



Developing Digital Ethics Literacy Through Game-Based Learning: A Preventive Approach to Cyberbullying Using Interland Game in Indonesian Secondary Education

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Abstract. This study explores the development of digital ethics literacy as a preventive strategy against cyberbullying among high school students in Indonesia. Recognizing the increasing prevalence of cyberbullying in digital environments, this research investigates the effectiveness of game-based learning using Interland, a digital educational game developed by Google, in promoting ethical digital behavior. Conducted at Senior High School 4 in South Tangerang, the study employs a qualitative approach with data collected through classroom observations, student reflections, and interviews with teachers and students. The findings indicate that the use of Interland not only enhances students' understanding of digital ethics, such as privacy, respect, and responsible online behavior—but also fosters active engagement and critical thinking in navigating digital spaces. This research highlights the potential of game-based learning as an innovative pedagogical tool to cultivate digital citizenship and prevent harmful behaviors in online interactions. The study suggests the integration of digital ethics education into the national curriculum and calls for further research on the long-term impacts of digital game interventions in educational settings.

Keywords: Digital Ethics, Game Learning, Interland, Education, Cyberbullying

1 Introduction

In today's increasingly digital environment, cyberbullying has emerged as a significant challenge in educational settings. While Indonesia's general digital literacy shows modest improvement, the ethical dimension of digital behavior remains underdeveloped and demands greater attention. Comprehensive digital literacy comprises four pillars, digital skills, digital ethics, digital security, and digital culture highlighting that ethical awareness is a vital component to be addressed in online interactions. In the Indonesian context, reports from the Ministry of Communication and Information indicate a steady increase in cyberbullying cases involving adolescents, particularly through social media and messaging platforms, underscoring the urgency of preventive and educational interventions at the school level.

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Cyberbullying has become a significant concern in Indonesian secondary education, mirroring global trends of increasing online harassment among adolescents. A recent multi-regional study reported that 69.64% of high school students in major Indonesian cities, including Jakarta, had experienced cyberbullying (Haryanto & Fadillah, 2022). Complementary survey data indicate that 46% of youth aged 14–24 reported being victims of cyberbullying, with males (49%) reporting slightly higher rates than females (41%) (Setiawan, 2021). These findings highlight the pervasive nature of the problem and its potential psychological and academic impacts. Urban areas with high internet penetration, such as South Tangerang, are particularly susceptible to such risks due to intense social media use. A study at SMA Negeri 6 Tangerang revealed a strong positive correlation between the intensity of social media use and cyberbullying behavior ($r = 0.754, p < .05$), suggesting that higher engagement online increases exposure to harmful behaviors (Nuraini & Pratama, 2023). Despite these patterns, preventive interventions at the high school level remain limited.

Game-based learning has emerged as a promising pedagogical strategy to address digital ethics and responsible online behavior. Interland, developed by Google as part of the Be Internet Awesome program, is designed to teach digital citizenship principles, such as privacy, respect, fact-checking, and responsible sharing, through interactive gameplay (Google, 2020). Prior research indicates that game-based approaches can enhance engagement, foster critical thinking, and improve retention of ethical concepts in digital contexts (Gee, 2014; Turner, 2019). Designed originally for children but adaptable for older students, Interland immerses players in four themed worlds, each addressing a core principle of ethical digital behavior:

1. Kind Kingdom: Encourages kindness and empathy in online interactions, while modeling ways to respond constructively to cyberbullying.
2. Reality River: Develops critical thinking by challenging players to distinguish between credible information and misinformation or phishing attempts.
3. Mindful Mountain: Promotes responsible information sharing and awareness of privacy implications.
4. Tower of Treasure: Teaches password security and protection of personal data.

Each world is structured as an interactive mini game, combining immediate feedback, problem-solving challenges, and narrative elements to reinforce learning outcomes. The pedagogical foundation aligns with constructivist learning theory, emphasizing active participation, discovery-based learning, and contextually relevant scenarios (Turner, 2019). Google has also developed accompanying lesson plans, worksheets, and educator guides, which have been recognized with the International Society for Technology in Education (ISTE) Seal of Alignment, ensuring that the content meets international digital literacy standards (Google, 2020).

Given the increasing prevalence of cyberbullying among adolescents and the growing importance of digital citizenship education, this study aims to examine the effectiveness of game-based learning using Google's Interland in developing digital ethics literacy among Indonesian secondary school students. Specifically, this study addresses the following research questions: (1) How does the use of Interland influence

students' digital ethics knowledge over time? (2) How does game-based learning affect students' attitudes toward responsible online behavior, including privacy, respect, and critical evaluation? and (3) To what extent does participation in Interland-based learning contribute to sustained behavioral awareness related to cyberbullying prevention? The research further investigates the game's potential to foster active engagement, critical thinking, and long-term behavioral change in navigating digital environments.

2 Literature Review

Digital ethics literacy has emerged as a critical component in preparing students to navigate increasingly complex online environments. As digital technologies permeate every aspect of daily life, young people are not only active consumers of online content but also active participants in shaping digital spaces. Digital ethics refers to the moral principles that guide online behavior, including respect for privacy, responsible information sharing, and respectful communication (Floridi & Taddeo, 2016). In educational contexts, fostering digital ethics literacy is considered essential in cultivating responsible digital citizenship and preventing harmful behaviors such as cyberbullying (Ribble, 2015).

Cyberbullying, defined as the intentional and repeated harm inflicted through digital devices and platforms, has become a growing concern in Indonesia. According to data from the Ministry of Communication and Information Technology (Kementerian Komunikasi dan Informatika [Kominfo], 2023), reports of cyberbullying incidents among Indonesian youth increased by 23% between 2021 and 2023, with a significant proportion occurring among high school students. In South Tangerang specifically, a local survey by the City Education Office in 2023 indicated that approximately 18% of high school students reported experiencing or witnessing online harassment, with social media platforms being the most common medium. Such statistics underscore the urgent need for preventive educational interventions that address both the technical and ethical dimensions of online engagement.

Game-based learning has gained increasing attention as a pedagogical approach for promoting engagement, critical thinking, and knowledge retention. It integrates educational content within interactive game formats, enabling students to learn through active participation and problem-solving (Gee, 2007). In the context of digital ethics, game-based learning offers a unique opportunity to simulate real-life online scenarios, allowing students to practice decision-making and ethical judgment in a safe, controlled environment (Whitton, 2014). Previous studies have demonstrated that serious games can enhance moral reasoning and promote prosocial behavior among adolescents (Khalili et al., 2021).

One notable example of a serious game designed to promote digital ethics is Interland, developed by Google as part of its "Be Internet Awesome" initiative. Interland comprises four interactive mini-games—Kind Kingdom, Reality River, Mindful Mountain, and Tower of Treasure—each targeting specific aspects of digital citizenship, such as online kindness, critical evaluation of information, digital

mindfulness, and password security (Google, 2022). Through challenges, scenarios, and decision-making tasks, the game reinforces key principles of responsible online behavior. Research by Evans and Hoyos (2020) found that integrating Interland into classroom activities significantly improved students' awareness of online safety and ethical considerations, particularly when coupled with teacher-led discussions and reflections.

In the Indonesian context, the adoption of Interland and similar digital ethics programs remains limited, often due to a lack of curriculum integration and teacher training (Pratama & Firmansyah, 2021). Nevertheless, given the rising rates of cyberbullying and the increasing digital engagement of adolescents, the game presents a promising avenue for developing ethical competencies in young learners. This study builds on existing literature by examining the application of Interland in a secondary school setting in South Tangerang, evaluating its effectiveness not only in enhancing knowledge of digital ethics but also in fostering behavioral change over a sustained period.

Although previous studies have demonstrated the potential of game-based learning and serious games in enhancing digital citizenship and ethical awareness, most existing research focuses on short-term cognitive outcomes or is conducted in Western educational contexts. Empirical evidence examining sustained attitudinal and behavioral change, particularly in Global South settings such as Indonesian secondary education, remains limited. Moreover, few studies explicitly investigate the use of Interland as a structured pedagogical intervention rather than as a standalone digital tool. This study addresses these gaps by examining both immediate and longitudinal impacts of Interland-based learning on students' digital ethics literacy and cyberbullying-related behaviors. This study is theoretically informed by constructivist learning theory and digital citizenship frameworks, which emphasize active learning, experiential engagement, and the internalization of ethical norms through social interaction and reflection.

3. Methodology

This study adopts a qualitative-dominant mixed-methods design, combining qualitative data from interviews and classroom observations with descriptive quantitative data from pre-test, post-test, and six-month follow-up quizzes in fostering digital ethics literacy and preventing cyberbullying among secondary school students in South Tangerang, Indonesia. The approach was chosen to gain in-depth insights into students' experiences, perceptions, and behavioral changes over time, which are not easily captured through purely quantitative measures (Creswell & Poth, 2018).

The research was conducted at Senior High School 4 in South Tangerang, selected due to its relatively high internet penetration rate and active use of digital devices among students. Participants are secondary school students who participated in all stages of the intervention, including pre-test, game-based learning sessions, post-test, and follow-up assessment six months later. Participants consisted of 32 students (ages 15–17) with balanced gender distribution from grade XI, purposively

sampled to include diverse academic backgrounds and digital usage patterns. In addition, semi-

structured interviews were conducted with 12 purposively selected students and 3 teachers directly involved in the implementation. The quiz instrument was developed to measure knowledge and attitudes related to digital ethics, including privacy, online safety, respect, and critical evaluation. The items were adapted from established digital citizenship indicators and reviewed by subject-matter experts to ensure content validity: 1. Pre- and Post-Intervention Quiz

A short, researcher-designed quiz assessed students' baseline understanding of digital ethics concepts (e.g., privacy, online respect, information verification, password security) prior to the intervention.

The same quiz was administered immediately after the Interland sessions and again during the 6-month follow-up evaluation to measure knowledge retention. 2.

Semi-Structured Interviews

Conducted individually with 12 students and 3 teachers to capture their perceptions of the Interland learning experience, observed behavioral changes, and the game's relevance to daily digital interactions.

Interviews lasted between 25–40 minutes and were audio-recorded with consent.

3. Classroom Observations

Non-participant observations were conducted during the Interland sessions, focusing on student engagement, collaboration, and problem-solving strategies. Field notes documented the learning atmosphere, interaction patterns, and any spontaneous discussions about digital ethics.

4. Six-Month Follow-Up Evaluation

Conducted through a combination of quiz re-administration, short reflection essays from students, and follow-up interviews with both students and teachers. This longitudinal component assessed whether the intervention's effects persisted over time in terms of knowledge retention and reported behavioral changes in online contexts.

Data Analysis

1. All qualitative data (interview transcripts, observation notes, reflection essays) were analyzed using thematic analysis (Braun & Clarke, 2006). The process involved: 2. Familiarization with the data through repeated readings.
3. Initial coding to identify patterns related to digital ethics understanding, behavioral change, and student engagement.
4. Collating codes into themes such as privacy awareness, online respect, critical information evaluation, and sustained behavior change.
5. Reviewing and refining themes to ensure coherence with the research objectives.

Ethical considerations were carefully observed throughout the study. Informed consent was obtained from all participants and relevant school authorities, anonymity was ensured using pseudonyms, and the study received ethical clearance from the institutional ethics review board. Quiz results were analyzed descriptively to compare

pre-test, post-test, and follow-up scores, providing supportive quantitative evidence within the qualitative framework. Ethical approval was obtained from the school
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administration and informed consent was secured from both students and their guardians. Participants were assured of confidentiality, and pseudonyms were used in all reports.

4 Results

The evaluation of the Interland-based digital ethics literacy program at Senior High School 4, South Tangerang, demonstrates substantial improvements in students' digital citizenship knowledge, attitudes, and self-reported online behavior over a six-month period. The findings are presented through a combination of quiz scores, attitudinal measures, self-reported behavioral indicators, and classroom observation data.

1. Knowledge Improvement

As shown in Figure 1, students' mean quiz scores rose from a pre-intervention average of 56.89 to 75.43 immediately after participating in the program, marking an increase of nearly 19 points. At the six-month follow-up, the average declined slightly to 71.20 but remained well above the baseline. This pattern suggests that while some knowledge attrition occurred, most of the content, particularly lessons on privacy, security, and respectful online interaction was retained. These results suggest sustained positive attitudes toward responsible online behavior, despite a moderate attenuation effect over time.



Fig 1. Average quiz scores before, after, and six months following the intervention

Attitudinal change was measured through four key constructs, Privacy, Respect, Critical Evaluation, and Security, each scored on a 1–5 Likert scale (Table 1; Figure

2). All constructs exhibited improvement immediately post-intervention, with the greatest

gains in Critical Evaluation (+0.96) and Security (+1.06). These domains align directly with the “Reality River” and “Tower of Treasure” segments of Interland, which focus on phishing awareness and password safety. Notably, the six-month follow-up indicated a small reduction across all categories, yet averages remained above pre intervention levels, indicating sustained positive attitudes.

Table 1. Mean Attitude Scores on Digital Ethics Constructs (1–5 scale)

Construct	Pre	Post	6-Month
Privacy	3.12	4.01	3.84
Critical Evaluation	2.94	3.90	3.71
Security	2.89	3.95	3.78
Respect	3.25	4.05	3.87

Although the six-month follow-up data indicated a moderate decline across all domains, the post-intervention averages remained significantly higher than baseline levels, implying partial knowledge retention and sustained positive attitudes toward digital ethics. This attenuation pattern aligns with findings from prior longitudinal studies on game-based learning, which show that while attitudinal decay is common over time, residual effects persist when learning is anchored in emotionally engaging and experiential contexts (Hamari et al., 2016; Plass et al., 2015).

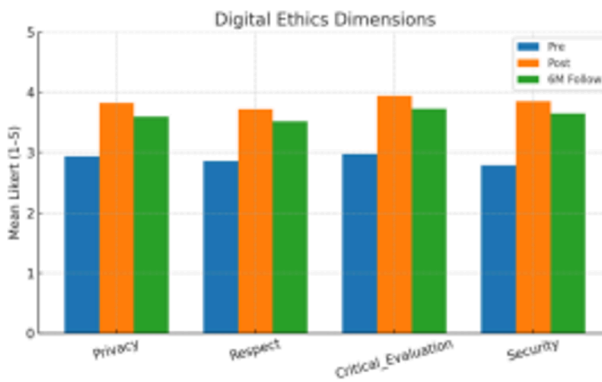


Fig 2. Changes in digital ethics attitudes across constructs

Self-reported cyberbullying incidents, whether as a victim or perpetrator, declined significantly following the program. Figure 3 shows that average incidents per 30-day recall period dropped from 2.38 pre-intervention to 1.12 immediately after, with only a slight rebound to 1.34 at the six-month point. This suggests that Interland's Kind Kingdom segment, which models empathy and constructive online behavior, had a tangible effect on students' digital conduct.

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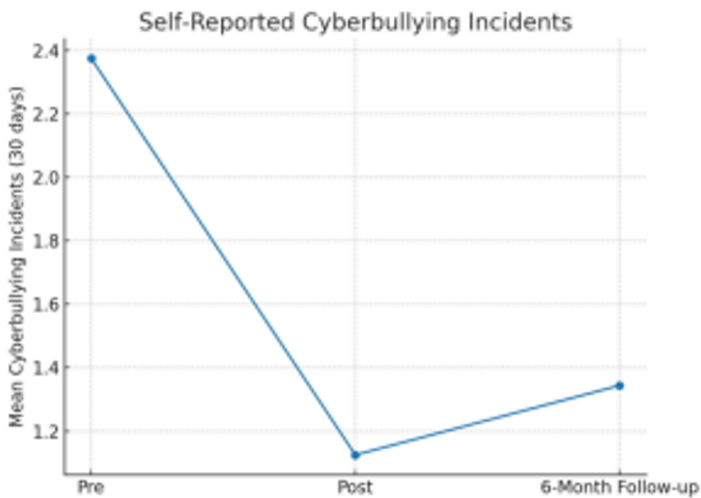


Fig 3. Average self-reported cyberbullying incidents over time

Classroom observation data (see Figure 4) demonstrated a consistently high level of student engagement throughout the intervention. On average, students devoted approximately 36.44 minutes per session to active interaction with Interland, maintaining focus and participation across all instructional stages. Moreover, an 86% completion rate across all four game levels indicates both persistence and motivation to achieve task objectives. Collaborative dynamics within the classroom were also notable, with peer collaboration averaging 4.0 on a 5-point scale, reflecting strong cooperative problem-solving and mutual support among students.

These findings corroborate prior research in game-based learning, which suggests that active and sustained engagement fosters deeper cognitive processing, leading to enhanced knowledge retention and attitudinal transformation (Plass et al., 2015). The observed behavioral indicators, such as extended time-on-task, persistence across levels, and high peer interaction, collectively illustrate how Interland's interactive mechanics promote a participatory learning environment that aligns with constructivist principles of experiential learning and social interaction.

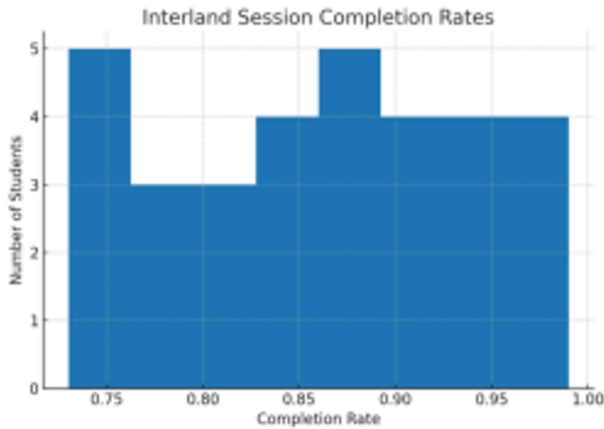


Fig 4. Engagement metrics: session duration, completion rate, and collaboration scores

To contextualize these results, Figure 5 illustrates the four thematic worlds that constitute Interland’s pedagogical framework, each designed to cultivate specific aspects of digital citizenship and online resilience. The Tower of Treasure focuses on principles of password security and account protection, reinforcing procedural knowledge through interactive decision-making. The Kind Kingdom emphasizes empathy, kindness, and prosocial digital behavior by modeling constructive social interactions in virtual communities. The Reality River trains learners to critically evaluate online information, particularly by identifying misinformation and deceptive content. Finally, the Mindful Mountain promotes reflective online engagement, encouraging users to consider the ethical implications of sharing digital content.

Collectively, these interactive environments integrate narrative storytelling, real time feedback mechanisms, and challenge-based progression, pedagogical features that have been empirically linked to deeper cognitive engagement and sustained behavioral transformation. As supported by contemporary game-based learning theories, such multimodal design elements do not merely transmit information but immerse learners in experiential problem-solving, thereby facilitating the internalization of digital ethics and responsible online conduct (Gee, 2003; Plass et al., 2015).



Fig 5. Screenshots of Interland’s game environments

Overall, the findings suggest that integrating game-based digital ethics education into secondary schooling can produce measurable improvements in students’ knowledge, attitudes, and behaviors. While knowledge decay over time is inevitable, the sustained gains in ethical awareness and reduction in harmful online behavior underscore the potential of serious games like Interland to serve as effective, scalable tools for digital citizenship education.

5 Conclusions

This study demonstrates that integrating the Interland game into high school digital literacy programs can effectively enhance students’ knowledge, attitudes, and behaviors related to online ethics and safety. Over the six-month evaluation period, participants exhibited notable gains in digital citizenship knowledge, heightened awareness of privacy and security practices, improved respectful online conduct, and a

measurable decline in self-reported cyberbullying incidents. The sustained post intervention improvements, even with slight declines at follow-up, suggest that game Based learning can generate lasting impacts when paired with structured classroom discussions and reflective activities. The interactive nature of Interland, combining engaging narratives, real-time feedback, and problem-solving challenges, appears to be a key factor in fostering both cognitive and behavioral change among adolescents. These findings carry implications for educational policy and practice. Schools, particularly in urban settings such as South Tangerang where cyberbullying and unsafe digital practices are growing concerns, should consider adopting serious games as

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complementary tools in digital literacy curricula. However, to maximize long-term retention, periodic reinforcement sessions or refresher modules are recommended. In conclusion, Interland not only promotes technical skills for navigating the online environment safely but also nurtures empathy, respect, and critical thinking, core competencies for responsible digital citizenship in the 21st century.

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