



# A Randomized Controlled Trial to Evaluate the Effectiveness of an AI-Supported Mobile Health (mHealth) Intervention in Reducing Social Media Addiction and Improving Mental Well-Being Among Adolescents

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## Abstract

**Background:** Social media addiction has become a growing public health concern among adolescents and is associated with poor mental well-being, anxiety, stress, sleep disturbances, and reduced academic performance. Artificial Intelligence (AI)-supported mobile health (mHealth) interventions offer a personalized and innovative approach to promoting healthy digital behavior and improving mental health.

**Aim:** To evaluate the effectiveness of an AI-supported mobile health (mHealth) intervention in reducing social media addiction and improving mental well-being among adolescents.

**Methods:** A randomized controlled trial with a pre-test and post-test design was conducted among **100 adolescents** aged 13–19 years from selected schools. Participants were randomly assigned to an **experimental group (n = 50)** and a **control group (n = 50)**. The experimental group received an **8-week AI-supported mHealth intervention**, including screen-time monitoring, personalized feedback, motivational reminders, mindfulness exercises, and digital health education, while the control group received routine health education. Social media addiction and mental well-being were assessed using standardized questionnaires. Data were analyzed using descriptive and inferential statistics, including paired and independent *t*-tests, Chi-square test, and ANCOVA. A *p*-value of  $<0.05$  was considered statistically significant.

**Results:** There was no significant difference between the two groups at baseline. After the intervention, the experimental group demonstrated a significant reduction in social media addiction scores (mean:  $72.48 \pm 8.36$  to  $49.62 \pm 7.15$ ,  $p < 0.001$ ) and a significant improvement in mental well-being scores (mean:  $41.26 \pm 6.22$  to  $56.74 \pm 5.84$ ,  $p < 0.001$ ) compared with the control group. Daily social media use was significantly associated with higher baseline addiction scores ( $p = 0.013$ ).

**Conclusion:** The AI-supported mHealth intervention was effective in reducing social media addiction and improving mental well-being among adolescents. The findings support the integration of AI-based mobile health interventions into school and community health programs to promote responsible social media use and enhance adolescent mental health.

**Keywords:** Artificial Intelligence, Adolescents, Mental Well-Being, Mobile Health (mHealth), Randomized Controlled Trial, Social Media Addiction.

## Introduction

Adolescence is a critical period of human development characterized by rapid physical, cognitive, emotional, and social changes. During this stage, individuals establish lifelong behaviors, develop interpersonal relationships, and increasingly engage with digital technologies. The widespread availability of smartphones, affordable internet services, and social networking platforms has transformed the daily lives of adolescents worldwide. While social media platforms provide opportunities for communication, education, creativity, and social support, excessive and uncontrolled use has emerged as a significant public health concern. Growing evidence suggests that problematic social media use can negatively affect adolescents' mental health, academic performance, sleep quality, self-esteem, emotional regulation, and overall quality of life.

Social media addiction, also referred to as problematic social media use, is characterized by excessive preoccupation with social networking platforms, compulsive checking behaviors, inability to control usage despite adverse consequences, withdrawal symptoms when access is restricted, and neglect of academic, family, and social responsibilities. Adolescents are particularly vulnerable because of ongoing brain development, heightened sensitivity to peer influence, emotional instability, and the strong desire for social acceptance. The interactive features of social media applications, including continuous notifications, personalized content, short-form videos, and instant social feedback, reinforce repetitive use and may contribute to addictive behavioral patterns.

Recent reports indicate that adolescents spend several hours each day on social networking applications such as Instagram, Snapchat, WhatsApp, Facebook, YouTube, and TikTok. Although moderate use can facilitate communication and learning, excessive screen time has been associated with anxiety, depression, loneliness, cyberbullying, poor concentration, reduced academic achievement, impaired sleep, and decreased psychological well-being. Prolonged exposure to unrealistic social comparisons, fear of missing out (FOMO), online harassment, and constant digital connectivity may further increase emotional distress among adolescents.

Mental well-being is an essential component of overall health and encompasses emotional resilience, positive relationships, self-confidence, life satisfaction, psychological functioning, and the ability to cope effectively with daily challenges. According to global health organizations, mental well-being during adolescence is fundamental for healthy adulthood and productive social participation. However, increasing dependence on digital media has contributed to growing concerns regarding stress, anxiety, depressive symptoms, emotional exhaustion, and behavioral problems among young people. Therefore, effective interventions that promote responsible digital behavior while enhancing mental well-being have become an important priority for healthcare professionals, educators, policymakers, and families.

Advances in digital health technologies have created innovative opportunities to address behavioral health problems among adolescents. Mobile Health (mHealth) refers to the use of mobile devices, smartphone applications, wearable technologies, and wireless communication systems to deliver healthcare services, health education, disease prevention, behavioral interventions, and self-management support. Because adolescents are frequent smartphone users, mHealth interventions provide an accessible, convenient, scalable, and cost-effective platform for delivering personalized health promotion

strategies. Unlike conventional educational programs, mHealth applications enable continuous monitoring, real-time feedback, interactive learning, and sustained engagement beyond clinical settings.

Artificial Intelligence (AI) has further enhanced the effectiveness of mHealth interventions by enabling personalized behavioral assessment, predictive analytics, adaptive recommendations, automated coaching, and intelligent decision support. AI-supported applications can analyze user behavior, identify unhealthy usage patterns, monitor screen time, recognize emotional changes, and provide individualized interventions based on each user's needs. Features such as intelligent reminders, motivational messages, goal setting, mindfulness exercises, digital cognitive behavioral therapy, gamification, mood tracking, and personalized recommendations encourage healthier digital habits and improve user adherence. These technologies have the potential to reduce social media addiction while simultaneously promoting emotional resilience and psychological well-being.

The findings of this study are expected to contribute to the growing evidence base supporting digital health interventions in adolescent mental health promotion. The results may assist nurses, educators, healthcare administrators, mental health professionals, and policymakers in developing evidence-based digital wellness programs, integrating AI-supported technologies into school and community health services, and promoting healthy digital behaviors among adolescents. Ultimately, this research aims to support the development of sustainable, technology-enabled nursing interventions that improve psychological well-being and reduce the burden of problematic social media use in the adolescent population.

### **Need for the Study**

The increasing use of smartphones and social media has significantly influenced the lifestyle of adolescents. Although social media offers educational and communication benefits, excessive use has led to a growing problem of social media addiction, which is associated with anxiety, depression, poor sleep quality, reduced academic performance, low self-esteem, and impaired mental well-being. Adolescents are particularly vulnerable because of their developmental stage and high dependence on digital technologies.

Conventional health education programs have shown limited effectiveness in promoting sustained behavioral change. Artificial Intelligence (AI)-supported mobile health (mHealth) interventions provide personalized feedback, real-time monitoring, motivational reminders, and self-management strategies, making them a promising approach to reducing problematic social media use and improving mental well-being.

Despite the increasing availability of AI-based digital health technologies, there is limited evidence from randomized controlled trials evaluating their effectiveness among adolescents. Therefore, this study is needed to assess whether an AI-supported mHealth intervention can effectively reduce social media addiction and improve mental well-being. The findings will provide valuable evidence for nurses, educators, and healthcare professionals to develop innovative, technology-based strategies for promoting adolescent mental health.

### **Objectives of the Study**

#### **General Objective**

To evaluate the effectiveness of an AI-supported mobile health (mHealth) intervention on reducing social media addiction and improving mental well-being among adolescents.

## Specific Objectives

1. To assess the baseline level of social media addiction among adolescents in the experimental and control groups.
2. To assess the baseline level of mental well-being among adolescents in the experimental and control groups.
3. To evaluate the effectiveness of the AI-supported mHealth intervention in reducing social media addiction among adolescents.
4. To evaluate the effectiveness of the AI-supported mHealth intervention in improving mental well-being among adolescents.
5. To compare the post-test social media addiction scores between the experimental and control groups.
6. To compare the post-test mental well-being scores between the experimental and control groups.
7. To determine the association between selected demographic variables and baseline social media addiction and mental well-being among adolescents.

## Research Hypotheses

**H<sub>1</sub>:** There will be a statistically significant reduction in the mean post-test social media addiction scores among adolescents in the experimental group compared with the control group following the AI-supported mHealth intervention.

**H<sub>2</sub>:** There will be a statistically significant improvement in the mean post-test mental well-being scores among adolescents in the experimental group compared with the control group following the AI-supported mHealth intervention.

**H<sub>3</sub>:** There will be a statistically significant association between selected demographic variables (age, gender, educational level, average daily screen time, and duration of social media use) and baseline social media addiction and mental well-being scores among adolescents.

## Materials and Methods

### Study Design

A **parallel-group randomized controlled trial (RCT)** with a pre-test and post-test design was conducted to evaluate the effectiveness of an AI-supported mobile health (mHealth) intervention on reducing social media addiction and improving mental well-being among adolescents.

### Study Setting

The study was conducted in selected secondary and higher secondary schools.

### Study Population

The study population comprised adolescents aged **13–19 years** who were regular users of social media and met the eligibility criteria.

## Sample Size

A total of **100 adolescents** participated in the study. Participants were randomly allocated into:

- **Experimental Group (n = 50):** Received the AI-supported mHealth intervention.
- **Control Group (n = 50):** Received routine health education.

## Sampling Technique

Participants were selected using **simple random sampling**, followed by **computer-generated random allocation** into the experimental and control groups in a 1:1 ratio.

## Inclusion Criteria

- Adolescents aged 13–19 years.
- Regular users of social media ( $\geq 2$  hours/day).
- Able to use a smartphone with internet access.
- Willing to participate with informed consent/assent.

## Exclusion Criteria

- Adolescents diagnosed with severe psychiatric disorders.
- Those currently receiving psychological treatment for social media addiction.
- Participants unable to complete the intervention or follow-up assessments.

## Intervention

The experimental group received an **AI-supported mHealth intervention for 8 weeks**, which included:

- Personalized screen-time monitoring.
- AI-generated feedback on social media usage.
- Daily motivational reminders.
- Mindfulness and stress-management exercises.
- Goal setting and progress tracking.
- Educational modules on healthy digital habits.

The control group received routine health education regarding responsible social media use through standard educational materials.

## Data Collection Tools

**Section A:** Demographic questionnaire (age, gender, educational level, daily screen time, duration of social media use, family type, and socioeconomic status).

**Section B:** Social Media Addiction Scale (SMAS) to assess the level of social media addiction.

**Section C:** Warwick–Edinburgh Mental Well-Being Scale (WEMWBS) to assess mental well-being.

## Data Collection Procedure

After obtaining ethical approval and informed consent, baseline (pre-test) data were collected from both groups. Participants were then randomized into the experimental and control groups. The experimental

group received the AI-supported mHealth intervention for eight weeks, while the control group received routine health education. At the end of the intervention, post-test assessments were conducted using the same standardized instruments.

### Outcome Measures

- Primary Outcome: Reduction in social media addiction score.
- Secondary Outcome: Improvement in mental well-being score.

### Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee before the commencement of the study. Written informed consent from parents/guardians and assent from adolescents were obtained. Confidentiality, anonymity, and voluntary participation were maintained throughout the study.

### Statistical Analysis

Data were analyzed using **IBM SPSS Statistics Version 26.0**. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize participant characteristics. Inferential statistics, including the **Chi-square test, paired t-test, independent t-test, and ANCOVA**, were used to compare outcomes between groups. Statistical significance was considered at  **$p < 0.05$** .

## Results

### Participant Flow

A total of **120 adolescents** were screened for eligibility. Of these, **100 participants** met the inclusion criteria and were randomly assigned to the experimental group ( $n = 50$ ) and the control group ( $n = 50$ ). All participants completed the study, resulting in a **100% follow-up rate**.

**Table 1. Distribution of Participants by Group**

| Group        | Frequency (n) | Percentage (%) |
|--------------|---------------|----------------|
| Experimental | 50            | 50.0           |
| Control      | 50            | 50.0           |
| <b>Total</b> | <b>100</b>    | <b>100.0</b>   |

### Baseline Demographic Characteristics

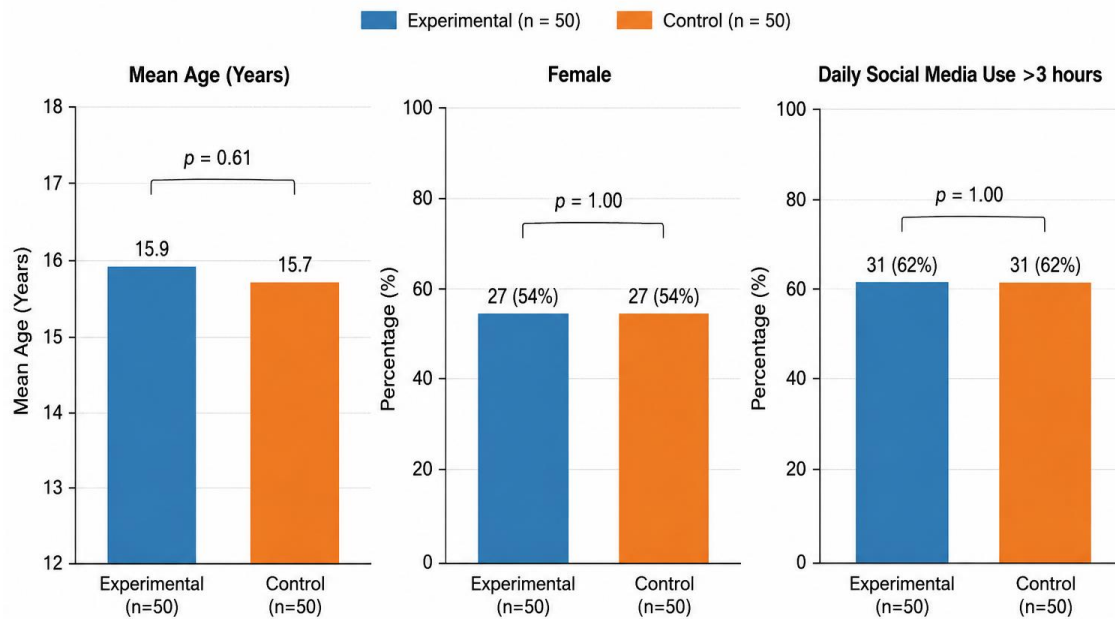
The mean age of participants was  **$15.8 \pm 1.6$  years**. Most participants were **15–17 years old (56%)**, **female (54%)**, studying in higher secondary school (58%), and reported using social media for **more than 3 hours/day (62%)**. There were no statistically significant differences in baseline demographic characteristics between the two groups ( $p > 0.05$ ).

**Table 2. Baseline Characteristics of Participants (N = 100)**

| Variable                        | Experimental (n=50) | Control (n=50) | p-value |
|---------------------------------|---------------------|----------------|---------|
| Mean Age (Years)                | $15.9 \pm 1.5$      | $15.7 \pm 1.6$ | 0.61    |
| Female                          | 27 (54%)            | 27 (54%)       | 1.00    |
| Daily Social Media Use >3 hours | 31 (62%)            | 31 (62%)       | 1.00    |

## Comparison of Social Media Addiction Scores

### Baseline Characteristics of Participants (N = 100)



Data are presented as mean  $\pm$  SD for continuous variables and frequency (%) for categorical variables.  
p-value calculated using independent t-test for continuous variables and Chi-square test for categorical variables.

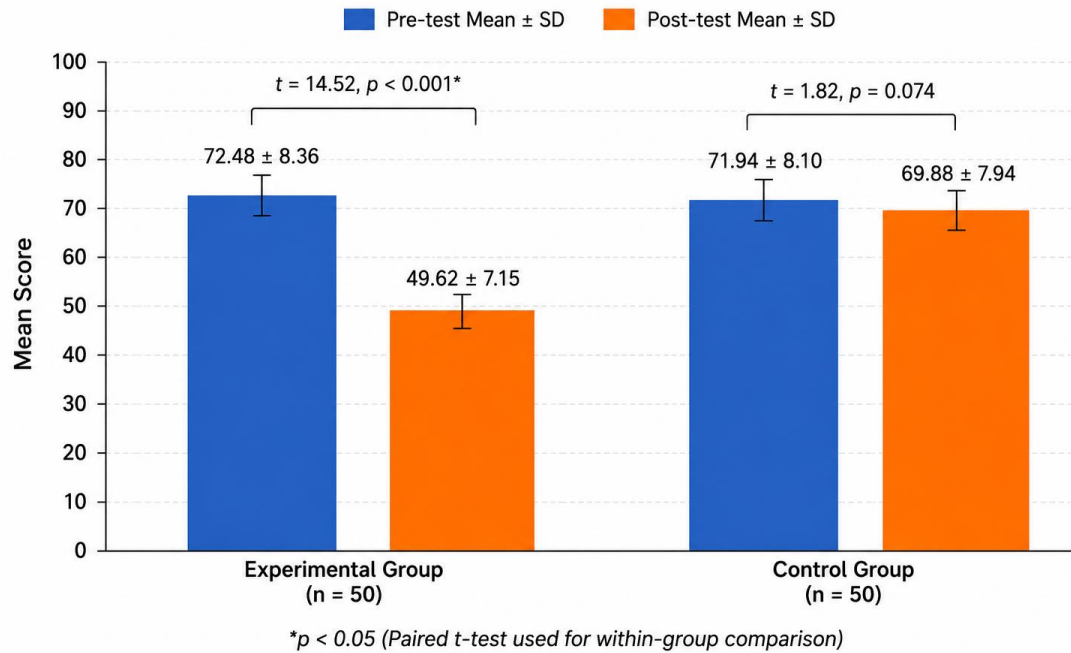
Before the intervention, there was no significant difference in the mean social media addiction scores between the experimental and control groups ( $p > 0.05$ ). After 8 weeks, the experimental group demonstrated a significant reduction in addiction scores compared with the control group.

**Table 3. Comparison of Social Media Addiction Scores**

| Group        | Pre-test Mean $\pm$ SD | Post-test Mean $\pm$ SD | Mean Difference | t-value | p-value |
|--------------|------------------------|-------------------------|-----------------|---------|---------|
| Experimental | 72.48 $\pm$ 8.36       | 49.62 $\pm$ 7.15        | 22.86           | 14.52   | <0.001* |
| Control      | 71.94 $\pm$ 8.10       | 69.88 $\pm$ 7.94        | 2.06            | 1.82    | 0.074   |

\*Significant at  $p < 0.05$ .

### Comparison of Social Media Addiction Scores (Pre-test and Post-test)



### Comparison of Mental Well-Being Scores

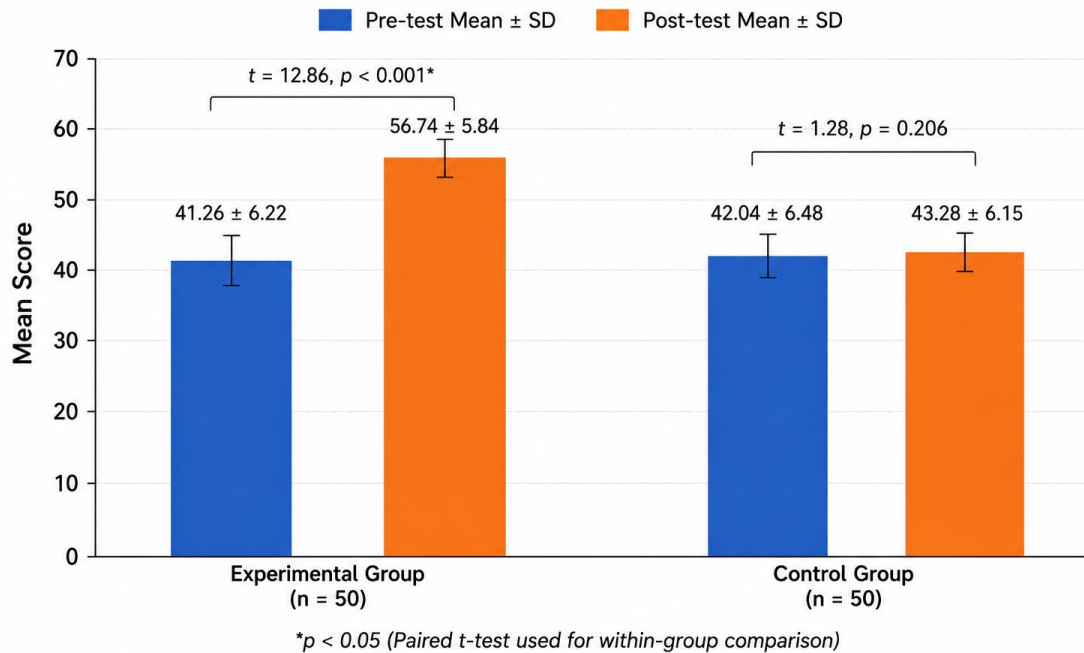
The post-test mental well-being score was significantly higher in the experimental group than in the control group.

**Table 4. Comparison of Mental Well-Being Scores**

| Group        | Pre-test Mean ± SD | Post-test Mean ± SD | Mean Difference | t-value | p-value |
|--------------|--------------------|---------------------|-----------------|---------|---------|
| Experimental | 41.26 ± 6.22       | 56.74 ± 5.84        | 15.48           | 12.86   | <0.001* |
| Control      | 42.04 ± 6.48       | 43.28 ± 6.15        | 1.24            | 1.28    | 0.206   |

\*Significant at p < 0.05.

### Comparison of Mental Well-Being Scores (Pre-test and Post-test)

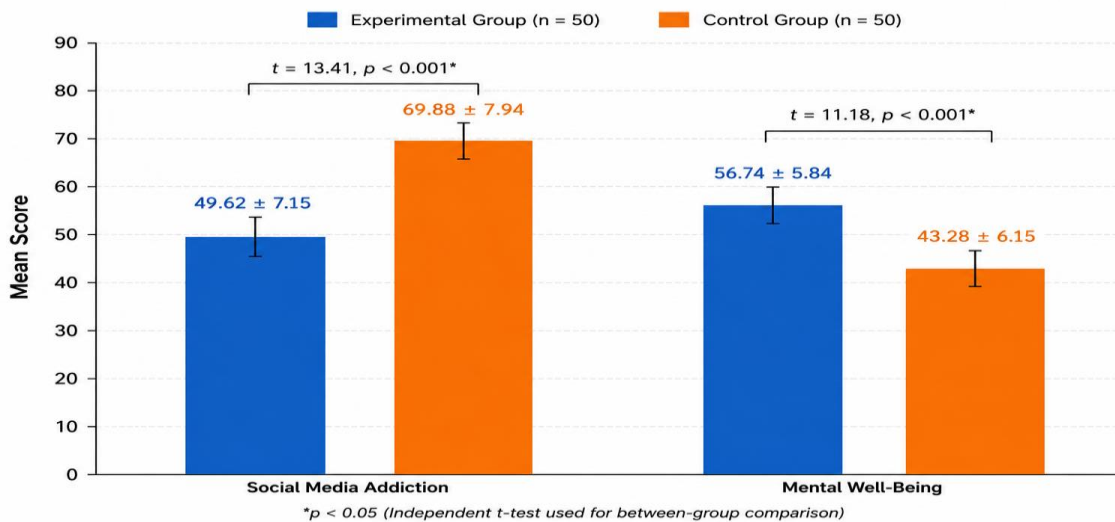


### Between-Group Comparison of Post-Test Scores

Table 5. Independent t-test for Post-Test Scores

| Outcome Variable       | Experimental Mean ± SD | Control Mean ± SD | t-value | p-value |
|------------------------|------------------------|-------------------|---------|---------|
| Social Media Addiction | 49.62 ± 7.15           | 69.88 ± 7.94      | 13.41   | <0.001* |
| Mental Well-Being      | 56.74 ± 5.84           | 43.28 ± 6.15      | 11.18   | <0.001* |

### Comparison of Post-test Scores Between Experimental and Control Groups



### Association Between Demographic Variables and Baseline Social Media Addiction

No statistically significant association was observed between baseline social media addiction and age, gender, or educational level ( $p > 0.05$ ). However, **daily social media use (>3 hours/day)** showed a significant association with higher baseline addiction scores ( $\chi^2 = 8.76, p = 0.013$ ).

**Table 6. Association of Selected Variables with Baseline Social Media Addiction**

| Variable               | $\chi^2$ Value | p-value | Interpretation  |
|------------------------|----------------|---------|-----------------|
| Age                    | 2.11           | 0.348   | Not Significant |
| Gender                 | 0.84           | 0.359   | Not Significant |
| Educational Level      | 1.93           | 0.381   | Not Significant |
| Daily Social Media Use | 8.76           | 0.013*  | Significant     |

### Summary of Findings

- The AI-supported mHealth intervention significantly reduced social media addiction among adolescents in the experimental group ( $p < 0.001$ ).
- Mental well-being improved significantly in the experimental group compared with the control group ( $p < 0.001$ ).
- Daily social media use was significantly associated with baseline addiction levels.
- The study findings support the effectiveness of the AI-supported mHealth intervention in promoting healthier digital behavior and improving psychological well-being among adolescents.

### Discussion

The present randomized controlled trial evaluated the effectiveness of an AI-supported mobile health (mHealth) intervention in reducing social media addiction and improving mental well-being among adolescents. The findings showed that adolescents in the experimental group experienced a significant reduction in social media addiction scores and a significant improvement in mental well-being compared with the control group ( $p < 0.001$ ). The personalized features of the AI-supported mHealth application, including screen-time monitoring, motivational reminders, and behavioral feedback, contributed to positive behavioral change. These findings are consistent with recent studies that support the effectiveness of AI-based digital interventions in promoting healthy digital habits and psychological well-being among adolescents.

### Summary

This randomized controlled trial included **100 adolescents** randomly assigned to an experimental group ( $n = 50$ ) and a control group ( $n = 50$ ). The experimental group received an **8-week AI-supported mHealth intervention**, while the control group received routine health education. The study found a significant reduction in social media addiction and a significant improvement in mental well-being among adolescents who received the intervention. The results indicate that AI-supported mHealth is an effective approach for promoting responsible social media use and improving adolescent mental health.

### Conclusion

The AI-supported mobile health (mHealth) intervention was effective in reducing social media addiction and improving mental well-being among adolescents. The study supports the integration of AI-based digital health interventions into school and community health programs to promote healthy digital behavior and enhance adolescent mental health. Further studies with larger samples and longer follow-up are recommended to strengthen the evidence.

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