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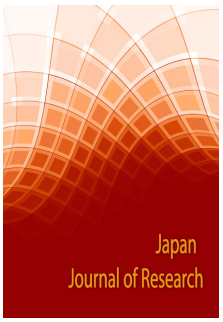

Investigation the Intervention Mitigating Problematic Social Media Engagement Among High School Students

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Abstract

Adolescents of 21st century mature in an advancing digital era, where their vulnerabilities are often exposed to a world driven by powerful algorithms. The present study proposes an innovative design scheme that potentially tackles problematic engagement with social media, from both motivational and neurobiological perspectives, with the aim of unveiling the underlying mechanisms regarding social media addiction. This design solution promotes transparency of individuals' personal usage behaviours through a simple prompt, "why are you here?", thereby activating individual's deliberate decision-making system. In study I, we conducted a two-phase survey involving 92 high school teenagers and collected empirical data on the correlations between goal-oriented social media use and mental health variables. In addition, a practical design intervention was developed and assessed with 36 participants over ten days to validate its effectiveness. The consequences indicated notable reductions in actual social media engagement time, as well as a decrease in distractedness. This research offers a novel motivation-driven digital behaviour and contributes to the existing empirical database on social media addiction by providing both theoretical insights and practical applications.

Introduction

Social media has been embedded into adolescents' daily lives, serving as a significant source of connection, entertainment, and information, whereas induces them into a world manipulated by science and technology. Tech companies continuously exploit individuals' limited attention and consciousness in favour of profit generation [1]. Their primary purpose is to strategically provide the personalized triggers and contents to users at the right moment, thereby affecting users' perceptions and behaviours imperceptibly. It has been debated since 2012 with respect to the associations between social media use and adolescents' mood disorders. A vast amount of research [2-4] have revealed a J-shape correlation aligning with the goldilocks hypothesis, suggesting that moderate usage of social media (< 2 hrs) was not extremely adverse and perhaps even contributed to ease unpleasant feelings, while only heavy users reported a poor-rating mental health status. However, a few considerable studies contended on the size and significance concerning these negative relations between social media use and mental health problems. In addition, Orben and Przybylski [5] also argued that how researchers identified "digital-screen use" and "mental health outcome" largely influenced consequences. As shown in figure 1 and 2, these line graphs were generated via an accessible online program [6] enabling researchers to adjust variables for capturing varied results. It is noteworthy that impacts of hours spent on social media on the "hard to concentrate" are more significant than "unsatisfied schoolwork" for girls group out to 4 hours per day. Furthermore, other earlier studies raised that person-specific effects [7] and social media usage pattern (active vs. passive) [8] were all remarkable factors affecting the associations between social media use and mental well-being issues. Based on the secondary research cited above, time spent using social media is no longer an overarching determinant causing low psychological well-beings. We assumed that the effectiveness of those interventions featuring screen-time restrictions or time reminders are limited in preventing social media addiction.

Hence, this research seeks to draw special attention to the motivations and usage patterns of excessive social media users among teenagers instead of merely controlling their digital screen time. We endeavour to examine the underlying mechanisms of social media addictions from motivational perspective and neurobiological perspectives comprehensively. Additionally, this study aims to propose feasible approaches enabling juvenile participants' capabilities of self-regulation to manage their

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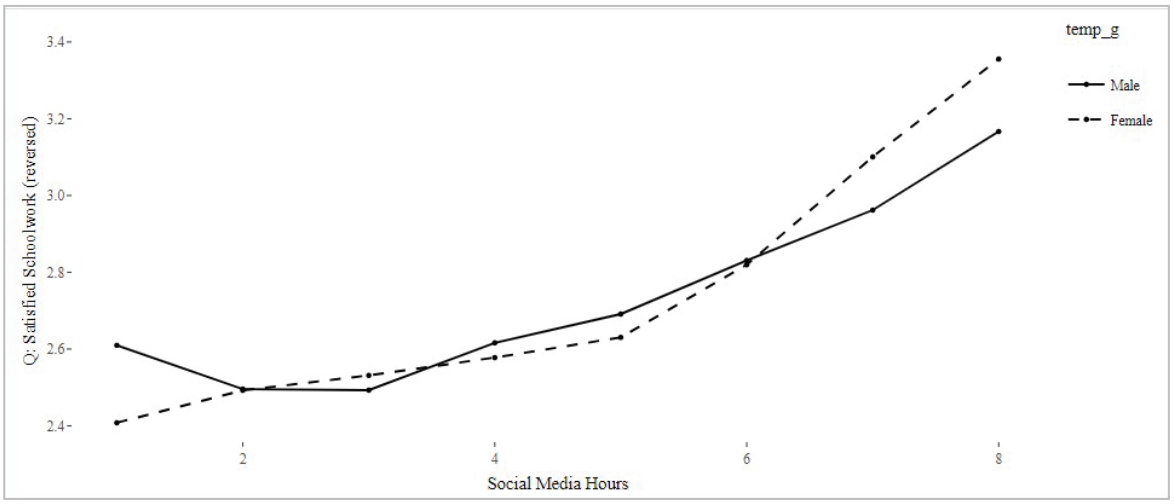

Figure 1. *Correlations between "social media hours" and "unsatisfied schoolwork".*

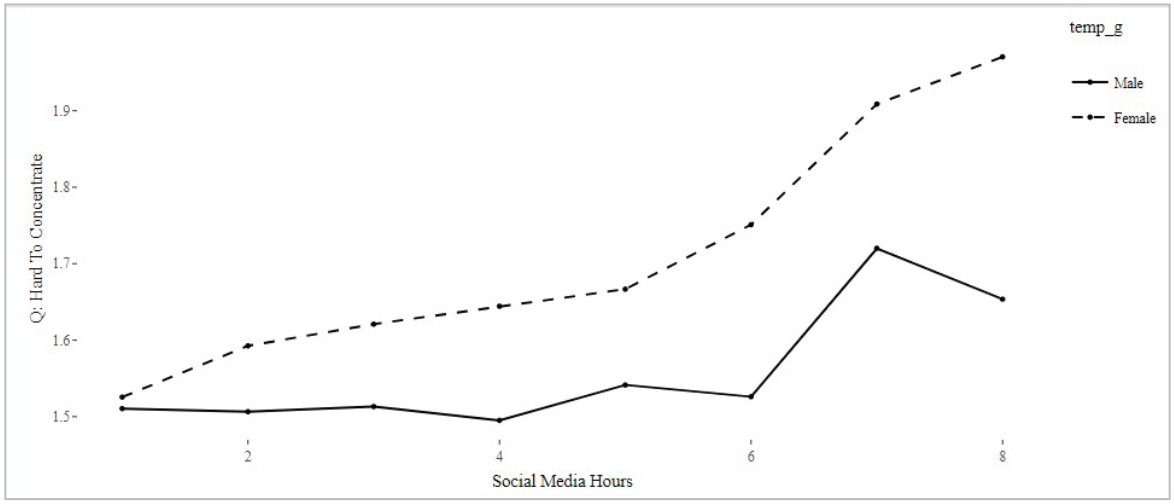

Figure 2. *Correlations between "social media hours" and "hard to concentrate".*

digital behaviours and pilot them make decisions in a conscious manner rather than being triggered mindlessly. Furthermore, a practical design scheme was delivered, as well as a following 10-day empirical test was undertaken in order to evaluate the effectiveness of this intervention program in mitigating problematic social media engagement.

Underlying mechanisms of social media addiction

Social media engagement can be initiated by internal (urge, memory, feeling etc.) and external (notifications, new messages, phone beeping etc.) stimulus. Although external-trigger behaviour seems like passive participation, we regard both internal and external incentives as antecedents of social media using intentions in this article.

Neurobiological perspective

Relevant studies have highlighted the value of dual-system theories (DST) in examining problematic behaviours of behaviour [9,10]. These theories articulate the existence of two conflict processing systems within individuals' minds [11]. System 1 operates automatically and impulsively, resulting in unconscious activities, whereas system 2 is reflective and regulated leading to conscious and rational behaviours with the capability of inhibition. Notably, system 1 is always effortless and rapid in reaction compared to system 2, which causes impulsive and addictive behaviours [11,12]. However, Hassan et al. [13] stated that a higher level of self-regulation could potentially suppress impulsions, although maintaining self-control can be challenging without sufficient cognitive resources. Scholars always believed that the excessiveness in the context of social media revealed specific similar characteristics to other activity addictive behaviours such as smoking and drug addictions [14,15] Nonetheless, the inhibitory system of excessive social media use can process as usual compared to other activity addictions [16], which means individuals retain the potential to control impulsive actions. Hence, it is presumed that the cause of problematic social media engage may stem from the deficit of specific motivations to limit.

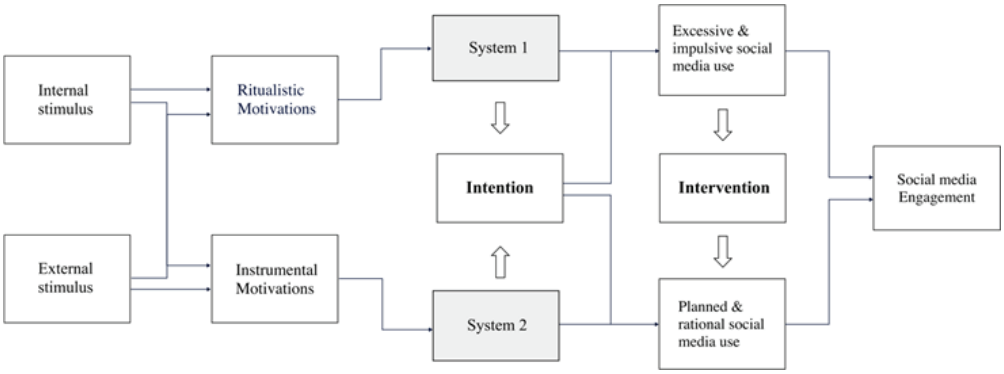

Figure 3. *Underlying mechanisms regarding problem social media engagement.*

Motivational perspective

In recent studies, U&G theory is considered one of the most influential approaches in explaining motivations evoking media usage [17]. This theory assumes that individuals actively engage with technologies triggered by their intrinsic needs and desires [18]. Motivations of media usage can be divided into two categories, instrumental and ritualistic, according to the research by Rosenbaum & Rubin [19] and McQuail & Windahl [20]. Instrumental use refers to a more goal- oriented usage manner, consistently links to the "informational needs and motives". By contrast, ritualistic use always happens in a habitual and less-active manner, associated with certain abstract gratifications (curiosity, novelty, adventure etc.). Likewise, Livaditi and colleagues [21] highlighted that instrumental users tend to involve in a purposeful process, while habitual uses tend to satisfy needs correlated with entertainment, companionship, and escape, which is perceived as a less active and less conscious usage modality. In other words, the ritualistic use driven by abstract needs more frequently trigger non-conscious behavior which contributes problematic engagement than instrumental. As figure 3 demonstrated, we considered that intentions driven by ritualistic purposes are more likely dominated by system 1, resulting in impulsive and excessive actions. In contrast, the purposeful usage manners are potentially controlled by system 2 with the capability of inhabitation, leading to a planned and conscious engagement behavior.

Methodology

Study I

The objectives of study 1 are twofold. In the first place, we intended to investigate the differences in motivation of teens to use social media applications in different periods, as well as the correlations of mental variables with goal-directed social media browse behaviour through a customized one-week experience sampling research. Additionally, target subjects for the subsequent study 2 would be recruited.

Participant

Participants were recruited from a high school which is in the Tianjin Province of China. A total of 92 (57 girls, 35 boys; Meanage = 16.51; SDage = 0.47) adolescents aged from 16 to 17 years were invited in this study. Consent agreements were collected from all participants and their parents. All of subjects are Chinese who live in Tianjin province of China. All of participants were allowed to use mobile phones at school (during recess between classes and lunch time) or at home.

Procedure

Study 1 involved two phases. In the first phase, participants were introduced to the study objectives and procedures, and the consent agreement form was signed via an online Zoom meeting, with the approval of their teacher. Following this, all participants were asked to complete a questionnaire that aimed to obtain their general information and social media usage patterns (i.e., which social media they used most frequently; how many hours they engaged in social media platforms per day; what period each participant engaged in social media most frequently; and whether they considered their engaging behaviours were problematic and hoped to adjust it.). Regarding the next phase, the participants were invited to participate in an experience sampling study spanned over 5 weekdays. In this study, each subject was instructed to follow the official account in WeChat (the most popular Chinese messaging application). Participants would receive notifications including a survey link via WeChat official account five times per day for capturing and assessing their motivations and mental well-being status, figure 5 elaborates the specific durations and research questions. In terms of the questions concerning mental health evaluation, respondents were required to determine to what extent they agree with each description on a scale of 1 to 10, with (1) representing "totally disagree" and (5) representing "totally agree".

Results and discussions

According to the initial survey conducted for study-I, the two most commonly used social media platforms are WeChat (99.8%) and QQ (73.6%). Following closely behind are Bilibili, the leading video community in China, and Weibo, the largest micro-blogging platform in China. Out of all the participants, approximately 23% of participants spent over 3 hours per day on social platforms, qualifying them as potential candidates for Study-II. Additionally, a total of 2,190 responses were collected from the experience sampling survey, out of which 2,176 were deemed valid. The data revealed that juvenile participants tend to engage social media purposefully at lunch time (51.42%) and after dinner (45.71%). Their engagement was often driven by specific purposes, such as completing assignments, connecting with friends, watching videos, and posting photos and stories etc. Furthermore, the experience sampling studies demonstrated considerable relationships (Table 1) between various psychological variables and goal-directed social media usage. For instance, "social anxiety", "depression" and "guilty" witnessed no significant associations with goal-directed browsing behaviour during daytime use (morning, lunch time, afternoon recess). Comparatively, mindless social

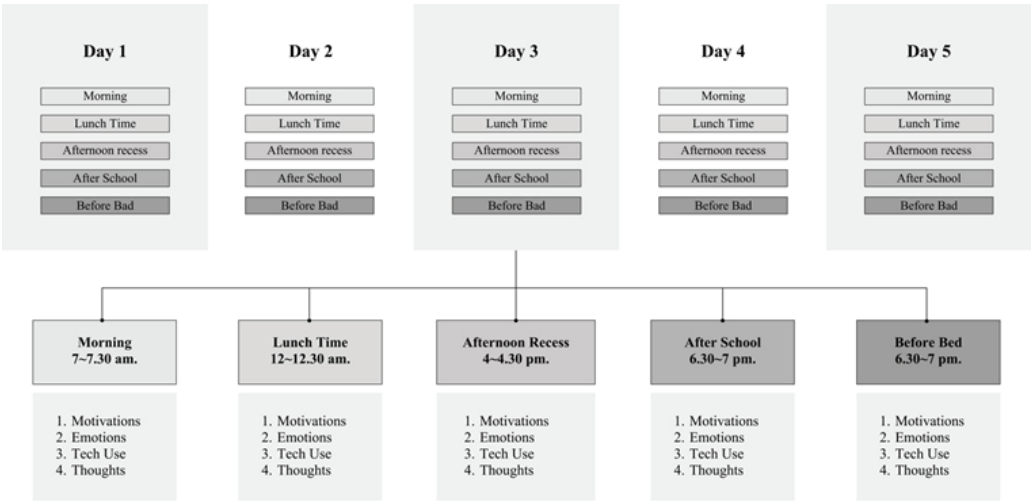

Figure 4. *The detailed procedure of experience sampling study.*

Table 1. *Scores and correlations of each variable with goal-directed behaviour.*

Variables	Mean Scores	Correlations with goal-directed behaviour				
		Morning	Lunch Time	Afternoon Recess	After Dinner	Before Bed
Goal-directed behaviour	0.37	/	/	/	/	/
Social anxiety	0.54	0.187	0.23	-0.446	-0.853	-0.693
Depression	0.51	-0.208	0.318	0.485	-0.835	-0.856
Sense of Guilt	1.41	-0.354	-0.159	0.294	-0.81	-0.776
Knowledge seeking	1.21	0.739	0.845	0.669	0.829	0.857
Meaningfulness	2.26	0.899	0.942	0.871	0.941	0.892
Emotions	8.51	0.768	0.539	0.754	0.822	0.849

media engagement without specific goals was found to increase levels of "social anxiety" and "the feeling of guilty" during nighttime use. Purposeful usage pattern indicates positive correlations with "knowledge seeking", "meaningfulness" and their emotions at that moment both for daytime use and nighttime use. This suggests that social media platforms may serve as a distractor from the academic stressors during daytime use. Since the duration of engagement is heavily affected by the school's schedule, the single usage time was shrunk, resulting in less harmful impacts on users. Moreover, due to the large overlap between online and offline social networks, teens tend to socialize more offline than online during the daytime.

Study-II

In the light of the comprehensive literature review, secondary research, and consequences obtained from study 1, we delivered a practical intervention program to prevent excessive and impulsive social media engagement and further pilot users to make rational decisions in an effortless manner. The essential design purpose is to alleviate the negative impacts brought by system 1, which induce unplanned and impulsive engagement. Without intervention, it is troubled for participants to self-regulate social media usage behaviors mindfully, as it is hard to activate the "lazy" system 2 only relied on our limited cognitive resources. We seek to, therefore, create a supportive tool featuring a "motivation-driven" intervention that allows users to respond to tempting triggers consciously and rationally. We listed six specific design objectives below:

- Enhancing individuals' awareness about their social media usage behaviours.
- Emphasizing and strengthening users' active participant role in social media.
- Creating opportunities to promote a deliberate sequential behaviour, rather than being manipulated by non-conscious impulsions.
- Altering the implicit attitudes about the impulsive social media engagement.
- Guiding users to apply "fast thinking mode" in social media participation drawing on the framework of thinking proposed by Daniel Kahneman in 2011 [22] to make rational choices effortlessly.

Figure 5 articulates that this tool would provide interventions at three different points throughout the social media engagement: before, during and after use. We classify individuals' intentions regarding social media usage into 3 categories: "achieving a specific goal", "taking a break", and "browsing randomly". In this study, we label "achieving a specific goal" as a positive incentive, since it has potentials to stimulate active using patterns

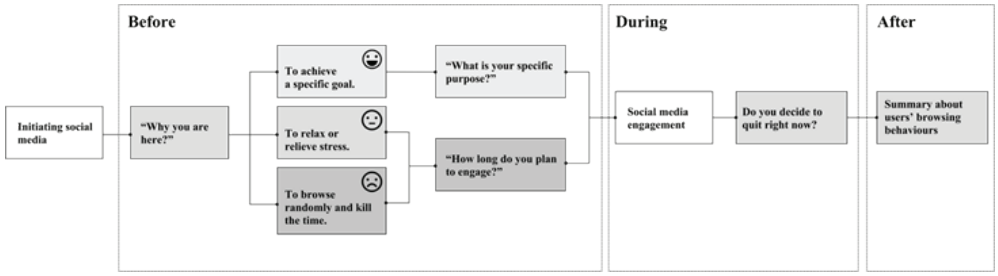

Figure 5. *Interventions are provided at three different points: before, during and after social media use.*

and planned engagement. Hence there is no time restrictions for such user who identify a specific goal before engagement. In terms of the second category, "taking a break", it is regarded as moderate risk of addiction, since they utilize social media as a distractor to lessen adverse emotions (depression, anxiety, and exhaustion etc.) and pressures. Yet there were considerable risks involve due to their passive and mindless using modality. Finally, "browsing randomly" was defined as negative in this research, as such individuals would dive into social media in an unconscious way. Only the latter two options would activate the timer feature that aims to diminish risks of addiction.

Validation

A 10-day user test was conducted to appraise the efficacy of this intervention by comparing the social media engagements and behaviour change of subjects in phase 1 (control) and phase 2 (experimental). A total of 36 participants (20 girls, 16 boys; Meanage = 16.28, SDage= 0.45) were invited from the respondents in study 1 who reported their time-spent using social media were over 3 hours per day and those who demonstrated a strong desire to modify their social media engaging behaviours. In the initial 5-day session, participants did not receive any interventions or instructions prior to social media engagement, they were merely required to complete a survey with 12 questions sent by our WeChat official account after each engagement. Subjects reflected on each engagement of social media at least three times a day randomly, including which social media they engaged, what were their original motivations, how long they spent in each use, what percentage they were distracted, their thoughts and emotions concerning mental well-being evaluations. The second session (experimental) took place in the following 5 days, during which participants were provided the "motivation-driven" intervention program (Figure 6) before each engagement, assisting subjects in identifying their specific intentions. After each participation, subjects would be instructed to complete another survey consisting of 11 questions..

Results

Result 1 – Exceeded Time Percentage

Participants reduced their daily social media engagement by 21.28% of total use under stage 2 (with intervention) relative to stage 1 (without intervention). A repeated-measures one-side T-test demonstrated that this was a significant reduction in total use ($t = 1.79 > 1.653$, $df = 422$, $\alpha = 0.05$). Specifically, the exceed time percentage (ETP) overall decreased by 20.63% in the second stage (with intervention) as figure 9 demonstrated. A repeated-measures one-side T-test demonstrated that this was a significant reduction in total use ($t = 1.99 > 1.653$, $df = 422$, $\alpha = 0.05$).

Result 2 – Distractive Percentage

The distracted percentage was another critical criterion, which witnessed a considerable 9.36% decrease in total use on average weekdays. Although the data of distracted percentage relied on the self-report from participants, we verified this data's reliability by comparing the following values shown in figure 10, the Average Distracted Percentage (ADP) and Average Overshot Percentage (AOP). The mean value of ADP and AOP was close, which could be assumed that the exceed time was roughly equivalent to the duration when participants were distracted by irrelevant contents with their original goal-settings.

Result 3 – Goal-directed engaging behaviour

A remarkable growth on the percentage of Goal-directed social media use, from 68.7% (SD = 0.038) to 77.2% (SD = 0.065). This increase was verified to be extremely significant ($t = 16.265$, $df = 422$, $\alpha = 0.005$) by a repeated-measures one-side T-test. It largely implies that this intervention enabled users' capabilities regarding self-reflection and self-regulation to manage their browsing behaviours and effectively develop a deliberate digital usage habit at least in a short term.

Discussion

The overall consequences have generally confirmed the potential effectiveness of this "motivation- driven" intervention program in mitigating excessive social media use and orienting participants towards purposeful browsing, at least in the short term. The significant decrease in overall amount of time spent using social media, as well as the reductions in excess time and distractions, indicate that participants are actively managing their digital behaviour as a result of this intervention. Moreover, the increase in the percentage of goal-directed browsing pattern signifies that users are consciously engaging social platforms for targeted purposes, leading to the development of a mindful digital usage habit. In study I, we observed a significant association between goal-directed social media use and mental health outcome during night-time use in Study-I. However, the results of Study-II showed either a minor change or no change pertaining to mental variables. It is probably attributable to the absence of time point control in Study II, since the majority of responses were collected during daytime. Furthermore, several subjects reported experiencing feelings of guilt and depression several hours after excessive social media use, rather than immediately. This emphasizes the necessary of gathering daily summary surveys from all subjects at the end of each day. Additionally, the volume of completed questionnaires revealed a continuous downward trend, indicating an incremental exhaustion of participants towards recurrent interventions over time.

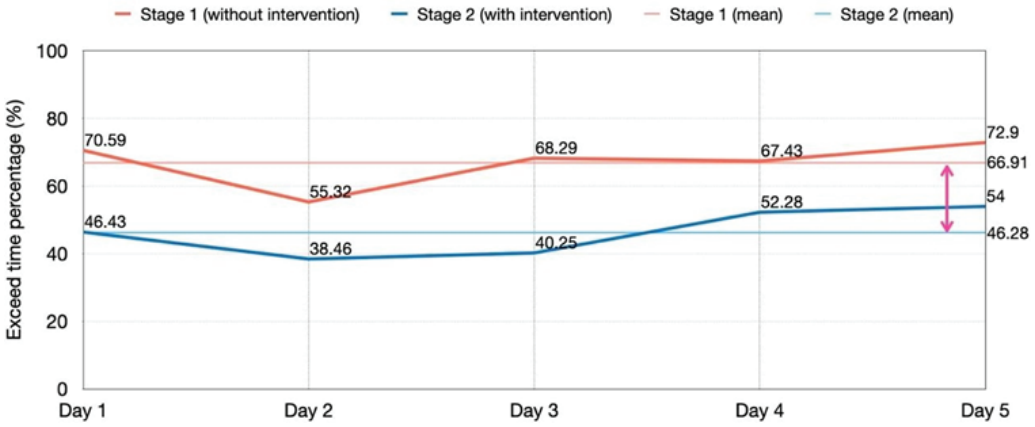

Figure 6. *Exceeding time percentage in stage 1 and stage 2.*

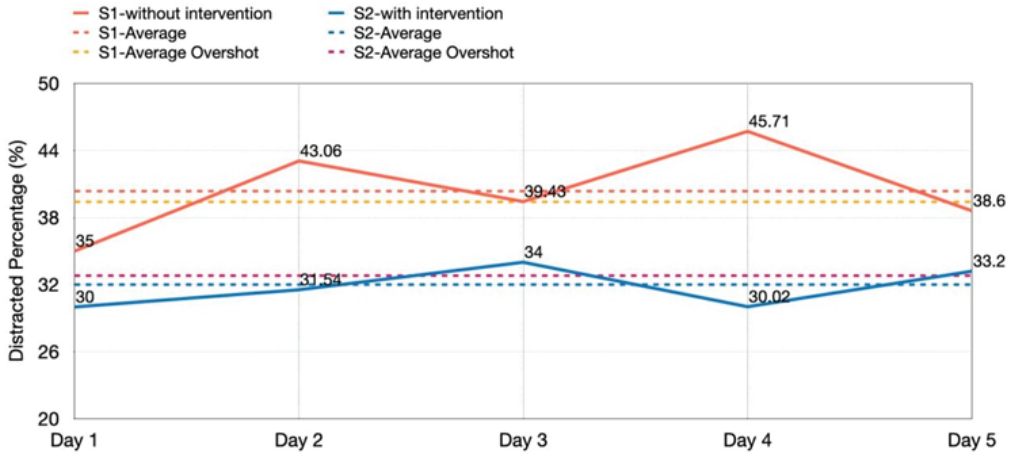

Figure 7. *Average distracted percentage and Average overshot percentage in stage 1 and stage 2.*

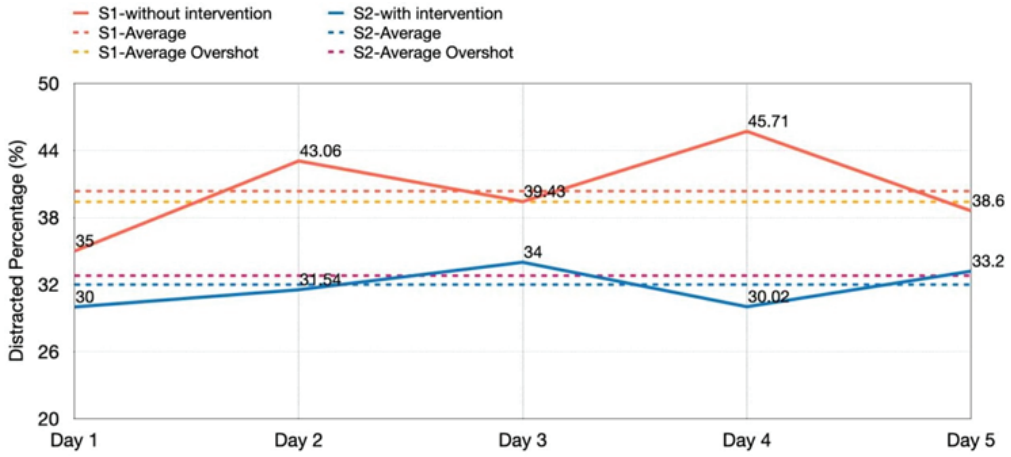

Figure 8. *Average distracted percentage and Average overshot percentage in stage 1 and stage 2.*

General Discussion and Conclusion

The current study proposes a motivation-oriented mindset concerning digital engagement and delivers a practical design scheme aimed at alleviating problematic social media using behaviours. Study I offered empirical evidence that purposeful social media using behaviour is positively correlated with the variables of "knowledge seeking", and "sense of meaningfulness", while also showing negative associations with negative emotional states such as social anxiety, depression, and guilt, particularly during nighttime use. This finding provided valuable guidance for intervention design in study-II. The succinct prompt, "why are you here?", unveiled the root causes of social media addictions, enabling users to consciously consider and manage their social media use. The effectiveness of this intervention program was examined in subsequent empirical examinations using representative criteria, such as overall engagement duration, excessive time spent, and time distracted. Nevertheless, there remains space for improvement and further investigation. Firstly, the consequences of Study-II merely confirmed short-term efficiency. It is predicted that the effectiveness would incrementally decrease over time due to users' fatigue and boredom from repeated exposure to the intervention. The design objectives, accordingly, would move forward to "how might we create a more engaging and informative trigger for stimulating excessive social media users to participate?" or "how might we reduce the annoyance and boredom of triggers from repeated exposure?". Secondly, the impact on psychological well-being showed marginal differences between phase 1 and phase 2, highlighting the imperative of the daily summary survey assessment. Moreover, it is valuable to conduct user test on a broader scale or focus on specific target groups (e.g., elderly, disabilities etc.) and contexts (e.g., reducing social media engagement during work period or dinner time). In conclusion, this study offered considerable findings concerning the correlations between goal-directed usage pattern and particular variables, contributing to the empirical database with respect to social media addiction and having significant practical implications on intervention strategies.

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