Social Media Addiction: Analysis on Impact of Self-esteem and Recommending Methods to Reduce Addiction

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Abstract. In today's world, everything moves towards virtual from the real world especially business, meetings, shopping, and connections to people. As technology makes life easier, everyone is slowly moving towards it. A platform that allows people to connect with other people all over the world is known as social media. Social media has a wide variety of features that make people stay on that platform. The use of social media has many benefits but excessive use of social media can degrade mental health, and physical health and can affect daily-functional life. Also, human mental health is closely connected to self-esteem. In this research, we have identified the impact of social media addiction on self-esteem and the impact of different variables such as notification response, age, gender, etc. on self-esteem and social media addiction. After analyzing the impact, we have suggested methods to reduce social media addiction based on all groups of people and based on similar social media addiction level groups of people using a collaborative filtering algorithm. As a result, we have found that there is a significant difference in self-esteem based on notification response, and a significant difference in social media addiction based on social media daily usage but there is no significant difference in social media addiction and self-esteem based on gender. Recommending methods to reduce social media addiction based on a similar group of people perform a bit better than all groups of people.

Keywords: Social media addiction · Self-esteem · Recommendation system · reduce social media addiction

1 Introduction

Over the last decade, there is numerous changes happening in smart technology. As technology innovates and updates, online platforms are becoming smarter day by day which leads to making people slaves to these platforms. Social media is a web and mobile based platform where individuals build a personal and professional network with other users, and communities and share their opinions, interests, and explore new things. As these platforms are easily accessible from everywhere, more people are started using them. According to global social media statistics research [1], up to July 2022, 63.1% people of the total population uses the internet, among them 59% of the total population

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of the world actively used social media and the daily time spent on social media is on an average 2 h and 29 min. Total users of social media and time spent on social media are still increasing.

Nowadays, multiple social media platforms are available to use based on different use cases that all have some common features such as attractive designs, interactive, creating and sharing own content, indefinite scrolling, smart recommendation, and building a network with other users. Although online platforms open a large number of opportunities for business, career, and day-to-day life activities in a very convenient and easy way, there is more chance to depend on these technologies. Social media provides individuals with continuous rewards that they're not receiving in real life, so they end up engaging in the activity more and more. This continuous use eventually leads to engaging more in social networking. When social network users repeat this cyclical pattern of relieving undesirable moods with social media use, the level of psychological dependency on social media increases [2].

Social media addiction is a behavioral addiction that is characterized as being overly concerned about social media, driven by an uncontrollable urge to log on to or use social media, and devoting so much time and effort to social media that it impairs other important life areas. In the non-virtual world, it's estimated that people talk about themselves around 30 to 40% of the time, in the virtual world people talk about themselves a staggering 80% of the time [2].

Being more active on social media can lead to physical diseases such as headaches, back, and joints pain due to unusual sitting positions, and eye strain. Unintentionally, staying in the same positions and focusing on screens for a long time without any fruitful work would also create mental health problems, that can affect behaviour, mood, concentration power, perception, self-esteem, life satisfaction, and more [3]. So, this study explores the impact of social media usage, and notification response on self-esteem and social media addiction based on different age groups and identifying relationship between social media addiction and self-esteem. Also, this study represents the recommendation of remedies to reduce or prevent social media addiction according to the social media addiction level of a particular user using a machine learning algorithm.

2 Related Work

Addiction is mainly related to using drugs and alcohol. In this digital era, as the number of smartphone users increases, it also increases the risk of addiction to technology especially addiction to social media [4]. As we all know that things are moving from offline to online, and excessive use of online tools can impact physical health as well as mental health that is proven by different studies.

One study is shown that social media addiction has a negative impact on self-esteem and social-avoidance and distress [5]. Some researchers in their study [6–9] pointed out that social media addiction has a positive correlation with depression, anxiety, and stress and a negative correlation with mental health. In the last decade, research conducted to find the effect of social media addiction on academic performance in different fields of students. The results from these studies concluded that academic performance is negatively impacted by social media addiction [6, 10, 11]. Another study [12], showed

that based on the type of use of social media has a different impact on social media addiction levels. Their research proved that entertainment use has more chance to lead to addiction and social use can reduce the impact of social media addiction.

The previous studies showed the direct and indirect impact of social media addiction on different variables and the effect of some mediators too by different analysis techniques yet very few research towards the reduction or prevention the effect of social media addiction. For that purpose, we created a recommendation logic that can help to reduce the effect of social media addiction based on addiction level and that helps to make an individual's life healthier at the physical and mental level.

3 Measures

3.1 Bergen Social Media Addiction Scale (BSMAS) [5]

The BSMAS consists of six items that are measured using 5 standard responses—1: very rarely, 2: rarely, 3: sometimes, 4: often, and 5: very often. The BSMAS score range is from 6 to 30. According to the score, it is interpreted as follows: 1: Low Addiction (score less than 12), 2: Moderate Addiction (score between 12 to 19), 3: High risk of being addicted (score more than 19) [13], 4: High addiction (More than 3 items scored more than 3 out of 6 items).

3.2 Rosenberg Self-esteem Scale (RSES) [5]

RSES has 10 questions of which 5 are positive and 5 are negative. The RSES items are measured using 4 standard responses – 0: strongly disagree, 1: disagree, 2: agree, 3: strongly disagree for positive questions, and 3: strongly disagree, 2: disagree, 1: agree, 0: strongly disagree for negative questions. The RSES score range is from 0 to 30. The score is interpreted as follows: 1: Low self-esteem (score less than 15), 2: Moderate self-esteem (score between 15 to 25), and 3: High self-esteem (More than 25).

3.3 Recommendation Methods [14, 15]

We have collected ratings for 17 methods which are taken from the internet and have ratings range 1 to 5 based on feasibility, effectiveness, and implementation complexity to reduce social media usage according to users' opinions. This rating is interpreted as 0: No preference, 1: ineffective/complex to 5: most effective/feasible/easy. The methods used for recommendation are defined in tips_data.csv [16].

3.4 Dataset Collection 1

We have collected data through google Forms which includes Bergen social media addiction scale (to calculate social media addiction score), Rosenberg self-esteem scale (to calculate self-esteem score), and users' information like age, gender, social media usage, etc. For the collection of data, we shared google form among students, faculties, and friends who are daily using social media. In total, we have collected 216 samples, of

which 122 were male (56.49%) and 94 were female (43.51%). The collected data have a raw value which is converted to standard value according to likert scale mapping to use in this research.

Cronbach's alpha is used to check the internal consistency of a survey. The survey used in our study has Cronbach's alpha is 0.699 which is acceptable for BSMAS and for RSES Cronbach's alpha value is 0.711 which is good. Descriptive statistics for social media addiction (SMA) and self-esteem (SE) are displayed in Table 1. Skewness and kurtosis values suggested that data were normally distributed, thus we applied linear regression for identifying the relationship between these two. Detailed questionaries, collected data, and preprocessed data are available on Kaggle [16].

Table 1. Descriptive Statistics of SMA and SE from dataset collection 1

Variable	n	M	SD	Skewness	Kurtosis
SMA	216	14.53	4.32	0.272	0.168
SE	216	19.03	4.14	0.047	0.622

3.5 Dataset Collection 2

We have collected the data through an online survey for user characteristics (age, gender, and daily social media usage), questionaries of BSMAS (to calculate social media addiction score), and ratings of recommended methods. In this dataset, we have collected 55 users' data for 17 methods which are mentioned in Sect. 3.3 that can reduce social media addiction. So, a total of 877 ratings are there after preprocessing collected dataset. The Questionaries used for this dataset collection, collected data, and preprocessed datasets which include users, ratings, and tips datasets that are used in current research are available on Kaggle [16].

4 Proposed Methodology

Our proposed system mainly focuses on two points:

1. Analyze the relationship between social media addiction and self-esteem using regression algorithms.
2. Suggesting methods that can reduce social media addiction using user-based collaborative filtering (user-based CF) and user-based CF with similar levels of addiction.

4.1 Statistical Analysis

1. Dataset collection 1 is used to analyze and find the relationship between self-esteem and social media addiction.

2. Next step, that we performed is data preprocessing which includes calculating the social media addiction score and self-esteem score based on Likert scale values. Also, assigned labels to the level of social media addiction and self-esteem based on social media addiction score and self-esteem score according to mentioned in Sects. 3.1 and 3.2.
3. After that, we applied different statistical tests to check the significance of different variables. We have applied a t-test to check the significance of the variable that is divided into two groups. For the variable that has more than two groups, applied the rank based the Krushkal-Wallis test to check the significance.
4. In step 4, we have done the multiple linear regression analysis between social media addiction and self-esteem. In this regression analysis, we used independent variables social media addiction, age, social media usage, notification response, and dependent variable self-esteem.
5. The last step is to evaluate the regression model using an R-squared value.

4.2 Recommendation System

1. Dataset collection 2 is used to create a recommendation engine model.
2. Using this data, calculated social media addiction scores and addiction labels of users for the collected dataset. Then, Split the dataset into user-item ratings and user personal information to use in the next steps. Also, the Rating dataset is split into train and test datasets.
3. The next step is to apply the recommendation logic and the steps are as follows:

    a. Find the social media addiction level of the particular user.
    b. Get a set of users (similar users) with the same social media addiction level. (skip this step for user-based CF)
    c. Find cosine similarity of a current user with all similar user Cosine similarity between users X and Y

$$sim(X, Y) = \frac{\sum_{i=1}^{n} Xi * Yi}{\sqrt{\sum_{i=1}^{n} Xi^2}\sqrt{\sum_{i=1}^{n} Yi^2}} \tag{1}$$

    where Xi is the rating score for item X by user i and Yi is the rating score for item Y by user i

4. Find the Rating score of similar users for a particular item
5. Remove the Rating score which has 0 value (Ratings not given) and cosine similarity values according to the removed rating score
6. Predict the user rating for a particular item using the sum of rating methods. Calculate the rating score of user u for item X using

$$R_{u,X} = \frac{\sum_{i=1}^{n} sim(u, i) * R_{i,x}}{\sum_{i=1}^{n} sim(u, i)} \tag{2}$$

    where i represents the user from the filtered user and Ri,x represents the rating for item X by user i.

7. Evaluate the model using the Root Mean Squared Error (RMSE) score

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} (P_i - O_i)^2}{n}} \tag{3}$$

where Pi is the predicted value of i and Oi is the actual value of i.

8. And the last step is to recommend 2 methods with the highest ratings that can reduce social media addiction.

NOTE: If the user is new and doesn't have any ratings then find the average ratings for each time and recommend 2 methods with the highest average ratings.

5 Results and Discussion

5.1 Statistical Analysis

We have collected a total of 216 samples which have 122 male (56.49%) and 94 female (43.51%) samples. After calculating the social media addiction score and self-esteem score, we have given labels to samples for the same. we have identified the relationship between social media addiction and self-esteem and the results show that a weak negative correlation exists between social media addiction and self-esteem. The R-squared score for this regression analysis is 0.214. Results from the statistical significance t-test and Krushkal-Wallis test are shown in the table (Table 2, 3, and 4).

Table 2. Statistical significance in SMA and SE by gender.

Variable	Category	N	M	SD	t-value
Gender					
SMA	Male	122	14.17	4.30	−1.398
	Female	94	15.0	4.33	
SE	Male	122	18.97	4.28	−0.229
	Female	94	19.10	3.97	

Table 3. Statistical significance in SMA and SE by age, social media usage time, notification response

Variable	Category	h-value
Age		
SMA	13–18, 19–25, 26–35, > 35	4.517
SE		6.143

(*continued*)

Table 3. (*continued*)

Variable	Category	h-value
Social media daily usage		
SMA	Less than an hour, 1–2 h, 2–3 h, 3–4 h, >4 h	37.764*
SE		5.098
Notification response		
SMA SE	Immediately, Immediately only if it's important, I don't respond if it's not important, As soon as possi-ble, Whenever took a phone, I put off the notification	7.436 12.153*

Table 4. Performance measurement for collaborative filtering algorithms.

Algorithm	RMSE
User based CF	1.355
User based CF with similar level of addiction	1.334

Results of the t-test showed that there is no significate difference in social media addiction and self-esteem by gender. And, in Krushkal-Wallis test results show that there is a significant difference in self-esteem according to a group of people based on notification response and a significant difference in social media addiction according to a group of people based on social media daily usage.

5.2 Recommendation System

We have applied two algorithms to predict ratings of tips and recommend the top 2 tips to the users. In the first algorithm, we predicted the ratings based on finding similarities between all users, and in another algorithm, we filtered the users based on addiction level and then recommended tips by finding similarities between groups of people with the same level of addiction. The performance is measured by calculating RMSE according to Eq. 3.

The results are shown that recommended tips for reducing social media addiction based on a similar group of people have a bit fewer error than simple user-based recommendations.

6 Conclusion

Even though many works have been done on the impact of social media addiction on various mental health factors such as stress, anxiety, depression, etc., day-to-day life activities such as job/studies, etc., and on physical health but there is very few research

available that can allow users to reduce or prevent from addiction. We have applied multiple linear regression to find out the relationship between social media addiction and self-esteem and found that they have a weakly negative correlation with each other. Also, responding to notifications has a significant difference in people's self-esteem and daily usage of social media has a significant difference in social media addiction levels. To reduce social media addiction levels or to prevent being addicted to social media, we have created a recommendation engine model that will suggest methods based on social media addiction levels. And the results have shown that the recommendation model with a group of a similar level of addiction users (RMSE 1.334) is slightly better than the recommendation model with all users (RMSE 1.355). In the future, these results can be verified by the defining group based on notification responses or daily social media usage. The recommended methods can also be collected from professional psychiatrists for more effective results. Even this study can be conducted as longitudinal research to find the reliability and effectiveness of different methods.

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