Smartphone addiction reduction: effectiveness of print and social media education

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Article Info

ABSTRACT

Smartphone usage dependency in daily activities also causes vulnerability to addiction and its effects on health, especially the increment during the COVID-19 pandemic because of the switching activities to online. Research on the prevention and treatment to overcome smartphone addiction is still relatively limited. This study aims to analyze the effectiveness of educational media programs using social-media compared to printed-media in reducing smartphone addiction levels. Changes in interpersonal-relationship and self-esteem as a related mediator and affected negative impacts of smartphone addiction were also investigated. Media effectivity was assessed by the decrease of users' addiction level, and affected interpersonal-relationship and self-esteem. A three-wave cross-sectional series conducted on 54 subjects, divided into two groups were given the routine printed or social-media educational program for a month. Results from comparative analysis showed printed-media is more effective than social-media in reducing smartphone addiction; both are statistically significant (p=0.000). It shows that health education has a role in smartphone addiction prevention, but choosing the right and most effective media for specific populations is necessary. Both groups increased interpersonal-relationship, but self-esteem rose only in the printed-media group. Interpersonal-relationship tended to increase, while self-esteem varied from person to person, showing the addiction level might affect mental-behavioral health but still need further analysis of other influencing confounding factors.

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1.   INTRODUCTION

Addictivevulnerability rose coincides with the global smartphone usage dependency as an essential need in doing daily activities. Indonesia as the fourth largest smartphone users in the world, reach more than 170.4 million active users in 2021, while based on the scale of use, Lee *et al.* estimated that 1 out of 7 people is a smartphone user [1], [2]. This incidence is increasing during the global COVID-19 pandemic as a result of various activities switching to online [3]–[5]. However, research on the prevention and treatment to overcome smartphone addiction is still relatively limited; and therefore becomes one of the main focuses in our study to compare and found the most effective method of educational media prevention for Indonesia's young adult population [3]. Our previous study showed that communication through social media application was the main reason of smartphone usage among public transport passengers, however, we found that smartphone addiction

occurrence was not influenced by type of smartphone use activities nor the demographic factors (gender, age, educational status, and employment status [6]. The smartphone addiction diagnosis criteria has not been clearly defined, but its social effects were similar and correlated to other behavioral addiction, such as gambling disorder or internet gaming disorder [2], [7], [8].

Smartphone addiction, as called smartphone zombie, has a correlation with users' psychological condition and how users 'connect' to the real world, including their depth and intensity of interpersonal interaction and individual self-esteem [9]. Excessive smartphone usage correlated with the impairment of physical and mental health behavior in a bidirectional pattern, as a vicious cycle [10], [11]. People with high interpersonal relationship tend to choose the activity that involving social interaction, vice versa low interpersonal relationships and low self-esteem are found in people with smartphone addiction. The condition results in disrupted daily activities and the tendency of communication through social media due to discomfort in interpersonal communication [12]. Self-esteem takes an important role in smartphone addiction because it directly affects a person's physical and mental health [13], [14]. The negative association between addiction and mental health has also been proven to be mediated by self-esteem, and it can be used as a parameter to measure the effectiveness of intervention in reducing addiction [15]. High self-esteem leads to good mentality, happiness, self-adjustment, academic achievement and satisfaction, whereas low self-esteem leads to a state of depression, anxiety, food intake abnormalities, poor social life, and risk of changes in behavior [13].

The cognitive approach to improve inhibitory and attentional control has long been proven to be effective as an intervention and prevention for internet and smartphone addiction, among another methods (psychotherapy, behavioral therapy, application restriction, social intervention and complementary-alternative medicine) [3], [15]. Hou *et al.* using education through mixed media, namely reminder cards and diary technique which proved effective in reducing social media addiction and improving mental health [15]. Although the use of social media for health campaigns to raise health awareness has been widely used nowadays, however, are these promotional and preventive efforts really effective? This study aims to analyze the effectiveness of educational media program using social media comparing to printed media in reducing smartphone addiction level in a period of time. Both of them are part of the cognitive approach, but to the best of the authors' knowledge, there has been no similar study comparing the effectiveness of the two. The changes in interpersonal relationship levels and self-esteem as a related mediator and affected negative impacts of smartphone addiction were also investigated in this study.

2. RESEARCH METHOD

2.1. Study design

This research was a comparative study of numerical analysis with more than two related groups longitudinally. This research was divided into three educational media program series: pre-program, post-program 1, and post-program 2 with a two-week distance in between. In these series, we measured the level of smartphone addiction using smartphone addiction scale (SAS) questionnaire, followed by the assessment of interpersonal relationships value through the Interpersonal Support Evaluation List (ISEL) questionnaire and self-esteem value through the rosenberg self-esteem scale (RSES) questionnaire [16]–[18]. The respondents were divided into two groups based on printed or social media educational program that were given.

2.2. Participants

Before the pre-program, we conducted our data collection using purposive sampling method by distributing SAS questionnaires to 200 AJCUI students on School of Medicine and Health Sciences, School of Biotechnology and School of Psychology who were willing to follow the research and educational program processes. To avoid the bias on questionnaire's responding, the respondents whose addict to smartphone would be taken as further research participants without disclosing their SAS results. Using inclusion criteria, respondents who experienced smartphone addiction based on the scale who were also Transjakarta bus passengers would be taken as further research participants through the respondent's approval. Transjakarta passenger as an inclusion criterion is based on the continuation of our previous study, which selected this group as the portrait of urban society in Jakarta, Indonesia, which was found to have a high smartphone addiction incidence (majority of young adults' university students and office employees) allegedly due to excessive smartphones. usage with extended screen time during and every use of public transport [6]. Data collection and educational program in this study was conducted with a total initial 54 respondents, among them there were four participants dropped out from printed media group who were not willing to continue the research in the middle of the process. The respondents were divided into the group with printed media educational program consisting of 23 respondents, and the social media educational program consisting of 27 respondents.

2.3. Educational media program

The contents of educational program that we provided covers the following topics; i) general explanation about addiction and form of smartphone addiction, ii) positive functions of smartphones and its impact of daily life, iii) needs and desires in using smartphone, iv) negative impacts of excessive use of smartphones, v) fun facts data on smartphone addiction in Indonesia and globally, vi) smartphone addiction relationship with interpersonal relationships and individual self-esteem as well as its impact in everyday life, and vii) steps to reduce smartphone usage and to prevent smartphone addiction. Before being given the educational program, each of the respondents received a verbal explanation about the program, the aims of the study, and the goals to improve their current scores (pre-program), which is to reduce smartphone addiction and to enhance the participant's interpersonal relationship with family and friends, and their self-esteem which is expected to continue after the program is completed.

The educational contents have been made in such a way with the same topic and essence of discussion between the two mediums that will be given according to the session. Our media educational program was divided into two sessions, the first session was given after pre-program data collection and the second one after post-program 1 data collection, the final data results is collected at the post-program 2. Printed media education was using leaflet, while social media was delivered through LINE application because of its popularity as chatting application among university students in Indonesia. Printed media educational program containing four pages in each session, while the social media educational program was provided using three infographic design and an information text in each session within two-days spans of each infographic. Shortly before the provision of printed media education, each respondent will be met to be given a verbal explanation of the big picture of the educational content, while for the social media group, an explanation will be given via LINE chat. Educational media was then given to each participant, and an explanation was given that education can be read repeatedly, pondered over, and explained that changes in unhealthy smartphone use behavior would occur on a whim and start from oneself. To ensure the content of educational program has been read by the participants, we gave a quiz using Google Form with questions and answers related to the education. We assume the educational media has been read if the quiz result was more than 50% correct for each participant.

2.4. Statistical analysis and measurements

We used SPSS for Windows version 25.0 (SPSS Inc., Chicago, IL, USA) to analyze the quantitative data collected from the scores of SAS, ISEL and RSES, and a p-value of 0.05 means statistically significant. Friedman test was conducted, followed by post-hoc analysis using Wilcoxon signed-rank test. Data analysis consisted of pre-program, post-program 1 and post-program 2 data. Data processing was performed to see changes in smartphone addiction scores as independent variables before, mid, and after program. Changes in smartphone addiction scores were also assessed in relation to changes in interpersonal relationship scores and self-esteem scores as the dependent variable.

The SAS questionnaire developed by Kwon *et al*. consists of 33 questions with a scoring system with six Likert subscales, the scoring interval is between 33-198, and the results are referred to a smartphone addict if the score is more than 104.52. This SAS cut-off was suggested based on our previous study using a statistical evaluation of the best area under a curve (AUC) values of the receiver operating characteristic (ROC) curve with the maximum Youden's index with optimal sensitivity and specificity. This cut-off might not define the addiction severity and might differ depending on the population characteristics; the majority of our previous population is male, 21-25 years group, public transport passengers with an occupation of university students and office workers [6], [16].

Interpersonal relationship assessment based on ISEL shows that the higher the score obtained, the higher the interpersonal relationship of respondents, and vice versa. The ISEL developed by Cohen and Hoberman consists of 40 questions with four Likert subscales for calculating scores with a maximum score of 120 [17]. While in assessing self-esteem using RSES, developed by Rosenberg *et al*. consists of 10 questions with four Likert subscales for calculation with a score range of 0-30. RSES shows normal self-esteem in the range of 15-25, with high self-esteem above 25, and if the score is below 15, respondents have low self-esteem [18].

3. RESULTS AND DISCUSSION
3.1. Results

Based on the SAS mean scores Figure 1, the group of respondents who received printed media educational program showed greater reduction in their SAS scores compared to the group received using social media. In the group of printed media educational program, the initial mean score of smartphone addict at the pre-program stage was 130.83 (N=23), and the final assessment at the post-program 2 stage has decreased the mean score to 103.26 (N=23). Based on the average score, the respondents in printed media group were no longer addicted to smartphone. Whereas in the group of social media educational program, the initial mean

score of smartphone addict at the pre-program was 123.70 (N=27), lower than the group of printed media, but the mean score at the final assessment on post-program 2 decreased only to 112.85 (N=27).
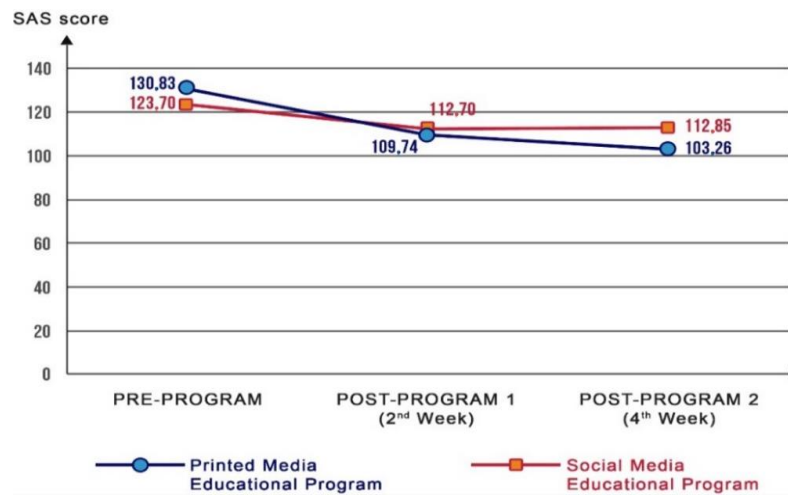

Figure 1. Comparison of SAS mean scores on printed (blue line) and social media (red line) educational program

3.1.1. Printed media educational program

Printed media as an educational program was statistically significant in reducing smartphone addiction (p=0.000). The average SAS score for all respondents (N=23) experienced a gradual decline starting at the pre-program stage with a score of 130.83; indicating smartphone addiction; to 109.74 in post-program 1, and decreasing to 103.26 in post-program 2; indicating not addict to smartphone base on SAS Table 1. Friedman test on changes in ISEL scores in the group of printed media respondents (N=23) showed a statistically insignificant value. Changes in the scores of interpersonal relationships that occur were fluctuating with the mean ISEL score at pre-program is 79.48 and shows a slight decrease to 78.70 in post-program 1, while in post-program 2 it has increased to 83.87. Even though the increase in ISEL score indicates an improved interpersonal relationship condition along with the decrease in addiction level, it was insignificant statistically. The same thing also happened to the change in respondent's self-esteem level (N=23) through RSES score, since the pre-program stage the mean score was in the normal range which is 17.30 and gradually increased to 17.83 in post-program 1 then to 18.04 on post-program 2, but the changes was not statistically significant.

Table 1. Friedman test and post-hoc Wilcoxon signed-rank test result of SAS, ISEL and RSES on printed media educational program group

	Friedman test			Post-Hoc Wilcoxon Signed-Rank Test (Post-Program 2 from Pre-Program)	
	Session (N)	Mean (SD)	p-value	Ranks (N)	p-value
SAS	Pre-Program (23)	130.83 (21.43)	0.000***	Negative ranks (18)	0.001**
	Post-Program 1 (23)	109.74 (22.30)		Positive ranks (5)	
	Post-Program 2 (23)	103.26 (25.84)		Ties (0)	
ISEL	Pre-Program (23)	79.48 (14.68)	0.146	Negative ranks (7)	0.144
	Post-Program 1 (23)	78.70 (10.89)		Positive ranks (15)	
	Post-Program 2 (23)	83.87 (14.11)		Ties (1)	
RSES	Pre-Program (23)	17.30 (4.86)		Negative ranks (7)	0.195
	Post-Program 1 (23)	17.83 (4.93)	0.246	Positive ranks (12)	
	Post-Program 2 (23)	18.04 (6.01)		Ties (4)	

SD, standard deviation. N, number of participants.
[†]p<0.1, *p<0.05, **p<0.01, ***p<0.001

3.1.2. Social media educational program

Statistically, social media educational program was also significant in reducing smartphone addiction Table 2. However, comparing to the printed media educational program, the decrease in SAS scores tended to be smaller and at the end of the program. The mean score on post-program 2 was 112.85 (N=27), showed

addiction to smartphone. Changes in interpersonal relationship ISEL scores in the social media group (N=27) was increased significantly (p=0.000). The ISEL mean score on pre-program was 78.81 which then increased to 80.26 and 112.85 in post-program 1 and 2 respectively. It showed an increase in interpersonal relationships along with the decrease in smartphone addiction. While the mean score of respondent self-esteem through RSES scores in this group is fluctuating and statistically insignificant, with a score of 17.52 in pre-program and then decreased to 16.63 in post-program 1, and increased again to 16.81 in post-program 2. However, overall respondents' RSES scores still within normal range.

Table 2. Friedman test and post-hoc wilcoxon signed-rank test result of SAS, ISEL and RSES on social media educational program group

		Friedman test		Post-Hoc Wilcoxon Signed-Rank Test (Post-Program 2 from Pre-Program)	
	Session (N)	Mean (SD)	p-value	Ranks (N)	p-value
SAS	Pre-Program (27)	127.70 (12.89)	0.000[***]	Negative ranks (19)	0.015[*]
	Post-Program 1 (27)	112.70 (22.40)		Positive ranks (8)	
	Post-Program 2 (27)	112.85 (25.65)		Ties (0)	
ISEL	Pre-Program (27)	78.81 (14.08)	0.000[***]	Negative ranks (4)	0.000[***]
	Post-Program 1 (27)	80.26 (12.11)		Positive ranks (23)	
	Post-Program 2 (27)	112.85 (24.65)		Ties (0)	
RSES	Pre-Program (27)	17.52 (4.29)		Negative ranks (15)	0.398
	Post-Program 1 (27)	16.63 (3.93)	0.457	Positive ranks (11)	
	Post-Program 2 (27)	16.81 (5.09)		Ties (1)	

SD= standard deviation, N= number of participants, [†]p<0.1, [*]p<0.05, [**]p<0.01, [***]p<0.001

3.2. Discussion

This research showed that educational program using printed media and social media both reduced smartphone addiction significantly in all groups of respondents who received the educational program for 4 weeks. The results showed that printed media was more effective than social media as it was indicated by the decrease in SAS scores of smartphone addiction assessment. However, further research is needed to know whether its effectiveness is influenced by educational program duration, variation of media obtained, and the respondent's motivation to reduce addiction [19]. Media that are effective in reducing smartphone addiction also need to adjust to the causes of varied smartphone addiction in each individual. According to the SAS questionnaire there are six major components of smartphone addiction assessment: daily life disturbance, positive anticipation, smartphone withdrawal, cyberspace-oriented relationship, smartphone overuse, and tolerance of smartphone addiction.

3.2.1. Effectiveness of printed media as an educational program

The use of printed media educational program showed a significant difference through post-hoc analysis at all stages of the program, and the decrease in smartphone addiction scores was also greater than the social media educational program. The use of social media educational program as smartphone addiction prevention was less effective due to the distraction to respondents together with other activities when opening a smartphone. This affected the focus on the information provided, in contrast to the printed media which provides focus outside the smartphone when receiving the program. Based on Ahn *et al.* analysis, the most common activities carried out by people with smartphone addiction were communication and information updating through social network sites (SNS) [20]. Using Korean Addiction Proneness Scale, Lee *et al.* shows the purpose of smartphone use in the smartphone addiction group was significantly higher scores for habitual use, pleasure, communication, games, stress relief, ubiquitous trait, and not to left out; While this group also showed problematic use on preoccupation, tolerance, lack of control, withdrawal, mood modification, conflict, lies, excessive use and loss of interest [2]. The excessive use of smartphones can disrupt the user's focus and concentration on the surrounding environment, so that the use of social media as educational media program does not divert recipients' information from the smartphone. Varies form of educational media that can be used in public facilities to shift the focus on smartphones included flyers, newspapers, posters, magazines, banners, or even electronic text or picture [6].

The principle of providing educational program in reducing smartphone addiction using any media is to increase awareness, the importance of interactive social life in the real world, and the consequences of smartphone addiction. The use of printed media requires clear content so that the recipient of the information understands the message quickly. The message should contain motivation for changing attitudes, positive messages, the consequences and the stigma that results when bad habits such as smartphone addiction continue. Elder *et al.* stated the effectiveness of media interventions in reducing addiction is influenced by factors of different levels of knowledge or education, attitude, and behavior in each individual [21].

Our research used leaflets as printed media educational program because it has a wide scope of distribution and the target readers can be controlled. Unlike social media, printed media is a passive media, the effectiveness of which depends on the daily habit of the respondent in reading non-electronic media such as newspapers, books or magazines, while social media is classified as active media because it requires respondent participation to initiate open an application or social media platform in obtaining information [22]. Indonesian people still have a habit or dependency on printed media which was a passive media as a reading tool even though the development of social media takes place rapidly nowadays. This was proven in our research that showed printed media educational program more effective to reduces the smartphone addiction score significantly. Kim *et al.* also showed the success of printed media as educational program in West Java, Indonesia, in increasing patient participation in accessing health communication and consultation services to health care workers [23]. The study also states that developing countries and developed countries have a similar problem related to the quality of physician-patient interaction and lack of communication in consultation session, which meant health information provided through direct education tends to be incomplete. This showed the need for effective media as a form of education.

3.2.2. Effectiveness of social media as educational program

Althoughsocial media is widely used today as a media for health education and promotion, research on its effectiveness in Indonesia is still limited. Indonesia ranks sixth in the world in the number of internet and smartphone users, with estimated data reaching 100 million users in 2018 [24], [25] The large number of smartphone users, making social media as educational media can reach a large number of recipients of information. However, our research showed social media was less effective than printed media as an educational program to reduce smartphone addiction. Like the previous discussion, the effectiveness of an educational media adjusted to the suitability pattern of the community, and Indonesian people tended to still rely on printed media as a source of learning and information both in educational institutions and health care centers.

Effectivity of educational media program may also be different in developing countries such as in Indonesia compared to developed countries, as well as patterns of habit at different age groups. Around 55-82% of teenagers and adults use smartphones to access entertainment sources, to obtain certain information, to manage personal needs, and mostly to communicate [26]. Developed countries like the US data showed 30% of 58% of the citizen who depended on social media to send messages were teenagers, while in Asia, especially South Korea, 30% of teenagers send an average of 100 messages every day through social media [27]. This made the potential of social media educational program more effective than printed media in developed countries. In addition, social media had a wider and faster scope of distribution for groups accustomed to using smartphones in daily works, and also in terms of price which was relatively cheaper than the cost of printed media production. Social media also provided direct communication services between providers of educational program and recipients of information.

The willingness of smartphone users to provide time to read educational content can indeed determine the effectiveness of educational program, but the timing of social media educational program might also be a determining factor of effectiveness as well. An analysis study in South Korea used a smartphone usage monitoring system (SAMS) to see the pattern of frequency and duration of application usage on smartphones. The smartphone addiction group usage was at 11.00 a.m. to 3.00 p.m. [20]. The study also stated that the average usage of smartphones at night time which was reduced at midnight. The groups of smartphone addicted people spent the most time on social networking applications (LINE and Facebook) and web browser information.

Changes in community patterns would occur due to people's current dependence on technology and the internet in facilitating various work activities. Combining several types of media at the same time can be a solution to achieve results that would be more meaningful and significant than just using social media [27]. A randomized controlled trial in Norway proves the use of digital media by combining several types of media on smartphone features such as e-mail, web-pages, telephone and text messages as an intervention to reduce smoking addiction in adolescents. The results showed more significant reduction than using only printed media such as booklets [19]. Research on the effectiveness of social media as an educational media program would be interested and open to be developed and evaluated, especially with the increasing number of smartphone usage and dependency, globally.

3.2.3. Pattern of change in interpersonal relationship

Our research showed that there was an increase in interpersonal relationship scores through ISEL assessment, along with the reduction in smartphone addiction in both groups of printed media and social media educational programs. Although the use of SNS could facilitate communication and create relationships online, SNS also allowed the formation of new psychosocial problems in which interpersonal relationships in the real

world would be ignored. Problematic smartphone and internet use can also reflect a state of depressed people and adverse childhood experience, which to alleviate the negative feelings is to spend time on activities and communication using a smartphone [10], [28]. By increasing interpersonal relationships, through reducing dependence on smartphones and increasing face-to-face communication, can break the cycle of problematic use of smartphones. Excessive use of social media interfered mental health while attachment to technology changed the pattern of a new generation whose quality of relationships obtained through online applications [29]. Our research trying to measure changes in interpersonal relationships through decreasing smartphone addiction scores, so that it would increase awareness for interpersonal relationship improvement in the 'real' world.

The value of interpersonal relationship was different for each person even though they had the same smartphone addiction score. Social environment and the tendency in using certain smartphone functions affected the differences. Smartphone use that affected addictive behavior was broadly divided into social functions, informational and educational functions, leisure functions, and virtual emotional functions. People who depend on the use of smartphones and the internet to get social functions have more interpersonal relationship problems in the real life than those who tend to use them for educational purposes [30]. Smartphone addiction had two sides, as both a cause and an effect. Anxiety behavior to socialize and difficulty building an interpersonal relationship in the community cause the smartphone addiction, because through social media communication a person made connections through a new identity description for themself that they could not show outside the virtual world [31]. Therefore, by reducing the level of smartphone addiction through the most effective media educational program that suitable for the community, people may raise their interpersonal relationships in the community.

3.2.4. Pattern of Change in self-esteem

Like the previous discussion, people with addictive behavior who depend on using smartphones to get social functions can reflect the weaknesses of socializing outside the virtual world [30]. Our research found that by providing educational media program through social media, the mean scores of self-esteem through RSES assessment in the respondent group slightly decreased in condition of reducing smartphone addiction scores. On the other hands, the printed group experienced an increase in self-esteem scores. People who spend most of their time relying on social media to get relationships tend to have lower self-esteem. It was due to emotional adjustments in dealing with reality in the real world, with the number of relationships that were not as much as they got through social media [29]. People whose work and daily activities depended on the use of smartphones or other internet technology media, might experience addiction, but their self-esteem tended to be better than those who were limited by social function dependency through smartphone usage [26].

People with smartphone addiction and low self-esteem tend to form negative habits called preference for an online social interaction (POSI). They feel more secure, effective, and comfortable compared to their direct communication [32]. Low self-esteem also forms new characteristics in cyberspace, adjusting to the desires of the expected self-image that cannot be formed in the real world, comfort that gained by forming an ideal person according to their perception [33]. Therefore, our study assessed the importance of self-esteem measurement as one of the determinants of the effectiveness of educational media program along with the decrease in smartphone addiction, although we did not examine the relationship directly. Even so, there are still many things that affect a person's level of self-esteem, including differences in age, socioeconomic status, sociodemographic, gender equality in the surrounding community and cultural values [34].

4. CONCLUSION

The use of printed media in educational program was more effective in reducing smartphone addiction than social media. The decrease in addiction that occurs in both media education is statistically significant. Changes in interpersonal relationships and self-esteem were not significant along with the decrease of smartphone addiction. Interpersonal relationship scores increased with the change in smartphone addiction to non-addiction in both groups of educational media program recipients. The score of self-esteem in the group that received printed media increased, on the contrary it decreased in the group with social media educational program.

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