cyberbullying prevention in distinct ways. The identification of digital hygiene skills is based on an extensive review of relevant literature, culminating in the formulation of the study hypotheses, which are presented.

2.2.1. Privacy protection

Privacy protection refers to the ability of teenagers to safeguard their personal information and control their online presence to prevent unauthorized access and potential misuse [27]. It involves adopting privacy settings on social media platforms, being cautious while sharing personal details, and understanding the risks associated with online oversharing [28]–[30]. Privacy protection is a crucial skill in cyberbullying prevention. The research has shown that cyberbullies often use personal information obtained online to target victims. Adolescents who are cautious about sharing sensitive information and actively manage their privacy settings on social media platforms are less likely to become victims of cyberbullying. Studies have also found that individuals who prioritize privacy protection are more likely to prevent cyberbullying. For example, Ramezanian and Niemi [31] used privacy protection to detect cyberbullying, and Faucher *et al.* [32] also showed the importance of privacy protection in cyberbullying protection. Therefore, the first hypothesis of this study is expressed as: higher levels of privacy protection reduce cyberbullying experiences (H1).

2.2.2. Safe reporting

Safe reporting encompasses the willingness and capability of teenagers to report cyberbullying incidents or harmful online behavior in a secure and supportive environment [33]. It emphasizes the importance of having accessible and trustworthy reporting channels to encourage victims to seek help and discourage the perpetration of cyberbullying. Safe reporting is an essential component of effective cyberbullying prevention. Adolescents who are aware of how to report cyberbullying incidents to the appropriate authorities or platforms are more likely to take prompt action when they encounter or witness cyberbullying [34]. Studies have indicated that individuals who believe in the effectiveness of reporting are more likely to intervene in cyberbullying situations, leading to timely intervention and potential consequences for the perpetrators [35]. Thus, the second hypothesis of this study is written as: enhanced safe reporting skills reduce cyberbullying experiences (H2).

2.2.3. Critical thinking

Critical thinking in the context of this study refers to the capacity of teenagers to critically evaluate information and messages encountered online [36]. It involves questioning the credibility and authenticity of online content, identifying potential misinformation or manipulation, and making informed decisions to avoid falling victim to cyberbullying tactics [37]. Critical thinking plays a significant role in identifying potential cyberbullying situations and avoiding falling victim to deceptive online content. Adolescents who possess strong critical thinking skills are more likely to recognize signs of cyberbullying and respond responsibly when they encounter harmful behavior. The research suggests that individuals with higher levels of critical thinking tend to engage in positive online behaviors and are less likely to engage in cyberbullying [38], [39]. Hence, the third hypothesis is considered as: critical thinking reduces cyberbullying experiences (H3).

2.2.4. Cyberbullying identification

Cyberbullying identification pertains to teenagers' ability to recognize and distinguish instances of cyberbullying from other online interactions. It involves identifying malicious behaviors such as harassment, threats, or spreading harmful rumors, which allows for timely intervention and support for both victims and perpetrators [40]. Being able to identify signs of cyberbullying is crucial for early intervention and support for victims. Adolescents who are adept at recognizing cyberbullying behavior, even in subtle or indirect forms, can offer timely assistance to those who may experience cyberbullying. Studies have found that individuals with high cyberbullying identification skills are more likely to have positive relationships with peers and show empathy toward victims [41]. Therefore, the fourth hypothesis of this study is expressed as: cyberbullying identification skills reduce cyberbullying experiences (H4).

2.2.5. Phishing and scam awareness

Phishing and scam awareness involve being vigilant and informed about various online schemes and tactics used by malicious actors to deceive and exploit individuals [42]. Teenagers with higher awareness can better detect and avoid falling into traps, thus minimizing their exposure to cyberbullying attempts. Phishing and scam awareness is an essential skill in avoiding cyberbullying situations in which individuals may be lured into sharing personal information or engaging in harmful behavior unknowingly. Adolescents who are aware of common phishing and scam tactics are better equipped to protect themselves from cyberbullies who may use these deceptive methods [43]. Research has shown that individuals with high scam awareness tend to engage in less risky online behavior and are less likely to experience cyberbullying incidents [44]. The fifth hypothesis is outlined as: phishing and scam awareness reduces cyberbullying experiences (H5).

2.2.6. Positive online behavior

Positive online behavior is related to teenagers' ability to maintain respectful and constructive interactions in the digital sphere [45], [46]. It encompasses being empathetic, supportive, and considerate in online communication, promoting a positive and inclusive online community that reduces the prevalence of cyberbullying [47], [48]. Promoting positive online behavior is a key aspect of fostering a safe and inclusive digital community. Adolescents who commit to respectful and kind online interactions contribute to a positive online culture and are more likely to stand up against cyberbullying. Studies have indicated that individuals with a strong sense of positive online behavior are less likely to become victims or perpetrators of cyberbullying [49], [50]. Thus, the sixth hypothesis of this study is inducted as: positive online behavior reduces cyberbullying experiences (H6).

2.2.7. Digital footprint awareness

Digital footprint awareness refers to teenagers' understanding of the trail of personal information they leave behind while engaging in online activities [51]. This variable emphasizes the importance of managing and controlling one's digital footprint to protect oneself from potential cyberbullying risks [52]. Understanding the impact of online actions on one's digital footprint is critical in avoiding behaviors that may have long-term consequences. Adolescents who are mindful of their digital footprint are less likely to engage in cyberbullying because they are conscious of the potential repercussions [53]. The research suggests that individuals with high digital footprint awareness are more likely to engage in responsible online behavior and prioritize privacy and safety [54], [55]. Hence, the seventh hypothesis of this study is as: digital footprint awareness reduces cyberbullying experiences (H7).

2.2.8. Online etiquette (netiquette)

Online etiquette, also known as netiquette, encompasses a set of social norms and guidelines for courteous and appropriate behavior in online interactions [56]. This variable highlights the significance of practicing respectful and polite communication online, which can contribute to a more positive digital environment and mitigate cyberbullying incidents [57], [58]. Adhering to respectful communication norms online contributes to a positive online environment and reduces the likelihood of engaging in cyberbullying language or actions. Adolescents who value online etiquette are less likely to engage in cyberbullying behaviors and are more likely to contribute to a respectful and supportive digital community [59]–[61]. Studies have found that individuals with strong netiquette skills tend to have healthier online relationships and experience less cyberbullying [58], [62], [63]. Therefore, the eighth hypothesis of this study is written as: online etiquette leads to reduced cyberbullying experiences (H8). Overall, this study considers privacy protection, safe reporting, critical thinking, cyberbullying identification, phishing and scam awareness, positive online behavior, digital footprint awareness, and online etiquette (netiquette) as digital hygiene skills and hypothesizes that these skills help teenagers reduce their cyberbullying experiences. The theoretical framework and hypotheses of this study are depicted in Figure 1.

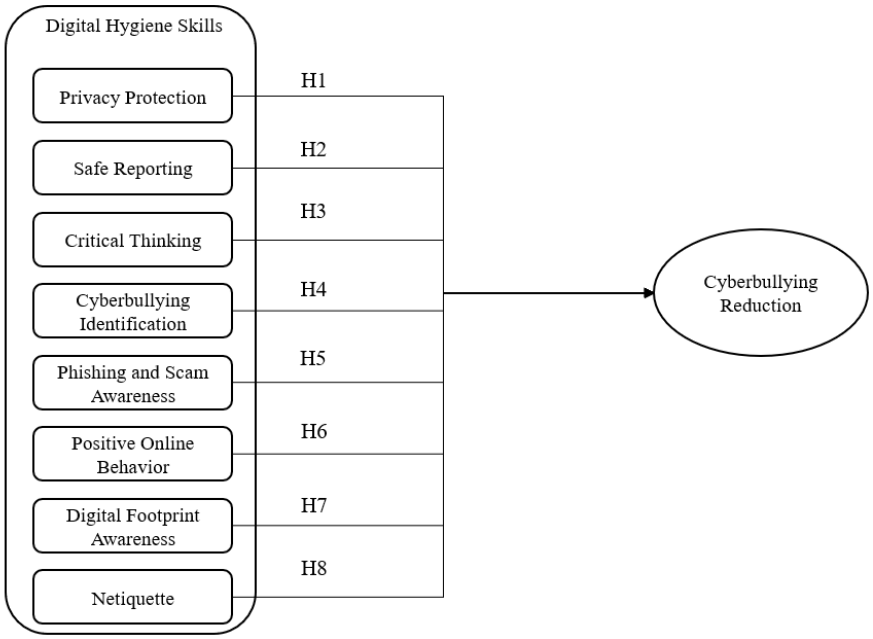

Figure 1. Proposed theoretical framework and hypotheses of this study

3. METHOD

This study adopts a quantitative research design to investigate the relationship between digital hygiene skills and cyberbullying reduction among teenagers in Kazakhstan. A quantitative approach was chosen to quantify the levels of digital hygiene skills and cyberbullying experiences among the participants. This approach allows statistical analysis to establish empirical associations between variables. The quantitative methodology enables us to examine the predictive strength of different digital hygiene skills in reducing cyberbullying incidents.

3.1. Data collection

The data were collected using a questionnaire designed specifically for this study. The questionnaire includes items based on the identified digital hygiene skills and cyberbullying experiences, using a 5-point Likert scale to assess participants' responses. The survey was administered to teenagers from town and district middle schools in Turkistan Region, Kazakhstan. The questionnaire can be found in the Table 1. To determine the appropriate sample size, this study used the approach proposed by Krejcie and Morgan [64] for a target population of 645 students across grades 7-9 in town and district middle schools. Based on their method, the recommended sample size was 200 students. However, anticipating potential non-response or incomplete data, we surveyed an additional 38 students, yielding a final sample of 238 participants. Surveying this slightly larger sample helps ensure sufficient statistical power and representation across the strata, even if some data points need to be excluded during the analysis. Thus, the total sample exceeds the minimum required size and provides a robust dataset for investigating the research questions. The participants were selected using stratified random sampling. The schools were stratified into town and district middle schools, and students from grades 7-9 were randomly sampled from each school type based on age and gender quotas to ensure representation of these segments in the final sample. The sample size is determined on the basis of the feasibility of data collection and statistical requirements for the chosen analysis technique. The participants will be given clear instructions on how to complete the survey, and the data collection process will occur from March 2023 to May 2023.

3.2. Data analysis

The data were analyzed using partial least squares structural equation modeling (PLS-SEM) with SmartPLS 4.0. This statistical technique is suitable for testing the hypothesized relationships between digital hygiene skills and cyberbullying experiences. PLS-SEM allows for modeling complex relationships between variables and is particularly useful when the sample size is relatively small, making it appropriate for this study. Figure 2 illustrates the flowchart of the study's methodology, outlining the step-by-step process from data collection to the attainment of findings.

Table 1. Questionnaire items

No.		Item
Privacy protection	PP1	I am cautious about sharing my personal information online.
	PP2	I actively manage my privacy settings on social media platforms.
	PP3	I am aware of the risks associated with sharing sensitive information online.
	PP4	I take measures to protect my personal information from potential cyberbullies.
	PP5	I believe that privacy protection is essential for reducing cyberbullying incidents.
Safe reporting	SR1	I know how to report cyberbullying incidents to the appropriate authorities or platforms.
	SR2	I feel confident in reporting cyberbullying when I witness it happening to others.
	SR3	I believe that reporting cyberbullying is an effective way to prevent further harm.
	SR4	I am aware of the importance of providing evidence when reporting cyberbullying.
	SR5	I trust that my reports of cyberbullying will be taken seriously and addressed promptly.
Critical thinking	CT1	I am capable of recognizing potential cyberbullying situations online.
	CT2	I use critical thinking skills to evaluate online content and avoid falling for scams.
	CT3	I think critically about the consequences of my online actions on others.
	CT4	I believe that critical thinking helps in identifying and addressing cyberbullying.
	CT5	I value the importance of being a discerning online user to avoid engaging in harmful behavior.
Cyberbullying identification	CI1	a. I can identify signs of cyberbullying in online interactions.
	CI2	b. I am confident in recognizing when I or others are being targeted by cyberbullies.
	CI3	c. I understand the different forms cyberbullying can take in digital spaces.
	CI4	d. I feel capable of identifying cyberbullying even when it is subtle or indirect.
	CI5	e. I believe that early identification of cyberbullying can help prevent its escalation.
Phishing and scam awareness	PSA1	I am aware of common phishing and scam tactics used by cyberbullies.
	PSA2	I take precautions to protect myself from falling victim to online scams.
	PSA3	I feel confident in recognizing and avoiding potential online threats.
	PSA4	I believe that being informed about phishing and scams helps reduce cyberbullying risks.
	PSA5	I value the importance of staying vigilant against deceptive online practices.
Positive online behavior	POB1	I engage in respectful and positive communication with others in online interactions.
	POB2	I am mindful of the language I use online to ensure it promotes a friendly and inclusive environment.
	POB3	I actively support and encourage my peers in digital spaces.
	POB4	I refrain from participating in online arguments or conflicts that could lead to cyberbullying.
	POB5	I believe that promoting positive online behavior is essential for creating a safer digital community.
Digital footprint awareness	DFA1	I am aware that my online activities contribute to my digital footprint.
	DFA2	I understand the potential consequences of leaving a digital trail on the internet.
	DFA3	I take measures to manage and control my digital footprint effectively.
	DFA4	I am cautious about the information and content I share online to protect my digital reputation.
	DFA5	I believe that being conscious of my digital footprint is crucial for safeguarding against cyberbullying risks.
Online etiquette	OE1	I adhere to online etiquette guidelines to maintain a positive and respectful online presence.
	OE2	I am considerate of others' feelings and opinions when engaging in online discussions.
	OE3	I refrain from using offensive language or engaging in behavior that may harm others' emotions.
	OE4	I am mindful of my tone and communication style in digital interactions to avoid misunderstandings.
	OE5	I believe that practicing online etiquette is essential for fostering a harmonious digital community.
Cyberbullying	C1	I have experienced cyberbullying in online spaces.
	C2	I witness cyberbullying incidents happening to others.
	C3	I believe that cyberbullying is a prevalent issue in the digital world.
	C4	I feel concerned about the potential impact of cyberbullying on individuals.

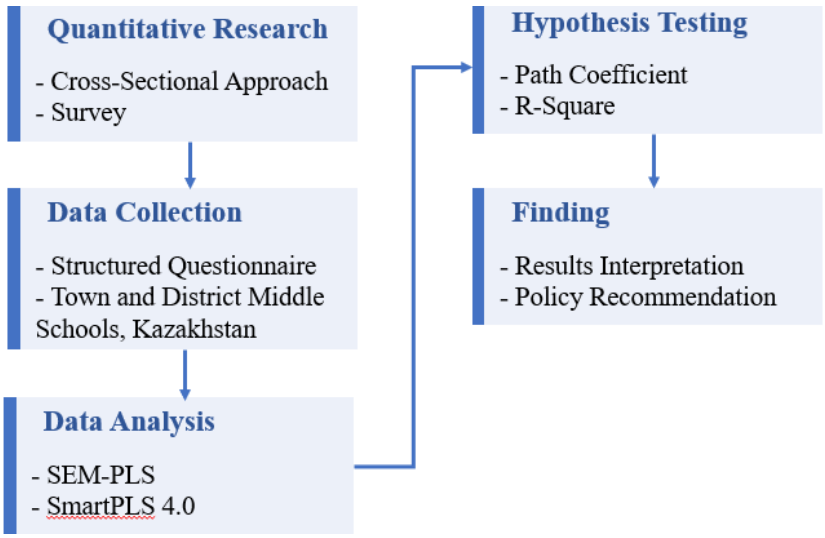

Figure 2. Flowchart of the methodology used in this study to reach the findings

4. RESULTS

Table 2 provides an overview of the demographic characteristics of the participants. The study involved 238 students who participated in distant interviews. These students were from various middle schools in the Turkistan region. The students' ages ranged from 10 to 17 years, encompassing a broad age group of teenagers. Approximately 53% of the students were male, and 47% were female. Approximately 73% of the participants attended town middle schools, while the remaining 27% attended district middle schools. This indicates that 43% of the students were in the 7th grade, 35% were in the 8th grade, and 22% were in the 9th grade.

Table 3 presents the results of reliability and validity analyses for the variables measured in this study. Cronbach's alpha is a measure of internal consistency reliability, which assesses the extent to which items in a variable consistently measure the same underlying construct. It ranges from 0 to 1, where higher values indicate greater internal consistency. In Table 3, all variables have acceptable Cronbach's alpha values ranging from 0.792 to 0.892, indicating that the items within each variable reliably measure the targeted construct. Composite reliability (CR) is another measure of reliability that evaluates the internal consistency of the scale items. Similar to Cronbach's alpha, it ranges from 0 to 1, with higher values indicating better reliability. In Table 3, all variables exhibit strong CR, with values ranging from 0.821 to 0.939, further confirming the internal consistency of the measurement items. Average variance extracted (AVE) assesses the convergent validity of the measurement model, indicating the amount of variance captured by the latent construct relative to the measurement error. AVE values range from 0 to 1, and higher values signify better convergent validity. In Table 3, all variables demonstrate satisfactory AVE values, ranging from 0.568 to 0.784, indicating that the items within each construct share a substantial amount of common variance. Overall, the high reliability (Cronbach's alpha and CR) and satisfactory convergent validity (AVE) of the study variables in Table 3 indicate that the measurement instruments used in the study are consistent, reliable, and valid for assessing the targeted digital hygiene skills and cyberbullying.

Table 2. Demographic characteristics of the participants

Participant characteristics	Number
Total number of interviewed students	238
Age range of students	10-17 years
Gender	Male (53%)
	Female (47%)
School type	Town middle schools (73%)
	District middle schools (27%)
Grade level	7 (Middle school) (43%)
	8 (Middle school) (35%)
	9 (Middle school) (22%)

Table 3. Reliability and validity analysis of the study variables

Variables	Cronbach's alpha	CR	AVE
Privacy protection	0.864	0.876	0.673
Safe reporting	0.892	0.938	0.568
Critical thinking	0.892	0.842	0.671
Cyberbullying identification	0.877	0.847	0.626
Phishing and scam awareness	0.858	0.892	0.606
Positive online behavior	0.881	0.852	0.683
Digital footprint awareness	0.821	0.841	0.784
Online etiquette	0.885	0.939	0.729
Cyberbullying	0.792	0.821	0.621

Table 4 presents the results of the measurement model analysis for digital hygiene skills and cyberbullying variables. The table includes various statistical indicators of each variable included in the study. The variable column represents the questionnaire items related to each study variable. Variance inflation factor is a measure used to detect multicollinearity among the variables in the measurement model. In this table, variance inflation factor values range from approximately 1 to 2.8, indicating that there is no significant multicollinearity among the variables.

The loading factors represent the strength of the relationship between the observed items and their corresponding latent constructs (variables). Higher loading factors (closer to 1) indicate a stronger relationship, suggesting that the items effectively measure the intended constructs. In Table 4, all the loading factors for the observed items (items used to measure each variable) are above the threshold of 0.7, indicating strong relationships between the observed items and their corresponding latent constructs (variables).

In addition, the p-values associated with the loading factors are statistically significant ($p<0.05$) for all variables. This means that the observed items are indeed effective indicators of the digital hygiene skills and cyberbullying variables under investigation, and the measurement instrument effectively captures the targeted constructs.

Table 4. The measurement model analysis for digital hygiene skills and cyberbullying variables

Variables		Variance inflation factor	Loading factors	Mean	S.D.	*p*-value
Privacy protection	PP1	1.248	0.899	4.424	0.999	0.041
	PP2	2.143	0.850	4.330	1.185	0.013
	PP3	1.960	0.775	3.460	1.122	0.028
	PP4	1.876	0.738	3.310	1.021	0.018
	PP5	1.919	0.851	4.279	0.930	0.023
Safe reporting	SR1	2.798	0.772	3.584	1.251	0.022
	SR2	1.256	0.878	4.512	1.157	0.006
	SR3	2.398	0.771	3.521	0.991	0.044
	SR4	2.319	0.900	4.021	1.279	0.013
	SR5	1.128	0.886	3.601	1.224	0.038
Critical thinking	CT1	2.533	0.805	4.340	0.980	0.032
	CT2	1.316	0.863	4.009	0.986	0.028
	CT3	1.401	0.819	3.955	0.869	0.038
	CT4	2.762	0.799	3.971	1.264	0.030
	CT5	1.561	0.898	3.632	1.131	0.015
Cyberbullying identification	CI1	1.621	0.740	3.864	1.127	0.040
	CI2	1.985	0.724	3.639	0.931	0.018
	CI3	1.336	0.901	4.189	0.892	0.038
	CI4	1.663	0.905	3.676	0.808	0.009
	CI5	1.957	0.839	4.401	1.055	0.000
Phishing and scam awareness	PAA1	2.028	0.889	3.343	0.859	0.040
	PAA2	1.705	0.766	4.515	0.944	0.000
	PAA3	2.237	0.744	3.507	1.108	0.022
	PAA4	1.597	0.885	3.953	0.968	0.043
	PAA5	2.425	0.863	4.176	1.261	0.009
Positive online behavior	POB1	2.105	0.756	4.248	1.176	0.028
	POB2	2.790	0.805	4.540	1.027	0.033
	POB3	2.131	0.739	4.546	1.196	0.018
	POB4	1.624	0.744	3.504	0.806	0.023
	POB5	1.895	0.725	4.472	0.979	0.006
Digital footprint awareness	DFA1	2.731	0.792	4.086	0.867	0.032
	DFA2	1.620	0.725	3.501	1.034	0.008
	DFA3	2.839	0.855	3.949	0.919	0.044
	DFA4	2.555	0.761	3.846	0.923	0.001
	DFA5	1.889	0.857	3.462	1.270	0.013
Online etiquette	OE1	1.170	0.875	3.585	1.150	0.024
	OE2	1.355	0.858	3.730	0.934	0.030
	OE3	1.577	0.776	4.268	1.180	0.020
	OE4	1.575	0.735	4.199	0.932	0.005
	OE5	1.442	0.848	4.047	1.226	0.009
Cyberbullying	C1	1.146	0.899	3.880	1.016	0.006
	C2	2.235	0.729	4.051	1.203	0.009
	C3	2.702	0.811	3.324	0.993	0.027
	C4	1.611	0.835	3.865	0.812	0.038
	C5	1.329	0.783	4.375	0.860	0.018

The results of the hypothesis testing using PLS-SEM are presented in Table 5. The findings from the analysis revealed important insights into the relationship between digital hygiene skills and cyberbullying experience among students. Starting with the confirmed hypotheses, it was observed that privacy protection (H1), critical thinking (H3), cyberbullying identification (H4), phishing and scam awareness (H5), and digital footprint awareness (H7) were all significantly and negatively associated with cyberbullying experience. This means that students who possess and actively engage in these digital hygiene skills are more likely to have a reduced experience of cyberbullying incidents. Specifically, students who are more conscious of their privacy settings, demonstrate critical thinking in their online interactions, can identify cyberbullying behaviors, are aware of phishing and scams, and understand the implications of their digital footprints are less likely to encounter cyberbullying situations. These results highlight the importance of these digital hygiene skills in fostering a safer online environment and protecting students from cyberbullying experiences as presented in Figure 3.

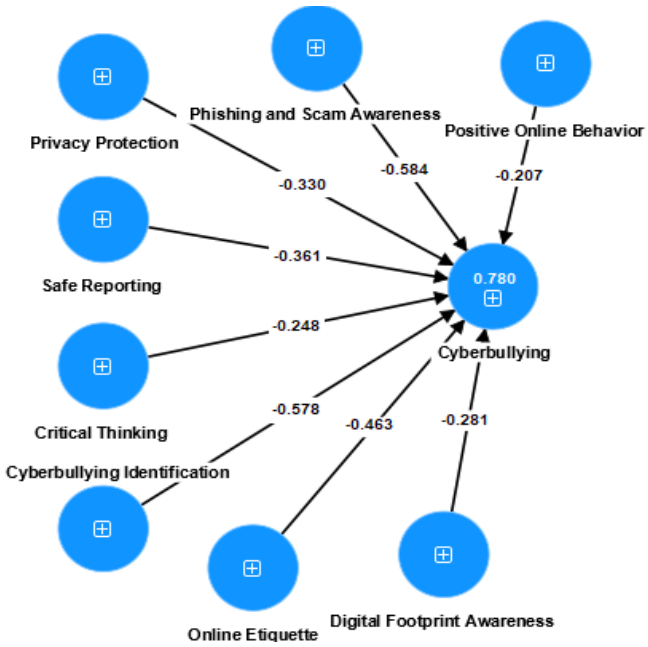

Figure 3. Results of the hypothesis testing using SmartPLS

Table 5. Results of hypothesis testing using PLS-SEM

	Hypotheses	β	S.D.	*p*-values	Result
H1	Privacy protection -> cyberbullying	-0.330	1.051	0.019	Confirmed
H2	Safe reporting -> cyberbullying	-0.361	1.180	0.072	Not confirmed
H3	Critical thinking -> cyberbullying	-0.248	1.046	0.021	Confirmed
H4	Cyberbullying identification -> cyberbullying	-0.578	0.963	0.023	Confirmed
H5	Phishing and scam awareness -> cyberbullying	-0.584	1.028	0.015	Confirmed
H6	Positive online behavior -> cyberbullying	-0.207	1.037	0.090	Not confirmed
H7	Digital footprint awareness -> cyberbullying	-0.281	1.003	0.019	Confirmed
H8	Online etiquette -> cyberbullying	-0.463	1.0844	0.086	Not confirmed

However, not all digital hygiene skills have a significant impact on cyberbullying experience. The hypotheses related to safe reporting (H2), positive online behavior (H6), and online etiquette (H8) do not exhibit statistically significant associations with the reduction of cyberbullying experience among students in this study. While the non-confirmed hypotheses indicate that safe reporting, positive online behavior, and online etiquette may not have a significant impact on reducing cyberbullying experience, it is important to consider potential contextual and cultural factors that may influence these relationships. Further research could explore the nuances of these digital hygiene skills and their potential effectiveness in other settings or student populations.

The findings also reveal that R^2=0.78, indicating that approximately 78% of the variance in the cyberbullying experience of students can be explained by the variance in the digital hygiene skills considered in the study. This suggests that the selected digital hygiene skills have a strong influence on reducing the cyberbullying experience among students. This finding highlights the importance and relevance of these digital hygiene skills in understanding and predicting cyberbullying prevention behaviors among the target population.

5. DISCUSSION

The main objective of this study was to explore the potential of digital hygiene skills in reducing the experience of cyberbullying among students. The results shed light on the importance of promoting responsible online behavior and equipping students with essential digital skills to foster a safer online environment. The first hypothesis (H1) posited that privacy protection would have a negative impact on cyberbullying experience, implying that students who are more vigilant about safeguarding their personal information online would encounter fewer instances of cyberbullying. The hypothesis was confirmed, indicating that privacy protection is indeed associated with reduced cyberbullying experiences among students. This finding aligns with previous literature highlighting the importance of privacy measures in

mitigating cyberbullying incidents [31]. For instance, Faucher *et al.* [32] emphasized the role of privacy protection in preventing cyberbullying, suggesting that students who are aware of privacy settings and actively manage their online presence are less vulnerable to cyberbullying. Similarly, individuals with higher levels of privacy concern and protective behaviors experienced lower rates of cyberbullying victimization [65]. The implication of this result is that fostering privacy awareness and teaching students how to protect their personal information online can be an effective strategy in cyberbullying prevention programs.

The second hypothesis (H2) suggested that safe reporting would negatively influence cyberbullying experience, implying that encouraging students to report cyberbullying incidents in a secure and supportive environment would lead to fewer instances of cyberbullying. However, this hypothesis was not confirmed in this study. Possible reasons for this non-confirmation include barriers to reporting, such as fear of retaliation or concerns about confidentiality. This finding contrasts with some previous studies that have highlighted the importance of safe reporting mechanisms in combating cyberbullying. For example, research by Ansary [34] argued that providing accessible and trustworthy reporting channels can encourage victims and bystanders to seek help and discourage perpetrators. Similarly, Yusop and Al-Shami [35] found that students who perceived their school's reporting system as effective were more likely to report cyberbullying incidents. Future studies should delve into the factors influencing reporting behavior and explore ways to improve reporting mechanisms within schools and online platforms. Implementing anonymous reporting systems and promoting a culture of trust and support may enhance the effectiveness of safe reporting in cyberbullying prevention initiatives.

The third hypothesis (H3) proposed that critical thinking negatively correlates with cyberbullying experience, suggesting that students who possess critical thinking skills are better equipped to recognize and avoid cyberbullying situations. The hypothesis was confirmed, aligning with prior research highlighting the significance of critical thinking in digital literacy and online safety [37]. This finding is consistent with the research by Koluri and Azar [36], who found that students with higher levels of critical thinking were less likely to be victims of cyberbullying. Nowduri [37] also emphasized the importance of critical thinking skills in identifying and responding to cyberbullying incidents. Additionally, research by Wassanasompong and Tussaworn [38] demonstrated that incorporating critical thinking exercises in cyberbullying prevention programs can effectively reduce cyberbullying incidents among students. The implication of this finding is that integrating critical thinking skills into educational curricula can empower students to critically assess online interactions, identify potential cyberbullying, and respond thoughtfully, thereby reducing their susceptibility to cyberbullying incidents.

The fourth hypothesis (H4) explored whether cyberbullying identification is negatively associated with cyberbullying experience, suggesting that students who are more adept at recognizing cyberbullying behaviors have fewer encounters with cyberbullying. This hypothesis was confirmed, indicating that the ability to identify cyberbullying incidents is linked to a reduced cyberbullying experience. This finding is consistent with previous studies emphasizing the importance of recognizing and acknowledging cyberbullying to effectively address the issue [66]. The implication is that educational programs should emphasize cyberbullying identification skills, enabling students to recognize harmful behaviors and intervene appropriately, thus fostering a safer online environment.

The fifth hypothesis (H5) posited that phishing and scam awareness would have a negative impact on cyberbullying experience, suggesting that students who are more aware of phishing attempts and online scams would encounter fewer cyberbullying incidents. The hypothesis was confirmed, indicating that students with higher awareness of phishing and scams are less likely to fall victim to cyberbullying. This finding resonates with studies emphasizing the role of digital literacy in reducing online risks [6]. For instance, Broadhurst *et al.* [42] found that students with higher levels of phishing and scam awareness were less likely to engage in risky online behaviors, which could potentially expose them to cyberbullying. Similarly, research by Back and Guerette [43] demonstrated that cybersecurity awareness training, which includes phishing and scam awareness, can effectively reduce the risk of falling victim to online attacks, including cyberbullying. Study by Garba *et al.* [44] also highlighted the importance of phishing and scam awareness in promoting safer online behaviors among university students. The implication is that promoting phishing and scam awareness in educational settings can enhance students' resilience against cyberbullying and online exploitation.

The sixth hypothesis (H6) explored whether positive online behavior negatively influences cyberbullying experience, implying that students who engage in positive online interactions are less likely to experience cyberbullying. However, this hypothesis was not confirmed in this study. This finding contrasts with some previous research that has suggested a link between positive online behavior and reduced cyberbullying experiences. For example, Zhong *et al.* [47] found that students who exhibited higher levels of digital citizenship, which includes positive online behavior, reported lower levels of cyberbullying involvement. Similarly, promoting positive online behavior through an anti-cyberbullying intervention

increased students' intentions to intervene on behalf of cyberbullying victims [48]. Potential reasons for this non-confirmation could involve the complexities of online interactions, where positive behavior may not guarantee immunity from cyberbullying incidents. Future research should delve into the nuances of online behavior and its impact on cyberbullying experiences, considering contextual factors and the dynamics of online social networks. Moreover, intervention programs should emphasize the importance of positive online behavior while acknowledging its limitations in isolation as a preventive factor.

The seventh hypothesis (H7) proposed that digital footprint awareness negatively relates to cyberbullying experience, suggesting that students who are aware of their digital footprints and online presence encounter fewer cyberbullying incidents. The hypothesis was confirmed, aligning with studies emphasizing the role of digital footprints in online vulnerability [65]. This finding is consistent with the work by Surmelioglu and Seferoglu [51], who found that students with higher levels of digital footprint awareness reported lower levels of cyberbullying victimization. Olipas [52] also highlighted the importance of raising students' awareness of their digital footprints to promote safer online behaviors and reduce the risk of cyberbullying. Additionally, Wook *et al.* [53] demonstrated that digital footprint management education can effectively enhance students' online safety and reduce their exposure to cyberbullying. The implication is that educating students about the consequences of their online actions and promoting responsible digital behavior can reduce cyberbullying experiences among adolescents.

The eighth hypothesis (H8) investigated whether online etiquette negatively influences cyberbullying experience, implying that students who adhere to proper online etiquette encounter fewer cyberbullying incidents. However, this hypothesis was not confirmed in this study. This finding differs from some previous research that has suggested a link between online etiquette and reduced cyberbullying. For instance, Park *et al.* [57] found that students who exhibited higher levels of netiquette (online etiquette) reported lower levels of cyberbullying involvement. Similarly, Rahman *et al.* [58] demonstrated that poor netiquette was a significant predictor of cyberbullying behavior among university students. Potential reasons for this non-confirmation may involve variations in the interpretation and application of online etiquette norms across different social contexts. Future research should explore the cultural and contextual factors that shape online etiquette and its influence on cyberbullying prevention. Moreover, interventions should address the challenges of defining and promoting universal online etiquette guidelines while considering cultural diversity and the evolving nature of digital communication.

Cyberbullying poses significant emotional, psychological, and even physical harm to its victims. Adolescents who experience cyberbullying often experience increased anxiety, depression, and feelings of isolation. The relentless nature of online harassment can have severe consequences on their mental health, leading to low self-esteem and, in extreme cases, suicidal ideation. Victims of cyberbullying may also face social exclusion and withdrawal because the constant fear of online attacks can deter them from participating in online communities and social interactions [67], [68]. Moreover, cyberbullying can extend beyond digital spaces and spill over into offline life, disrupting academic performance and school attendance. The negative impact of cyberbullying can be long-lasting, with effects extending into adulthood, affecting relationships and overall well-being [69], [70]. Given the devastating effects of cyberbullying on adolescents, it is crucial to implement effective prevention strategies to protect young individuals from such harm. Cyberbullying prevention involves not only mitigating individual suffering but also fostering a safe and respectful online environment for the entire youth population. Early intervention can interrupt the vicious cycle of cyberbullying, thereby reducing the likelihood of perpetrators engaging in harmful behaviors in the future. By nurturing a culture of digital responsibility and empathy, we can instill positive online behavior among students, thereby promoting a supportive and inclusive digital community. Preventing cyberbullying is not solely the responsibility of schools; it requires collaboration among parents, educators, policymakers, and online platforms to create a comprehensive approach to ensure the well-being of young people in the digital age.

The findings of this study offer valuable insights into the role of digital hygiene skills in reducing cyberbullying experiences among students. Confirming hypotheses related to privacy protection, critical thinking, cyberbullying identification, phishing and scam awareness, and digital footprint awareness underscores the importance of these skills in cyberbullying prevention efforts. Educational programs can leverage these findings to integrate these skills into the curriculum, empowering students to navigate the online world responsibly. Moreover, the non-confirmed hypotheses regarding safe reporting, positive online behavior, and online etiquette provide opportunities for further research and program refinement. Understanding the factors influencing the effectiveness of these skills and addressing their limitations can lead to improved interventions. For instance, promoting safe reporting may require implementing anonymous reporting systems and creating a culture of trust and support within schools. By leveraging the confirmed findings, educators and policymakers can develop evidence-based cyberbullying prevention initiatives that prioritize critical digital hygiene skills. Integrating privacy protection lessons can empower students to safeguard their personal information, thereby reducing the risk of cyberbullying incidents. Similarly,

enhancing cyberbullying identification skills can enable students to recognize harmful behaviors early and effectively intervene. Overall, the study's findings can serve as a foundation for comprehensive cyberbullying prevention programs that equip students with essential digital hygiene skills, fostering a safer and more respectful online environment. By prioritizing the development of these skills in educational settings and involving all stakeholders in the process, we can create a digital landscape where adolescents can thrive, free from the damaging effects of cyberbullying.

5.1. Theoretical contribution

This study makes several significant theoretical contributions to the fields of digital hygiene skills and cyberbullying prevention among teenagers. By exploring the interplay between digital hygiene skills and cyberbullying experiences, this research contributes to a deeper understanding of the complex dynamics in the online environment.

5.1.1. Advancement of digital hygiene skills framework

This study contributes to the evolving literature on digital hygiene skills by examining their specific impact on cyberbullying prevention. By confirming the relationships between privacy protection, critical thinking, cyberbullying identification, phishing and scam awareness, and digital footprint awareness with reduced cyberbullying experiences, the study substantiates the importance of these skills in safeguarding adolescents from online harm. The findings enrich the existing framework of digital hygiene skills, providing educators and researchers with a more comprehensive understanding of their practical applications in the context of cyberbullying prevention.

5.1.2. Identification of skill-specific cyberbullying prevention strategies

The study's confirmed hypotheses shed light on the unique contributions of different digital hygiene skills to cyberbullying prevention. By identifying the skills that are more effective in reducing cyberbullying experiences, the research provides educators and policymakers with valuable insights to tailor intervention programs. For instance, emphasizing cyberbullying identification and digital footprint awareness in educational curricula can help students develop a heightened sense of awareness and responsibility in their online interactions. Such skill-specific strategies contribute to a targeted approach, optimizing resources and efforts in combating cyberbullying.

5.1.3. Recognition of cultural nuances in cyberbullying prevention

Through exploring both confirmed and non-confirmed hypotheses, this study highlights the importance of considering cultural nuances in cyberbullying prevention. Non-confirmed hypotheses involving safe reporting, positive online behavior, and online etiquette suggest that the effectiveness of these skills may vary based on cultural and contextual factors. Understanding these nuances is crucial for designing culturally sensitive interventions that resonate with diverse populations. By acknowledging cultural influences on digital behavior, educators can create inclusive and adaptive prevention strategies that account for cultural diversity.

5.1.4. Validation of digital hygiene skills as a holistic approach

The confirmation of multiple digital hygiene skills as effective cyberbullying prevention mechanisms validates the significance of taking a holistic approach to online safety education. Instead of relying on a single skill or isolated strategies, this study underscores the importance of incorporating a repertoire of digital hygiene skills into educational curricula. Integrating privacy protection, critical thinking, cyberbullying identification, phishing and scam awareness, and digital footprint awareness collectively equips students with a robust toolkit to navigate the digital landscape responsibly and resist cyberbullying attempts.

5.1.5. Implications for policy and educational reform

The theoretical implications arising from this study provide strong support for policymakers and educational institutions to incorporate digital hygiene skills training into broader policies and educational reform efforts. By recognizing the influence of digital literacy and cyberbullying prevention, policymakers can prioritize the integration of these skills into national educational frameworks. Policymakers can also work toward promoting collaborative initiatives among schools, parents, and online platforms to create a comprehensive approach to digital hygiene education and cyberbullying prevention.

In conclusion, this study's theoretical contributions advance the understanding of digital hygiene skills as essential components of cyberbullying prevention efforts among teenagers. By substantiating the relationships between specific skills and reduced cyberbullying experiences, this study provides valuable

insights into effective prevention strategies. Moreover, by considering cultural nuances and embracing a holistic approach, this study emphasizes the importance of context-sensitive interventions in fostering a safer and more respectful online environment for youth. This study has theoretical implications for educational reform and policy development, paving the way for evidence-based initiatives that empower adolescents to navigate the digital world responsibly and effectively combat cyberbullying.

5.2. Practical contribution

The findings from this research have several important practical implications for stakeholders seeking to mitigate cyberbullying and promote digital literacy among teenagers. First, the results underscore the need for a multifaceted approach that integrates digital hygiene skills education into school curricula, teacher training programs, and youth-focused campaigns. Tailoring skill-building initiatives to emphasize the most impactful competencies identified, such as privacy protection and critical thinking, can optimize limited resources. Second, policymakers must develop holistic and adaptive cyberbullying prevention strategies that span regulatory, technological, and social domains. This requires ongoing evaluation of emerging online threats and trends to enact timely interventions. Third, fostering collaboration between educators, parents, authorities, and technology companies is vital to monitor cyberbullying, respond promptly to incidents, and consistently reinforce positive online behaviors. Unified efforts can promote shared responsibility in creating a safe, inclusive digital space for youth. Finally, cultural sensitivity must be embedded in all prevention programs, accounting for regional norms, perspectives, and barriers to engagement. Overall, translating these research insights into concrete actions will require multi-stakeholder coordination and an evidence-based, context-specific approach tailored to the youth population. Sustained investment in advancing teenagers' digital competencies and resilience promises significant societal dividends over the long-term.

5.3. Methodological contribution

This study makes notable methodological contributions to the field of cyberbullying research and digital hygiene skill assessment. By employing a comprehensive approach to investigate the relationship between digital hygiene skills and cyberbullying experiences. This study offers valuable insights for future research endeavors. First, the study's use of a theory-driven approach in developing the hypotheses and conceptual framework sets a strong foundation for the empirical investigation. By grounding the research in a well-defined theoretical framework. This study demonstrates the importance of a systematic and conceptually sound methodology in examining complex phenomena such as cyberbullying and digital hygiene skills.

Second, the study's application of PLS-SEM using SmartPLS 4.0 showcases the effectiveness of this statistical technique in analyzing the relationships between digital hygiene skills and cyberbullying experiences. The use of PLS-SEM allows simultaneous examination of multiple relationships while taking measurement errors into consideration, providing a more accurate representation of the underlying constructs. This methodological choice serves as a valuable reference for future studies aiming to investigate similar multifaceted relationships in the context of cyberbullying and digital literacy.

Third, the study's comprehensive measurement model, which encompasses a wide range of digital hygiene skills and cyberbullying experiences, offers a robust framework for assessing these constructs in future research. The carefully designed questionnaire items and the use of a 5-point Likert scale provide a reliable and valid means of capturing participants' perceptions and experiences. The thorough reliability and validity analyses conducted in this study further strengthen the methodological rigor and credibility of the findings.

Finally, the study's use of stratified random sampling to ensure representativeness across different school types, age groups, and genders in the sample highlights the importance of considering diverse perspectives in cyberbullying research. This methodological approach enables the generalizability of the findings to a broader population and underscores the need for inclusive and representative sampling techniques in future studies.

5.4. Policy recommendations

This study produced important findings regarding the relationship between digital hygiene skills and cyberbullying among teenagers in Kazakhstan. The analysis identified specific skills that were significantly associated with reduced cyberbullying incidents. Based on the empirical results and theoretical contributions, comprehensive policy recommendations are proposed. These interventions address cyberbullying and promote essential digital skills among adolescents, mitigating risks and fostering safer online behaviors.

5.4.1. Integration of digital hygiene education into school curricula

Education policymakers should prioritize the integration of digital hygiene education into school curricula across all grade levels. By incorporating lessons on privacy protection, critical thinking, cyberbullying identification, phishing and scam awareness, and digital footprint awareness, schools can equip

students with essential skills to navigate the digital landscape responsibly. These lessons should be designed to promote active engagement, practical application, and critical reflection on digital behaviors.

5.4.2. Development of comprehensive cyberbullying prevention policies

National and regional education authorities should work collaboratively to develop comprehensive cyberbullying prevention policies. These policies should outline guidelines for identifying and addressing cyberbullying incidents in schools and online platforms. Emphasizing the importance of safe reporting and creating mechanisms for anonymous reporting can foster a culture of trust and support, encouraging victims and bystanders to come forward without fear of retaliation.

5.4.3. Cultural sensitivity in cyberbullying prevention initiatives

Policymakers and educators must recognize the cultural nuances that influence digital behavior and cyberbullying experiences among teenagers. Cyberbullying prevention initiatives should be context-sensitive and acknowledge and respect cultural diversity. By incorporating diverse perspectives and considering local norms, policies and educational programs can resonate with the diverse population and enhance their effectiveness. Stakeholders should engage in an inclusive design process, consult and collaborate with local communities to develop culturally aligned strategies.

5.4.4. Teacher training and capacity building

Providing professional development opportunities for teachers on digital hygiene skills and cyberbullying prevention is crucial. Equipping educators with the knowledge and tools to effectively teach these skills will empower them to foster a safe and supportive digital learning environment. Training sessions should emphasize evidence-based strategies and practical approaches to integrate digital hygiene skills in various subjects. By regularly evaluating the impact of training initiatives and incorporating teacher feedback, the professional development programs can be continuously improved to maximize their effectiveness.

5.4.5. Collaborative efforts with parents and online platforms

Collaboration between parents, educators, and online platforms is vital to comprehensively tackle cyberbullying. Parental involvement in digital hygiene education can reinforce learning at home and facilitate open conversations about online safety. Online platforms should actively participate in cyberbullying prevention initiatives, enforce stricter policies against cyberbullying, and enhance reporting mechanisms for harmful content. Unified efforts across these stakeholders can promote shared responsibility in fostering positive online behaviors and ensuring the well-being of youth in the digital age.

5.4.6. Long-term evaluation and monitoring

Policymakers should implement a long-term evaluation and monitoring system to assess the effectiveness of cyberbullying prevention initiatives and the integration of digital hygiene skills in schools. Regular assessments will help identify areas of improvement and inform evidence-based policy adjustments for sustained impact. Evaluation measures should encompass quantitative data on program outcomes and qualitative feedback from students, parents, and educators on their experiences. Policy revisions should respond promptly to emerging cyberbullying trends and use technologies such as online surveys and digital monitoring tools to generate real-time data and insights.

5.4.7. Media and public awareness campaigns

Governments and relevant authorities should launch media and public awareness campaigns to raise awareness about cyberbullying and digital hygiene. These campaigns can inform the public about the risks of cyberbullying, the importance of responsible online behavior, and the available resources for support and reporting. Campaigns should use diverse media platforms such as television, radio, social media, and streaming services to reach a wide audience. Messaging should be age-appropriate and localized to resonate with different groups. Campaigns should partner with influencers, youth advocates, and community organizations to enhance promotion and foster ongoing public engagement.

In conclusion, these policy recommendations create a holistic and proactive approach to address cyberbullying and promote digital hygiene skills among teenagers in Kazakhstan. By aligning educational policies, teacher training, parental involvement, and collaborative efforts with online platforms, these recommendations seek to foster a safe and respectful online environment for youth, empowering them to navigate the digital world with confidence and resilience. Implementing these policies will contribute to a comprehensive strategy for reducing cyberbullying incidents and fostering responsible digital citizenship among the younger generation.

6. CONCLUSION

This study has provided valuable insights into effective strategies for fostering a safer online environment for adolescents. The theoretical contributions of this research have advanced our understanding of digital hygiene skills as crucial components of cyberbullying prevention efforts. The findings of the study confirmed the significance of certain digital hygiene skills in reducing cyberbullying experiences among students. Privacy protection, critical thinking, cyberbullying identification, phishing and scam awareness, and digital footprint awareness demonstrated significant associations with reduced cyberbullying incidents, validating their importance in online safety education. These skill-specific findings can inform the design of targeted interventions and educational programs to equip students with essential digital literacy tools. The study also highlighted the importance of recognizing cultural nuances in cyberbullying prevention. Non-confirmed hypotheses related to safe reporting, positive online behavior, and online etiquette underscored the need for context-sensitive approaches that consider diverse cultural backgrounds and social norms. Understanding these nuances will enable the development of inclusive and adaptive prevention strategies. This study contributes significantly to the fields of digital hygiene skills and cyberbullying prevention. By leveraging these findings, policymakers, educators, and parents can collaboratively work toward fostering a safer and more respectful online environment for youth. Implementing evidence-based policies and educational initiatives will empower adolescents to navigate the digital world responsibly, promote positive digital citizenship, and combat cyberbullying effectively. Ultimately, through these concerted efforts, we can build a society where young individuals can thrive and grow free from the harms of cyberbullying in the digital age.

This study provides valuable insights into the relationship between digital hygiene skills and cyberbullying experiences among teenagers in Kazakhstan. However, it has some limitations, such as reliance on self-report measures, a cross-sectional design, and the use of questionnaires to assess digital hygiene skills. These limitations may affect the accuracy and generalizability of the findings. To address these limitations and further advance the field, future researchers should consider employing additional data collection methods, conducting longitudinal and intervention studies, exploring cultural differences, and investigating the role of parental involvement. Qualitative research can provide deeper insights into the lived experiences of adolescents, and cross-cultural studies can identify culturally specific factors contributing to cyberbullying.

ACKNOWLEDGEMENTS

This work was supported under Grant AP19679127 “Development of a methodological system for forming digital hygiene skills in adolescents and prevention of cyberbullying”.

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