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Five-week of solution-focused group counseling successfully reduces internet addiction among college students: A pilot study

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FULL-LENGTH REPORT

ABSTRACT

Background and Aims: In the digital age, Internet addiction (IA) was deemed an epidemic and few treatments had been effectively developed for it. Here, we proposed a solution-focused group counseling (SFGC) as a potentially solution to reduce Internet addiction among college students. The present study examined the short- and long-term effect of a five-week solution-focused group counseling intervention on Internet addiction. *Methods:* Thirty-two participants were recruited and randomly assigned to either the experimental or control group, and twenty-six participants completed the whole intervention. The experimental group (n = 14) received the intervention, while control group (n = 12) did not. The revised version of the Chinese Internet Addiction Scale (CIAS-R), the Future Time Perspective, and resting-state EEG were administered pre-intervention, post-intervention, and at two follow-up tests (one month and six months after intervention). *Results:* The results showed that the scores of the CIAS-R in the experimental group were significantly decreased after intervention, and these effects could be sustained for one month and six months follow-ups. Additionally, the intervention conducted an increase in future time perspective. EEG results further suggested that the alpha, beta, and gamma absolute power decreased after the intervention. *Conclusion:* These results from the pilot-study primarily suggested that solution-focused group counseling could be an effective intervention for Internet addiction.

KEYWORDS

future time perspective, internet addiction (IA), psychotherapy, resting-state EEG, solution-focused group counseling (SFGC)

INTRODUCTION

Internet addiction (IA) is a growing phenomenon that has become the subject of considerable research. It is defined as an inability to control one's Internet use, which can lead to serious psychological and social consequences (Young, 1996). IA is characterized by two main features: (1) addiction-like symptoms such as compulsive Internet use, withdrawal, tolerance, and difficulty controlling oneself; and (2) impaired social functioning, such as disruption of eating, sleeping, and academic and social activities (Alimoradi et al., 2019; Block, 2008; Monezi Andrade et al., 2020; Shaw & Black, 2008). IA has been linked to negative emotions, such as loneliness, depression, and anxiety (Cataldo, Lepri, Neoh, & Esposito, 2021; Gioia, Rega, & Boursier, 2021). Additionally, IA has been identified as a public health concern, with associated problems including reduced sleep duration and quality, poor eating habits,

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migraines, impaired cognitive control, and changes in brain grey matter volume (Kokka et al., 2021; Lam, 2014; Wacks & Weinstein, 2021). Furthermore, a meta-analysis has shown a significant correlation between IA and self-injurious and suicidal behaviors (Marchant et al., 2017).

In recent years, solution-focused brief therapy (SFBT) has gained considerable attention as an efficient, straightforward, and long-lasting intervention approach (Daki & Savage, 2010; Franklin, Zhang, Froerer, & Johnson, 2017; Kim, Brook, & Akin, 2021; Wichowicz, Puchalska, Rybak-Korneluk, Gąsecki, & Wiśniewska, 2017). Previous study (Zhang et al., 2020) conducted a solution-focused group counseling (SFGC) based on SFBT for college students with IA and reported positive outcomes, although preliminary, indicating that SFGC can be an effective approach for IA group. Nevertheless, few studies have explored the mechanisms through which SFBT counseling techniques work or the therapeutic factors behind them. To address this issue, researchers have deconstructed the SFBT process and proposed the dialog orientation quadrant (DOQ) model, which classifies conversations according to their timeline and content (Moon, 2017). The DOQ reflects that SFBT not only focuses on the content attributes and temporal dimensions expressed by the client, but also conducts content-specific interventions, thus changing and broadening the client's perception of their past, present, and future experience.

The DOQ is arranged in accordance with the division of time perspective, which separates time into past (negative/positive), present (hedonistic/fatalistic), and future. Studies have shown that a greater focus on the future can reduce addictive behaviors and aid in the withdrawal and recovery of those affected (Du & Lyu, 2021; Kooij, Kanfer, Betts, & Rudolph, 2018; Lyu, Du, & Rios, 2019). A study conducted in 2016 found that those with a future-oriented time perspective had a lower risk of IA (Przepiorka & Blachnio, 2016). It has also been suggested that time perspective is a cognitive construct that can evolve over time (Carstensen, 2006). Research on a psychotherapeutic program for alcohol addiction revealed that those who achieved sobriety also experienced a shift in time perspective, particularly an increase in future time perspective (Davies & Filippopoulos, 2015). SFBT is a future-oriented therapy, focusing on clarifying the future and achieving goals. Therefore, the study hypothesizes that the SFGC could also improve IA symptoms through improve the future time perspective.

Resting-state electroencephalography (EEG) is proven to be associated with various aspects of behavioral and event-related cognitive processes, and have high reliability in measurement, as well as producing stable indicators of characteristic brain function (Massar, Kenemans, & Schutter, 2014). In term of resting-state EEG, previous research suggest that individual with IA appear to have increased gamma power activity and reduced beta and delta power activity, which are associated with the severity of internet addiction, impulsivity, and inhibit control (Burleigh, Griffiths, Sumich, Wang, & Kuss, 2020; Choi et al., 2013; Son et al., 2015; Sun, Wang, & Bo, 2019). Therefore, this study seeks to further explore the characteristics of resting EEG activity of IA and investigate whether SFGC intervention will change the resting-state activity of IA groups.

Taken together, we are interested in exploring the efficacy of SFGC for IA among college students. Through the immediate intervention effects and long-term follow-up results, along with behavioral and EEG indicators, we aim to assess the impact of SFGC in reducing the symptoms of IA and investigate the change of future time perspective. Our hypothesis is that the experimental group (those who participated in group counselling) will experience significant improvements in core symptoms of IA and Internet use related problems after the intervention, as well as an improvement in future time perspective. At the neural level, we anticipate that experimental group will display significant changes after the intervention.

MATERIALS AND METHODS

Participants

Participants were recruited through both online and campus fliers. Participants were selected based on a structured interview and score of the Revised Chinese Internet Addiction Scale (CIAS-R). Participants with inclusion criteria of CIAS-R score ≥46, which indicating moderate to high levels of IA. A total of 32 participants were recruited and randomly assigned to experimental or control groups. The pre-test scores of CIAS-R did not show any significant difference between the two groups ($t = -0.081$, $p > 0.05$). The final analysis comprised of 26 participants who finished the entire intervention; 14 in the experimental group (6 males, 8 females; mean age 19.50 ± 1.22) and 12 in the control group (5 males, 7 females; mean age 19.73 ± 1.34).

Procedure

The experiment employed a two-factor mixed experimental design of 2 (group: experimental group, control group) × 2 (test time: pre-test, post-test). The process was supervised by an experienced SFBT-oriented tutor (XZ), and each group consisted of one leader and one assistant, who were professionally trained. Figure 1 illustrates the specific design and procedure. In order to meet the needs of participants for a larger sample of data, the intervention was implemented for both groups. During the first counselling session (dotted square), the experimental group received SFGC once a week for five weeks, while the control group did not receive any intervention. In the second counselling session, the same SFGC was provided to the control group. During the group counseling, members are required to complete the satisfaction survey (to evaluate the satisfaction with the group) and self-assessment (to measure their current state of Internet usage, from "0 the worst" to "10 the best") each time. Both two groups completed the scales include CIAS-R, ZTPI-future (the future time perspective subscale of the Zimbardo Time Perspective Inventory) and resting-state EEG in pre-test and post-test in order to examine the immediate intervention effects on IA and future time perspective.

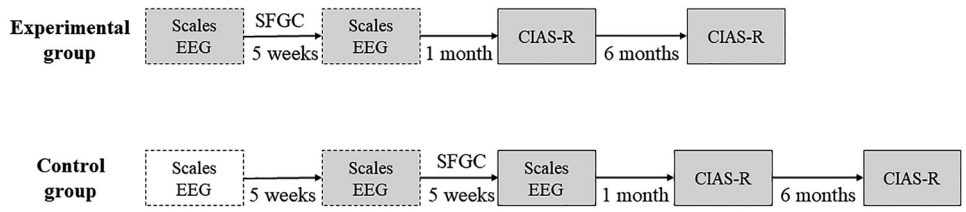

Fig. 1. Experiment design and procedure. The dotted square encompasses the pre- and post-intervention, allowing for a comparison between the two groups to analyze the immediate effects of SFGC. The gray square refers to the whole intervention and two follow-ups. Combining the two groups to assess the individual differences and long-term effects of SFGC. Scales include the Future Time Perspective subscale of the Revised Chinese Zimbardo Time Perspective Inventory Scale and the Revised Chinese Internet Addiction Scale (CIAS-R). SFGC: Solution-focus Group Counseling

In order to evaluate the long-term follow-up results, CIAS-R was employed to trace the Internet usage of all participants one month and six months after the group counseling.

Instruments

Revised Chinese Internet Addiction Scale (CIAS-R). The CIAS-R is a 19-item Likert scale, including 4 sub-dimensions: Compulsive and Withdrawal Symptoms, Tolerance Symptoms, Interpersonal and Health-Related Problems, and Time Management Problems. The scores of each dimension were the sum of the scores of the items, with higher scores indicating a deeper degree of addiction. The scale was administered before and after the group counseling, as well as one month and six months after the intervention. The Cronbach's alpha coefficients for the four rounds of administration were all above 0.87.

Future time perspective. The Future Time Perspective subscale of the Revised Chinese Zimbardo Time Perspective Inventory was used to assess future time perspective, and this scale was administered both prior to and following the group counseling. A higher score on this dimension suggests a propensity for an optimistic outlook on the future. The Cronbach's alpha coefficients for the two rounds of administration were 0.73 and 0.84.

EEG recording

During the EEG recording, participants were seated in an isolated sound-shielded room, connected to a recording room via a one-way glass window, and asked to rest comfortably with eyes closed. EEG signals were collected using a 64-channel amplifier (based on the 10–20 system; Brain Products, Gilching, Germany) with a sample rate of 500 Hz, with the reference set at FCz, and the ground located between FPz and Fz. The vertical and horizontal electrooculogram (VEOG and HEOG) were recorded on the right and left eye respectively, and scalp impedance were kept below 5 kΩ. The EEG and EOG activities were amplified with a DC 0.1–1000 Hz band pass, and the recordings lasted for 5 min.

Solution-focused group counselling programs

SFBT is a short-term approach to counselling that focuses on creating positive changes in the client's life in a timely manner. This method is based on two core concepts: the development of a vision of a preferred future, and the utilization of existing skills and resources to make this vision a reality (Ratner, George, & Iveson, 2012). In order to cater to the needs of college students who use the Internet, we have designed SFGC Programs that are tailored to their needs (see Supplemental Materials Table S1).

In the intervention process, various techniques based on SFBT were used. These included helping participants to set solution-focused goals (e.g., asking them to describe their desired change in Internet use as specifically as possible), using scaling questions for self-assessment (e.g., allowing group members to rate their current Internet usage and identify ways to improve their performance), enhancing positive resources and exploring exceptions (e.g., asking participants to recall moments where they felt closer to the ideal state), assigning homework (e.g., weekly tasks to reinforce the effects of intervention), proactively seeking and refining new solutions (e.g., engaging group members in brainstorming and refining solutions together), and creating a supportive team atmosphere (e.g., listening attentively to members' changes and offering timely feedback). Additionally, Miracle Imagination was used, which involved guiding members to imagine a world where all Internet use problems have been solved, including detailed descriptions of daily life and interpersonal reactions, to further clarify the objectives and uncover resources for building solutions. At the end of each session, everyone's efforts to resolve IA issues were acknowledged and praised.

Statistical analysis

Behavioral data. All behavioral data was analyzed using IBM SPSS 23.0 to compare the effect of intervention between two groups. The non-parametric Mann-Whitney U test, Friedman test and ANOVA were used for the analyses.

Resting-state EEG data analyze. EEG data were pre-processed using EEGLAB, an open-source toolbox running under the MATLABR2019a environment. The main prepossessing steps included band-pass filtering (0.1–100 Hz); re-referencing to average reference; segmentation into 2s time courses; removal of segments contaminated by gross artifacts; removal of independent components (IC) based on topographies, frequency spectra, and temporal distributions;

correction for eye blink artifacts using ICA; removal of ocular artifacts, muscle activities, and power-line interference; and setting a threshold (±100 μV) after ICA to remove bad segments. Additionally, one participant was excluded due to excessive head movement. The absolute power (μV) of the accepted epochs of EEG data was calculated and smoothed with fast Fourier transforms, and then averaged in four frequency bands: slow-wave (1–8 Hz), alpha (8–12 Hz), beta (12–30 Hz), and gamma (30–50 Hz). According to Lee et al. (2014), 19 electrodes were divided into three regions (frontal, central, and posterior) and three sites (left, middle, and right) to reflect brain region and site factors. A 3 regions × 3 sites × 2 times (Pre-test vs. Post-test) repeated ANOVA was used to test the intervention effect.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the Faculty of Psychology, Southwest University approved the study (No. H21036). All subjects were informed about the study and all provided informed consent.

RESULTS

Effects of group counseling programs

In session 1, the experimental group received the SFGC, while the control group did not receive any intervention. We used the Mann-Whitney U test to compare the change in scores between per-intervention and post-intervention (Δ = post-test score − pre-test score). The results showed a significant effect of the intervention (Table 1), with the experimental group exhibiting a considerable decrease in total IA scores and all symptoms of IA (Supplemental Materials, Table S2), compared to the control group. Besides, the intervention also generated a noteworthy rise in Future time perspective.

Combine the two groups after intervention, a total of 26 participants were included and the paired-samples *t*-test was used to analyze the differences between the pre- and post-intervention (Table 2). The results showed that IA scores were significantly decreased after the intervention ($t = 5.999$, $p < 0.001$), and a noteworthy decrease in all symptoms of IA (Supplemental Materials, Table S3). More precisely, the score of Future time perspective significantly increased ($t = -4.088$, $p < 0.001$).

Table 1. Comparison between experimental group and control group

Measures	Experimental Group ($n = 14$)	Control Group ($n = 12$)	Z
△Total IA	−16.79 ± 16.24	1.00 ± 3.79	−3.192**
△ZTPI – future	3.07 ± 3.69	−0.50 ± 2.15	−2.650*

Note: △ = per-intervention - post-intervention, *$p < 0.01$, **$p < 0.001$.

Table 2. Comparison between pre-intervention and post-intervention ($n = 26$)

Measures	Total group		*t*	*p*
	Pre-test	Post-test		
Total IA	58.81 ± 8.81	43.35 ± 8.80	5.999	<0.001
ZTPI-future	14.81 ± 3.86	17.46 ± 3.69	−4.088	<0.001

Note: *$p < 0.01$, **$p < 0.001$.

Resting-state EEG results

The topography of each frequency band of all participants in pre-test and post-test is shown in Fig. 2. We employed 3 brain regions (frontal, central, posterior), 3 sites (left, midline, right), and 2 groups (experiment group, control group) MANOVA to examine the intervention effect in resting-state EEG between the two groups in the post-intervention. No significant differences were observed, and the results are presented in Supplement Materials Table S4 of the supplementary materials. A repeated measures ANOVA was conducted to compare the resting state EEG of 26 participants before and after the intervention. The ANOVA included 3 brain regions, 3 sites, and 2 time points (pre-test, post-test). Post-hoc comparisons were used to determine the time differences, and the results are summarized in Supplemental Materials Table S5.

A significant main effect of time was observed in the alpha. Specifically, the absolute power of alpha (F (1, 26) = 4.324, $p = 0.043$, $\eta^2 = 0.080$) was higher in the pre-test than in the post-test ($M_{pre\text{-}test} = 1.472$, $M_{post\text{-}test} = 1.135$.). Moreover, a significant time × regions interaction was found in the alpha (F (2, 26) = 3.209, $p = 0.049$, $\eta^2 = 0.116$), beta (F (2, 26) = 4.082, $p = 0.023$, $\eta^2 = 0.143$) and gamma band (F (2, 26) = 4.092, $p = 0.023$, $\eta^2 = 0.143$), with all the three bands being significantly higher in the central ($p = 0.041$; $p = 0.029$; $p = 0.029$) and the absolute power of alpha and beta in the posterior region were higher ($p = 0.024$; $p = 0.038$) in the pre-test than post-test. No significant time × sites interaction difference was found in any of the bands.

A significant time × regions × sites interaction was observed in the beta (F (4, 52) = 2.591, $p = 0.049$, $\eta^2 = 0.181$) and gamma (F (4, 52) = 2.835, $p = 0.035$, $\eta^2 = 0.194$) bands. Post hoc analyses showed that the absolute beta power in the left site of the central ($p = 0.01$) and the right and left site of the posterior region ($p = 0.021$; $p = 0.04$) was higher in the pre-test than in the post-test. Furthermore, gamma absolute power was significantly lower in the left site of central region in the post-test ($p < 0.01$).

Results of the resting state EEG of the experimental group showed a significant decrease in the alpha, beta, and gamma bands after intervention. The decrease in the alpha and beta band was mainly observed in the left central, left posterior and right posterior regions, while the gamma band was mainly reduced in the central region.

Long-term effects of intervention

The results of a repeated measure ANOVA showed a significant difference in the scores of IA between the four times

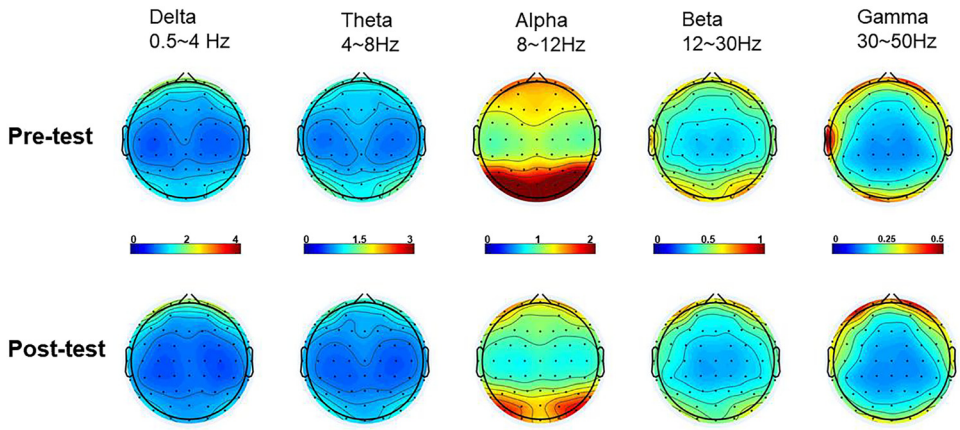

Fig. 2. Topographical maps of absolute power (μV) in each frequency band of participants before and after intervention

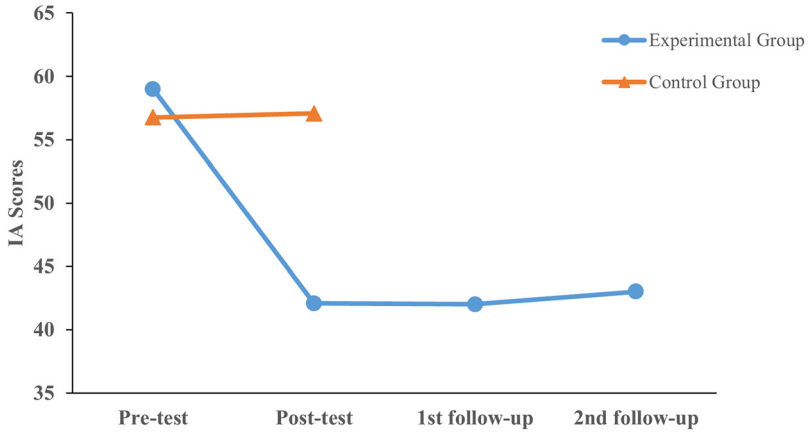

Fig. 3. Change tendency of IA scores. It shows the shift in IA scores after the intervention, with the first and second follow-up occurring one month and six months respectively

in Fig. 3 (F (1, 19) = 20.449, $p < 0.001$, $\eta^2 = 0.518$). A post hoc test showed that the pre-test scores of IA were significantly higher than those of the post-test ($t = 6.342$, $p < 0.001$), one month follow-up ($t = 6.596$, $p < 0.001$) and six months follow-up ($t = 6.224$, $p < 0.001$). Additionally, there was no difference between the pro-test and the one-month follow-up ($t = 0.254$, $p > 0.05$), and six months follow-up ($t = -0.117$, $p > 0.05$), and no difference between the two follow-up tests ($t = 0.372$, $p > 0.05$).

DISCUSSION

This research sought to evaluate the efficacy of SFGC in abating Internet addiction among college students, both in terms of behavioral modifications and resting state EEG. After five weeks of group counseling, the participants displayed a marked decrease in total IA scores that persisted at the one-month and six-month follow-up sessions. Moreover, the participants registered higher scores in Future time perspective. Resting state EEG revealed a significant decrease in absolute alpha, beta, and gamma power in all group members. In conclusion, this pilot-study of SFGC had a significant positive impact on a small sample of college students' Internet addiction behavior, the effect of which was sustained, thus leading to healthier Internet use habits.

Following a five-week period of group counselling, the experimental group displayed significant decrease in their level of IA. The average score on the experimental group on the post-test was 42.14, which is lower than the cutoff score for the at-risk group. Meanwhile, the control group's average score of 58.67 was still higher than the cutoff score of 53 for IA, further suggesting the significant change in the experimental group due to the group counselling. This finding is in line with previous research suggests SFGC is effective in improving individuals' IA (Tasiye Hoseini, Samady, & Madani, 2021). SFGC has developed a comprehensive and tailored approach to IA group which not only focuses on alleviating the core symptoms, but also assists individuals in developing the capacity to construct solutions. This framework consists of setting a clear, personal, and achievable goal regarding Internet use that aligns with the individual's life, as well as framing the function of the Internet in a positive way. Furthermore, SFBT emphasizes the importance of starting with success and expanding the individuals' range of positive experiences in order to reduce any negative

associations (De Shazer et al., 2021). Through exploring past successful Internet use experiences, members gain access to resources and strengths to become aware of and apply effective elements to enhance existing coping strategies. Additionally, weekly homework enables members to practice various methods, ultimately leading to a positive improvement in IA symptoms.

This study empirically supports the effectiveness of SFGC in regulating individuals' time perspective bias, especially in improving the future time perspective. SFBT is a future-oriented therapy that encourages members to co-construct a vision of a preferred future, adjusting goals according to their current state and replacing impulsive behavior patterns with more rational actions (Alimoradi et al., 2019; Deshazer et al., 1986; Reiter, 2010). The process of group counseling enhanced participants in the ability of formulating detailed plans and organizing future activities to achieve their goal. However, the mechanism behind how future time perspective intervenes in IA is unclear and further research is urgently needed.

At the neurophysiological level, after 5 weeks of SFGC, participants showed a significant decrease in the resting alpha, beta, and gamma bands. Previous studies have found that resting-state alpha band is positively correlated with IA, and the decreased absolute alpha band in this study coincide with the decreased IA scores in the behavioral (Wang & Griskova-Bulanova, 2018). Research has indicated that changes in resting-state gamma activity are associated with impulsivity and response inhibition (Barry, Clarke, Johnstone, & Brown, 2009). This reduction in gamma activity suggests that the SFGC was successful in reducing brain arousal and impulse seeking in the addicts, which is consistent with the significant increase in Future time perspective tendency behaviorally. Additionally, beta band activity is linked to attention and emotion, when individuals focus their cognitive resources the beta band activity is increased (Cahn & Polich, 2006; Clarke, Barry, & Johnstone, 2020; Güntekin, Emek-Savaş, Kurt, Yener, & Başar, 2013). Meanwhile, beta activity is associated with mental tension and emotional agitation (Hayashi et al., 2009; Ray & Cole, 1985). Saggar found that meditation training can reduce beta band activity after the subjects had a peaceful, relaxing psychological experience (Saggar et al., 2012). In the present study, the beta band activity decreased after the intervention, demonstrating that SFGC may help with stress relief and relaxation. These findings provide insight into the mechanisms of intervention effectiveness at the neurophysiological level, and suggest that more attention should be paid to impulse-seeking behavior and emotion regulation in intervention. It's worth noting that as a preliminary pilot-study, concerning a restricted number of participants, potentially not providing strong evidence regarding resting-state EEG outcomes. If future research could broader the inclusion of resting-state EEG data to provide a stronger and more compelling evidence.

It is important to note the limitations of the current study. First and foremost, due to the constraints posed by the sample size and the presence of methodological flaws, this study stands as a preliminary pilot-study with a relatively small sample, thus rendering the results not entirely conclusive. Our hope for forthcoming research lies in the expansion of the sample size, which will contribute to enhancing the dependability, credibility, and applicability of the findings. Second, the sample was composed of university students, who may have had a higher propensity to accept SFGC due to their advanced cognitive abilities. To further explore the efficacy of SFGC, future studies should include a more diverse range of participants. Third, the subjective nature of the research instrument may have impacted the accuracy of the results. To reduce bias, future studies should employ different methods to obtain more objective data. Last, this study only examined the resting-state EEG power spectra of the participants. To gain a more comprehensive understanding of the brain mechanisms of IA, future research could also consider ERP.

CONCLUSION

The present study sought to examine the effect of solution-focus group counselling in relation to Internet addiction among college students. The findings demonstrated that SFGC improved both behavioral and EEG responses to Internet addiction symptoms, thereby confirming the effectiveness of improving the future time perspective. Therefore, it's recommended that future research be conducted to explore the potential of a time perspective in augmenting the benefits of SFGC.

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Authors' contribution: Conceptualization, X.Z. and Q.H.; methodology, X.Z and Q.H.; investigation, Y.P., Y.Q., Y.L. Z.Y. and X.Z.; formal analysis, Y.Q. and Q.H.; writing—original draft preparation, writing—review and editing, Y.P., X.Z. and Q.H; project administration, Q.H.; funding acquisition, Q.H. All authors have read and agreed to the final version of the manuscript.

Conflict of interest: None.

SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at https://doi.org/10.1556/2006.2023.00064.

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