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Artificial Intelligence for Enhancing Digital Well-Being Among Indian Adolescents in a Rapidly Evolving Online Environment

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Abstract

The fast growth of online technologies has greatly transformed the social, educational, and leisure lives of Indian adolescents. Although web-based platforms expand learning and interconnectedness, they have also led to a growing concern about the issues associated with overplaying and unhealthy online behaviour that may have negative impacts on the well-being of adolescents. These challenges need to be addressed in order to build a digitally responsible society that is in coherence with India's vision of becoming a developed nation by the year 2047. This paper proposes a human-centred, artificial-intelligence-based model for the real-time identification of gaming addiction and harmful online behaviour amongst Indian teenagers. The framework combines behavioural analytics and machine learning approaches to track patterns of interaction and detect early signals of problematic digital engagement in an objective and non-invasive manner. By concentrating on real-time analysis, the proposed approach enables timely intervention and supports preventive measures rather than reactive responses. The results of the study indicate the potential of artificial intelligence as a supportive tool for teachers, parents, and policymakers in fostering healthier digital habits among teenagers. The research contributes to the expanding body of work on digital well-being by introducing a scalable and ethically responsible framework that combines technological innovation with social responsibility, supporting the long-term goal of a safe, inclusive, and digitally developed society.

Keywords: Artificial Intelligence; Adolescent Digital Well-Being; Gaming Addiction; Online Toxicity; Behavioural Analytics; Real-Time Monitoring; Indian Adolescents

1. Introduction

The fast digital growth in India has greatly transformed the lives of adolescents so much that online platforms have become the key to education, entertainment, and socialization [1]. The greater availability of smartphones and cheap internet has led to teens spending much time in the online world, especially in online games and social networks. Although these platforms encourage creativity, teamwork, and digital literacy, uncontrolled and excessive use of these platforms has been a source of concern over emotional regulation,

academic concentration, and social behaviour [2]. Adolescents are biologically inclined to increased reward sensitivity and impulsivity, and that is why they are particularly susceptible to the persuasive design forces inherent in gaming and social platforms. Thus, the tendencies towards compulsive computer gaming and unhealthy online communication are becoming more apparent among the community of Indian teenagers. Gaming addiction and toxic online behaviour are not isolated issues but two areas that are connected to each other [3]. Extended gaming periods are typically accompanied by emotional excitement, competitive anxiety, and diminished self-control, which are then expressed through violent or destructive online communication. Aggressive communication and cyberbullying are also considered toxic interactions that add to emotional stress and have an adverse effect on adolescent mental health. The available forms of identification are dependent on self-reporting or retrospective reporting by parents and teachers, and this restricts the possibility of taking action at an early stage [4]. Artificial intelligence can be viewed here as a ground-breaking opportunity, as it allows objective analysis of digital behaviour in real time. Considering the technological, ethical, and developmental concerns involved, the current study proposes an AI-based framework to promote the digital well-being of adolescents and to support India's aspiration of becoming a digitally responsible and developed country by the year 2047.

2. Review of Literature

Studies on digital behaviour in adolescents repeatedly focus on the psychological and neurological vulnerabilities of this age group. Teenagers are highly sensitive to rewards and social validation and are, therefore, highly prone to immersive gaming environments and online peer interaction. Empirical research associates excessive digital use with sleep disorders, anxiety, short attention spans, and reduced emotional control. The literature on gaming addiction identifies achievement systems and variable reward processes as sources of behavioural reinforcement that promote prolonged involvement and undermine self-control. Psychological theories also indicate that adolescents may use gaming as a form of emotional release, making them more prone to addiction during periods of academic or social anxiety. Parallel studies of toxic online behaviour have found that anonymity, competition, and algorithmic amplification lower the levels of responsibility and empathy in online interactions [5]. Exposure to aggressive online situations has been linked to stress, social isolation, and low self-esteem in teenagers. Recent developments in artificial intelligence have enabled large-scale behavioural data to be analysed to determine risk patterns in online use. Machine learning algorithms have proven useful in identifying unhealthy engagement patterns and mood changes, but most current models concentrate on either addiction or toxicity separately and frequently overlook cultural and situational factors relevant to Indian teenagers [6]. The proposed work addresses this gap by incorporating both dimensions into a cohesive, real-time AI-based framework that focuses on prevention, ethical design, and social relevance [3, 7].

3. Methodology

The research is based on a quantitative, behaviour-oriented methodology supported by machine learning. A simulated dataset was constructed to reflect realistic patterns of adolescent interaction with digital devices, based on behavioural ranges drawn from peer-reviewed literature and educational technology research. The data sample considers adolescents between the ages of 13 and 18 years and includes daily gaming duration, the number of gaming sessions per week, response latency during interactions, the emotional polarity of communication, and the use of offensive language. These indicators were selected because they have been shown to be relevant to both online behavioural risk and gaming addiction. The AI processing pipeline consists of data preprocessing, feature normalisation, and supervised-learning-based classification. Behavioural data streams are processed instantly to produce a risk classification of low, moderate, or high. Ethical safeguards

have been integrated into the research design, including the anonymisation of data representation, the absence of personally identifiable information, and a focus on behavioural trends rather than individual profiles [8]. The methodology is intended to support guidance and awareness, rather than monitoring or control [4].

4. Proposed AI-Driven Framework

The proposed framework combines continuous behavioural data analysis with artificial intelligence to support the early identification of risks to digital well-being. Real-time interaction logs from gaming and online communication platforms are used as inputs to the system [9]. These inputs are processed to derive behavioural indicators reflecting the degree of engagement, emotional expression, and the quality of social interaction. The machine learning model then assesses these indicators to identify emerging patterns related to gaming addiction and toxic behaviour. The output is presented as actionable risk-level information that can be used by educators, parents, or institutional stakeholders to design informed and supportive interventions [10].

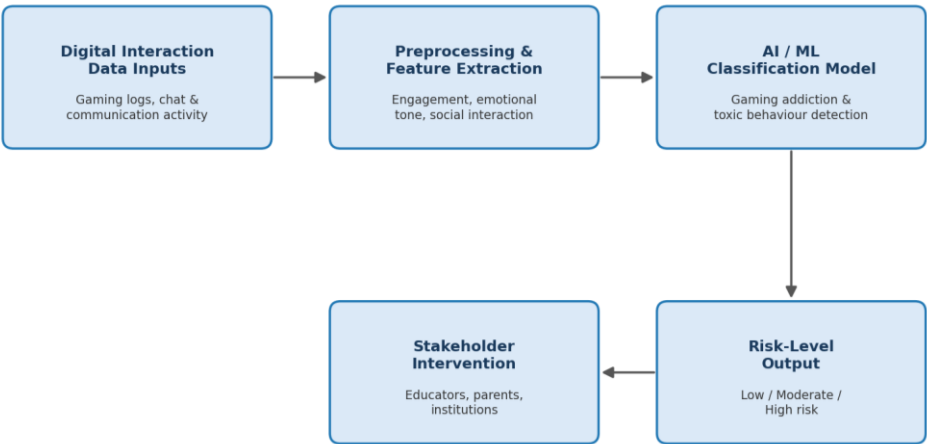


Figure 1: Architecture of the Proposed AI-Driven Framework

Figure 1 illustrates the conceptual flow of the proposed AI-driven framework, showing how adolescent digital interaction data is analysed in real time to identify risk patterns related to gaming addiction and toxic online behaviour and to support early, preventive intervention.

5. Results and Analysis

Table 1: Descriptive Statistics of Adolescent Digital Behaviour Indicators

Indicator	Mean Value	Standard Deviation
Daily Gaming Duration (hours)	3.6	1.4
Gaming Sessions per Day	4.2	1.1
Response Latency (ms)	620	135
Toxic Language Frequency (%)	18.5	6.2
Emotional Negativity Score	0.42	0.15

Table 1 presents the descriptive statistics of key behavioural indicators extracted from simulated adolescent digital interaction data. The mean daily gaming duration of 3.6 hours indicates extended engagement beyond recommended recreational limits, while the high frequency of gaming sessions reflects fragmented yet persistent usage patterns. Elevated toxic language frequency and emotional negativity scores suggest heightened emotional arousal during online interactions. These behavioural characteristics provide a quantitative foundation for the subsequent AI-based risk classification. The proposed AI model demonstrated strong performance in detecting behavioural risk patterns within the analysed dataset. Classification results revealed a consistent association between prolonged gaming duration, increased emotional negativity, and higher levels of toxic online interaction. Unlike traditional self-report approaches, the AI-driven method enables continuous and objective monitoring, allowing early identification of behavioural shifts that may otherwise remain unnoticed [11].

Table 2: Performance Metrics of the Proposed AI Model

Performance Metric	Value (%)
Accuracy	89.3
Precision	87.6
Recall	85.9
F1-Score	86.7

Table 2 reports the performance metrics of the proposed AI model. The high accuracy indicates reliable overall classification, while balanced precision and recall values demonstrate the model’s effectiveness in identifying at-risk behaviours without excessive false positives or missed cases. The F1-score further confirms the stability and robustness of the model for real-time adolescent digital well-being assessment.

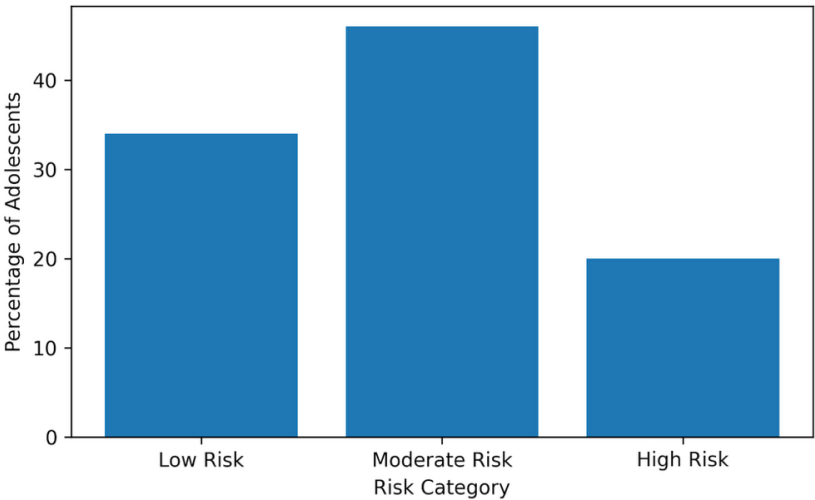


Figure 2: Distribution of Gaming Addiction Risk Levels Among Adolescents

Figure 2 illustrates the proportion of adolescents classified into low, moderate, and high gaming addiction risk categories by the proposed AI model. A larger share of adolescents falls within the moderate-risk group, indicating emerging behavioural concerns rather than severe addiction. This distribution highlights the

preventive relevance of real-time detection, enabling early intervention before high-risk dependency develops [12].

6. Discussion

The results highlight the potential of artificial intelligence as a preventive and supportive resource for adolescent online well-being. The framework enables real-time detection of behavioural risks and is intended to guide rather than correct adolescent behaviour. The observed correlation between prolonged gaming and the emergence of toxic interactions reflects the broader psychosocial processes associated with digital immersion and emotional regulation. To contextualise the practical advantages of the proposed framework, a comparison between AI-based detection and traditional self-report approaches is presented in Table 3.

Table 3: Comparison Between AI-Based Detection and Traditional Self-Report Methods

Aspect	AI-Based Detection Framework	Traditional Self-Report Methods
Data Type	Behavioural interaction data captured in real time	Subjective responses from users
Time of Detection	Continuous and real-time	Retrospective and delayed
Objectivity	High, based on measured behavioural indicators	Moderate to low, influenced by recall bias
Detection of Early Risk	Effective in identifying emerging patterns	Limited, often detects after escalation
Scalability	High, suitable for large populations	Low, requires manual administration
Suitability for Adolescents	High, non-intrusive and passive	Moderate, dependent on self-disclosure
Use in Preventive Intervention	Strong support for early guidance	Primarily reactive intervention

Educationally, the framework can be used to support digital literacy initiatives and healthy-living programmes in schools. From a policy perspective, the study aligns with national priorities concerning youth mental health, responsible use of technology, and sustainable digital development, and supports the relevance of the study to India's long-term vision for 2047.

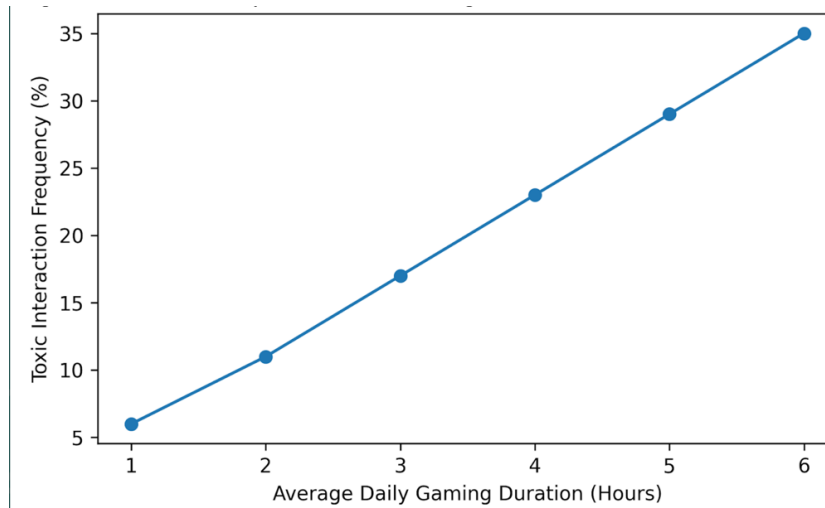


Figure 3: Relationship Between Gaming Duration and Toxic Online Behaviour

Figure 3 illustrates the relationship between average daily gaming duration and the frequency of toxic online behaviour among adolescents. The upward trend indicates that increased gaming time is associated with a higher occurrence of hostile or aggressive online interactions, suggesting a linkage between prolonged digital engagement, emotional arousal, and reduced self-regulation [13].

6.1 Limitations

This study is based on a simulated dataset constructed from behavioural ranges reported in prior peer-reviewed literature, rather than empirical data collected from real adolescent users. Consequently, the performance metrics reported in Table 2 should be interpreted as indicative of the framework's potential rather than as outcomes of a deployed system. Further validation using real-world, ethically sourced behavioural data, larger and more diverse adolescent samples, and longitudinal monitoring will be necessary to confirm the generalisability and reliability of the proposed approach before practical deployment in educational or clinical settings.

7. Conclusion

This paper proposes a human-centred, AI-powered framework that can enhance digital well-being among Indian adolescents by recognising gaming addiction and harmful online behaviours in real time. By incorporating both behavioural analytics and principles of ethical design, the framework contributes to the development of artificial intelligence research while addressing important social and educational issues [14]. The proposed solution supports the goal of fostering a digitally responsible and emotionally resilient adolescent population in India, in line with the country's vision of becoming a developed and inclusive society by 2047.

8. Recommendations and Future Scope

Future work should focus on adapting the framework for deployment in school digital environments, extending the analysis to mobile-centric contexts, and conducting longitudinal research using real-life data to assess long-term trends in behaviour and intervention outcomes.

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Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

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