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Universal Design of ICT

Dissecting Social Media and TikTok for Children
and Young Adults

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OSLOMET

Preface

We presented this report for the fulfillment of the requirement to peruse a master's degree program in applied computer science hosted by Oslo Metropolitan University. I could not have been able to complete this report properly without the supports from the panel of my supporters. Initially, the defined task was to answer the developed hypothesis from a systematic literature review. The systematic literature review included studies related to TikTok as well as other social media, artificial intelligence algorithms and the effect of social media on the mental wellbeing and mental health of youth and teenagers. And then answer the hypothesis developed from a systematic review by conducting in-depth interviews and an online survey. We conducted interviews of 5 participants via zoom meeting after following all the legal considerations. But due to the limitation of time, I could not conduct a qualitative analysis from the transcripts derived from in-depth interviews to answer the hypothesis developed from the systematic literature review. I will complete an analysis of interviews and survey in future research to answer the hypothesis developed from the systematic literature review we organized in this thesis.

Firstly, I would like to thank my supervisor "Aiko Yamashita" for her supervision and support throughout the start to the end of this Master's Thesis. Her continuous guidance, suggestions, and motivation helped me a lot to work in the right direction.

I would also show my gratitude towards the panel of advisors who advised me in recruiting participants, fulfillment of legal requirements, and the guidance to research social media studies. I am thankful to all those participants who took part in an in-depth interview and helping hands as well as, those who helped to complete this thesis successfully.

Ananta Pathak

Oslo, August 14, 2021

Abstract

Artificial Intelligence (AI) systems have made social media so much interactive and easier to use. Several types of researches about AI systems used in social media, studies showing the effect of social media on mental health/wellbeing are available, but none of those researches has shown the impact of AI algorithms used in social media on the mental health of youth and teenagers. The main purpose of this thesis is to find out the effect of such AI algorithms used in social media like TikTok on the mental health/wellbeing of Norwegian children and young adults. We used a systematic literature review (SLR) approach to answer our research questions. We used Snowballing search method to search works of literature for systematic literature review. Initially, we selected 87 studies as candidate articles, and then after filtering them, we included only 36 studies for the systematic literature review. As a result of a systematic literature review, we found that the AI algorithms used in social media as an undetermined factor with which most of the young and teenage users are not familiar. Similarly, users are unaware of the working principle of those algorithms. So teenage and young users get regularly engaged to the application without knowing that, such AI algorithms are grabbing their attention to use social media which are affecting their mental wellbeing and mental health indirectly. The effect of AI algorithms comes along with the effect caused by social media on mental health and wellbeing. After analyzing all the 36 studies in a systematic literature review, we concluded with a hypothesis that AI algorithms might negatively affect the mental wellbeing and mental health of young and teenage users who are addicted to social media like TikTok in the form of anxiety, depression, lower self-esteem while, the reasons behind those problems are body image dissatisfaction, cyberbullying, fear of missing out, stranger danger, social isolation, social comparison, and being disconnected from social media. We found that users who got addicted to social media might also get problems related to mental wellbeing and mental health even after they are disconnected from social media. In this research, because of time limitations, we could not analyze the qualitative results from transcripts generated from the in-depth interviews to answer the hypothesis developed from a systematic literature review.

Keywords: artificial intelligence algorithms, AI algorithms used in TikTok, recommendation system, social media, effects of social media, Tiktok, mental health, mental wellbeing

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1. Introduction

Currently, 3.8 billion people are using smartphones and by the end of 2019 total number of mobile applications downloaded reached up to 204 billion ([Statista, 2019](#)). This implies that the use of the application in smartphones is gaining popularity. Different categories of mobile applications exist, such as communication, game, multimedia, travel, utilities, and productivity. Out of these categories, Social Networking applications are the most popular after gaming applications i.e., ([Islam et al., 2010](#)). Social Networking applications were the second most downloaded category worldwide from September 2019 to August 2020 ([Clement, 2020](#)), and in Jan 2021, over 3.96 billion people all over the world were actively using social media ([Dean, 2021](#)).

Currently, we use social media in our daily life for personal as well as professional use. An individual user uses social media for various purposes like communication, experience sharing, information sharing, find career opportunities, and so on. Likewise, business organizations are using social media as a platform for marketing and advertising([Akram & Kumar, 2017](#)).

One potential reason behind their unprecedented popularity is the design and Artificial Intelligence (AI) algorithms behind these applications ([Neyaz et al., 2020](#)). Investigative journalistic sources like The Guardian and the Economist hint that social networking sites and applications are designed in such a way that users get addicted to them ([Leslie, 2016](#); [Seymour, 2019](#)) They claim that AI algorithms are behind what is known as digital addiction([Abd Rahman & Razak, 2019](#)).

Social media are often designed using the design thinking model and the “hook model” ([Eyal, 2014](#)) to continue the engagement of users ([Kundu, 2020](#)). Features like infinite scrolls in social media increase the engagement of users by showing new news feeds with unlimited pages. By doing so, they make users engaged to the platform, leading them to spend as much time as possible on the app.

The business model behind social media like Twitter, Facebook, TikTok is an advertisement. As such, business organizations have to pay according to the scheme they use for advertising their products on these platforms. Both the activities of private users and business users are supervised by the AI algorithm used by social media platforms ([Harris, 2016](#)). Social media can retrieve the personal data of the users like name, age, sex, location, personal interest, online behaviors, and so on. AI algorithms can predict the choices of the user, suggest to users about different alternatives, and post advertisements by identifying the gender, location, interests, and age of the user ([SIFO, 2019](#)). Such functionalities of social media help the user to find the feeds and products of their interests but users are guided by those algorithms to make their choice so that they won't make their own choice and select the alternatives and suggestions made automatically by the AI algorithms ([Harris, 2016](#)).

Social media is popular among the youth all around the world because they help communicate and can be used for study purposes too. However, some researchers have found out that excessive use of social media can be hazardous, especially for the youth. Overuse of social media can bring problems like lack of security, information overload, and loss of social contact ([Drahošová & Balco, 2017](#)). Also, digital addiction might lead to reduced creativity as well as productivity in young users. Some of the common mental problems like anxiety, stress, depression, and loneliness can be seen in children and youth who use actively social media apps ([Bashir & Bhat, 2017](#)).

1.1. The knowledge gaps

Data published by Statista¹ shows that majority of users of social media in Norway are from the age range of 12 to 24. They spend most of the time using social media and in return, social media fills the demand of a user which leads to an increase in the habit of using social media day by day. The craze of social media uncovers its dark side, since its vast users are young, and often unable to figure out the impact of social media on their cognitive and mental abilities([Abd Rahman & Razak, 2019](#)).

¹ [Statista](#)

Some researchers have focused on specific social media like Facebook, Twitter, and online streaming platforms like Netflix and Amazon Prime([Shabir et al., 2014](#)). Most of the research papers are focused on the theoretical overview of how social media are affecting youth([Abi-Jaoude et al., 2020](#)).

In November 2017, when the Chinese karaoke/short video application, Douyin(TikTok in China) owned by an international technology company ByteDance merged with another karaoke app musical.ly TikTok became even more popular globally than ever ([Xiaoye, 2019](#)). There is surprisingly little research focused on Tiktok on the technical aspect. Research about how the TikTok algorithm works or how TikTok runs in the back-end has not been made yet. TikTok is the most used short video sharing application not only in Norway but all over the world. By using TikTok a user can make and upload a short video by adding sound effects and, video effects. Users can gain popularity and can even earn money as well if s/he can go viral. A user can upload the video in different categories like comedy, music, travel, beauty, sports, and performance and the user who is over the age of 12 can use the application. Backlinko², an official website providing online training in Search Engine Optimization and Digital Marketing shows that 69% of the total TikTok users are from the age group from 13 to 24.

Norway has 1.2 million active TikTok users based on data provided by Bloomberg³. Out of total TikTok users in Norway, 21% of the users were young and teenagers but after the coronavirus outbreak (COVID-19) the number of youth and teenagers increased up to 37% of the total users ([Tankovska, 2020](#)). This data implies that the craze of using TikTok by teenagers and youth in Norway is increasing.

Online news publishers like the Mirror, BBC, and The Guardian⁴ also showed that many teen TikTok users are having problems of depression, anxiety and even are doing suicide too. These are examples of the negative impact of TikTok on youth. As teenagers and young users are in increasing order, problems might also increase.

² [Backlinko](#)

³ [Bloomberg](#)

⁴ [Guardian](#)

There is surprisingly little research focused on Tiktok on the technical aspect. Research about how the TikTok algorithm works or how TikTok runs in the back-end has not been made yet. Without knowing how the application works it is difficult to point out the reason for the increasing craze and adverse effects of such application on youth.

Some researchers have published an article about the impact of social media on the youth of Norway as well as other countries in the world([Abi-Jaoude et al., 2020](#)). However, there are currently no studies examining the impact of Tiktok on the psychological health of Norwegian teens. Therefore, it can be argued that a study on AI algorithms used in Tiktok is very relevant for understanding and mitigating factors that can influence the psychological health of young users, in particular under the context of the COVID pandemic.

This project intends to examine empirically, the relationship between AI algorithms behind the social media TikTok and the psychological health of young Norwegian users age ranging from 12 to 24.

1.2. Aim of this Thesis

Previous studies have not been able to explain how the algorithms behind the social media TikTok affect the mental health of young and teenage users. This project has the aim to answer the main research question:

What are the effects of AI algorithms behind the Tiktok app on the mental well-being of Norwegian youth and teens age ranging from 12 to 24 years?

Sub-questions:

RQ 1. What mechanisms are used in social media to attract youth and teenagers of age ranging from 12 to 24?

RQ 2. What type of AI algorithms is being used in TikTok?

RQ 3. What are the effects of Tiktok on the physical and mental well-being of Norwegian youth and teenagers?

RQ 4. What is the relationship between AI algorithms used in TikTok and the mental well-being of Norwegian youth and teenagers?

2. Theoretical Background

2.1. Mental Health

There are different definitions for describing mental health and mental wellbeing. World Health Organization defines mental health as the mental situation in which a person can deal with intellectual powers like reasoning, thinking, ability to make a decision. S/he can deal with a stressful situation and can constructively use his/her ability. Good Mental health is important for a person at an individual level, societal level, and organizational level.

The mental health of a person depends on different factors like social, psychological, and biological. So, poor mental health is the situation where s/he cannot use her/his mental ability properly. A person with poor mental health might get easily stressed, easily gets emotional, might have decreased work productivity, has the habit of overthinking and symptoms of anxiety as well. Status of the society, gender inequality, too much work pressure, poor physical condition, refusal by the society, social and family violence are some of the reasons that might lead a person toward poor mental health ([WHO, 2018](#)).

Pilgrim defined positive **mental health** as the good state of psychological wellbeing or people who seem to be completely sane. Whereas people with negative mental health seem to have problems in their sound mental state ([Pilgrim, 2019](#)).

Negative mental health is also known as mental illness. Mental illness may affect a person thinking capacity, level of his/their concentration, thinking capacity, level of happiness, and behavior. Symptoms like change in behaviors, stressed, feeling of loneliness, decreased level of happiness, change in social interaction, change in eating behaviors, low self-esteem, addictive to digital devices, alcohol, and drugs, feeling of loneliness, are some examples of factors that lead a person towards mental illness like anxiety and depression ([MayoFoundation, 2021](#)).

Mental wellbeing is also defined in different ways. BBC defines mental well-being as a state where a person can have better physical health, can perform better in his/her work,

can tackle stressful situations, has good interaction with members of society and family, and can utilize his/her intellectual power in a better way ([BBC, 2020](#)).

Chartered Accountants Benevolent Association of UK defines **mental wellbeing** as a mental state of a person where s/he is a high level of self-esteem, can make a relationship with others, can think critically, can work effectively and efficiently. It is also an ability to tackle complicated and stressful situations in an easier way ([CABA](#)).

Anxiety can be seen as a feeling of uneasiness, nervousness, and worries caused by the fear of activities that might happen either from external reasons or internal reasons([Walker et al., 1990](#)). Several factors can increase the probability of growing anxiety-like trauma, personality, use of drugs or alcohol, stress because of illness, family problems, and so on. In the current context, over and regular social media usage is also becoming emerging the factor for developing anxiety among the youth social media users. ([Vannucci et al., 2017](#)) surveyed to find out the relationship between anxiety and social media usage among adults and young adults of the USA. It was found that there is a high probability for young users to have anxiety disorder those who consume social media daily for more time.

An article published by WHO defines **depression** as a condition of a person if s/he symptoms like depressed mood, decreased self-esteem, decreased power of concentration, decreased energy level, self-blaming, overthinking, and problems in sleeping and eating habit([Marcus et al., 2012](#)). Depression is a common problem that can be seen because of social, individual, biological, and psychological factors([WHO, 2020](#)). Several studies have shown that over social media usage is also a contributing factor for depression among youths. A systematic literature review conducted by ([Seabrook et al., 2016](#)) concluded that positive use of social media like positive interaction, social support, and communication can help a user to reduce the level of depression and anxiety whereas negative use of social media like social comparisons, addictive use, negative social interactions can lead to an increased level of anxiety and depression.

As we mentioned above in the definitions of anxiety and depression several factors are affecting the sound mental health and wellbeing of a person such as family background, environment, addiction, behaviors, social factors, and biological factors([WHO, 2018](#)). In our study, we are assuming other factors constant and taking social media addiction as one of the most active factors for causing mental illness to the adult in the present situation.

2.2. Algorithms and Artificial Intelligence

To know about artificial intelligence, one should have prior knowledge about algorithms. AI, Machine Learning, Computer Vision, and Natural Language processing all are branches of computer science heavily based on algorithms. and Machine learning. So, in this section, we are discussing all of the above terminologies briefly.

Algorithm: An algorithm is a chunk of codes and instruction used in computer science as well as mathematics to solve a specific problem in a certain period. Algorithms are used to develop various types of digital systems like social media platforms, e-commerce platforms, robotics, Artificial Intelligence systems, Machine learning, and so on. For example, the Recommendation algorithm, matrix factorization algorithm, etc.([Uspenski, 1993](#)).

Artificial Intelligence (AI): System that is programmed to make it capable of doing mental activities of a person like decision making, reasoning, solving mathematical problems, drive vehicle, write computer programs automatically, reasoning, automation, and so on. Simply it can be understood as systems empowered by human intelligence ([Nilsson, 2014](#)). AI is used in Google⁵ apps like Google Maps, Real-Time Navigation, Voice Assistant, Automatic video recommendation in video streaming platforms, etc.

Machine Learning (ML): Machine learning is a subdomain of AI where a system can conduct human intellectual activities. Machine learning is used to improve and upgrade the system automatically based on requirements after observing and analyzing the set of

⁵ [Google](#)

input data ([El Naqa & Murphy, 2015](#)). ML is classified into three categories as Supervised, Unsupervised, and reinforcement. Machine Learning is used for various purposes like Speech Recognition, Traffic prediction, Social Media services (Recommendation).

Computer Vision: Computer Vision is also the subdomain of AI which enables a system to detect digital media like images and videos to extract information from them. A System uses computer vision to convey information to the user about the digital media and also provides possible recommendations ([Szeliski, 2010](#)). Computer vision is used in social media applications like TikTok to analyze video uploaded by a user, google photos use computer vision to provide photo information.

Natural language processing (NLP): Natural Language processing is also a subdomain of AI. Nlp-enabled systems can accept the natural language of humans as an input in the form of text or voice to process that language to provide relative output to the user([Nadkarni et al., 2011](#)). For example, [LaMDA](#)⁶(product of google) uses NLP to generate natural conversations in dialogue applications, TikTok uses NLP in hashtag recommendations and to proceed and analyze audio of the uploaded video([Medina Serrano et al., 2020](#)).

2.3. AI algorithms used in social media and other digital platforms

In this section, we described some of the popular AI algorithms used in social media and other digital platforms Different AI and machine learning algorithms are being used in social media, video streaming platforms, and e-commerce platforms. The use of AI and Machine learning in such platforms can make the platform intelligent and capable of assisting customers/users to use such platforms ([Peng & Xin, 2019](#)).

Video Recommendation system: Video Recommendation system is one of the most popular AI-powered techniques used in video streaming websites and applications. Recommendation systems are also used in movie streaming platforms, e-commerce platforms, and mobile application directories. Recommendation systems are developed

⁶ [LaMDA](#)

by using various machine learning algorithms like item-based clustering, matrix factorization, collaborative filtering (CF), and ensemble algorithm([Ma & Wang, 2017](#)).

Collaborative Filtering: It is an algorithm mostly used in e-commerce platforms to recommend products to the customer. A collaborative filtering algorithm can detect the customer behavior to collaborate or group the customers having an interest in the same products. CF tracks the customer ratings of items and the K-Means clustering process to group products into different categories to evaluate consumers' behavior and interest([Wei et al., 2012](#)).

Matrix Factorization (MF): Matrix factorization is an algorithm used in a recommender system. Matrix factorization is used in Collaborative filtering to relate clusters of users with the cluster of items. Matrix factorization algorithm divides a query received from a user into two sub-groups to identify the associations between that user and the product and make recommendations for that specific user([kumar Bokde et al., 2015](#)).

Ensemble Algorithm: Ensemble algorithms is also one of the popularly used algorithms in recommendation system. In an ensemble algorithm, several machine learning algorithms are combined to form a new algorithm that is more efficient and effective than the performance of those algorithms individually. The ensemble algorithm is divided into three categories i.e. integral, parallel, and pipeline([Ma & Wang, 2017](#)).

Learning to Rank (LTR): LTR observes the quality of input data sets to rank the quality of a model. LTR uses supervised machine learning techniques to provide training to a model to accomplish the ranking task. LTR is mostly used in search engines. ([Raza & Ding, 2019](#)).

Content-based recommender systems (CBRSs): Context-aware recommendation systems are also one of the most used recommendation systems. It is applicable in the website and application of the hotel industry, restaurants, and online ticket booking websites. CBRS can track information of the user based on context s/he is browsing the system like time, place location, and so on. This system is matching the profile of the targeted user with the description and type of the product to recommend the product. The

system evaluates the personal rating of every user to categorize users to make recommendations ([Ricci et al., 2015](#)).

3. Methodology

The methodology builds upon two parts. A systematic literature review and an in-depth interview. A systematic literature review was conducted by following the Snowballing protocol. In the snowballing protocol, references listed in the papers are used to find other similar papers for referencing ([Wohlin, 2014](#)).

The systematic literature review will cover two topics:

1. Different AI algorithms used in TikTok, and
2. Effects of social media on the mental health and wellbeing of the youth and teenagers

Algorithms are considered to be the brain of any form of application. So, we used a systematic review to find out the different AI algorithms used in TikTok as well as other social media and reasons for the popularity of TikTok along with other social media among youth and teenagers. So, after the overview of those algorithms, we can relate the reason for the increasing attraction of youth towards the TikTok application. While researchers have already reported on the impact of social media on youth. Thus, we used SLR also to analyze the literature related to researches showing the relationship between social media and the mental health/wellbeing of youth, teenagers, and adolescents. From SLR we could develop a hypothesis to relate AI algorithms, social media, and their impact on the mental health of young and teenage users in the first part of our methodology.

The second part of the methodology consists of an in-depth interview and survey of Norwegian youths and adolescents aging between 12 to 24 years. We asked questions related to popular social media and TikTok in an interview. From-depth interview, we aimed to find out the mental illness and well-being-related problems caused by excessive use of TikTok as well as other social media by using mental health measures like depressive symptoms, symptoms of anxiety, level of stress, level of self-esteem, social-emotional distress, sleep quality, and internet addiction. And then answer the hypothesis developed from SLR after analyzing the qualitative data from in-depth interviews.

But due to time limitations and the current COVID-19 situation, we were not able to conduct interviews of a large number of participants and surveys. Although, we took an

in-depth interview of 5 participants via zoom meetings/ digitally from the age range of 12 to 24 years old, we could not analyze the transcripts generated from interviews to derive qualitative results.

3.1. A Systematic Review

A systematic literature review is a systematic way of collecting and analyzing the empirical studies to answer the research questions of the particular research/study ([Keele, 2007](#)). We used the snowballing technique to conduct the systematic review. Snowballing technique in a systematic review is the way of searching and collecting citation-relevant studies. Under the snowballing approach, a researcher finds out the relevant articles, observes the references used in those articles, and finally uses the relevant references used in those articles to find out other relevant articles. Researchers repeat this process until S/He cannot find other relevant studies([Sayers, 2007](#)). In the context of this project, we followed the guidelines provided by ([Keele, 2007](#)).

Those guidelines suggest searching the relevant articles in the online database and conduct a study thoroughly on that papers. We then observed the studies and research articles that meet our inclusion and exclusion criteria and made an overview of the references used in those articles. Relevant articles used on those articles were selected and repeated the process until I found the closely related articles to our study. Through this approach, We conducted a systematic study and analyze them to get the answer to our research questions.

We followed the guidelines developed by Kitchenham and Charters for conducting a systematic review([Keele, 2007](#)). Guidelines include (1) Developing Review Question;(2) Developing a review Protocol;(3) Defining inclusion and Exclusion Criteria; (4) Search strategy; (5) Quality Assessment; (6) Data Extraction; (7) Data Synthesis. Above mentioned research questions will be answered after completing the process of the review.

3.1.1. Developing a review protocol

Before conducting a systematic review, it is important to develop a review protocol. Review protocol provides guidance and rules to be followed while conducting a review. A review protocol was developed by following the template provided by Arthritis Research

UK Primary Care Centre([Jo Jordan, 2011](#)) and Dalhousie University online Library([University, 2011](#)). The review protocol included the tasks like the background of the study, objectives of the study, inclusion and exclusion criteria, Search Methods, quality assessment, data extraction, and narrative synthesis. [See Appendix A.](#)

3.1.2. Defining inclusion and exclusion criteria

Empirical Studies related to Social Media, Artificial Intelligence, AI algorithms, Mental health and Social Media, Social Media, TikTok, and AI we grouped as inclusion criteria. Studies published from 2015 to 2021 in the English language with full version were also eligible for the inclusion criteria. Research papers from online databases and websites were also included for the review. Studies that were not closely related to the area of this research were excluded from the study. Studies related to the research of video games and other platforms, studies not related to social media platforms were excluded from the study.

3.1.3. Search Strategy/Methods

We used an online database to search the relevant papers and the studies. Some of the most used databases are mentioned below:

- ACM Digital Library
- IEEE Xplore
- ScienceDirect – Elsevier
- Springer Linker
- Oria Digital Library
- Research Gate
- Google Scholar

We used keywords like “Artificial Intelligence in Social Media”, Algorithm used in Social Media”, “Impact of social media”, “Tiktok Algorithm”, “Advantages and Disadvantages of using Social Media” Effect of Social Media on the mental and psychological health of youth and teenagers”, “Social Media Usage”, “Short video mobile application”, “Recommendation algorithm”. We used other official online libraries like Frontiers in Public Health, Journal of Advanced Management Science to collect journals and articles closely related to our study.

At the first stage of our literature collection, we selected 87 studies as candidate articles closely related to our studies in the online database. To store the details of those articles, Microsoft Excel was used along with the endnote library. We used details of the literature like author name, year of publication, the number of references used, the title of the study, name of the online database, type of the study, and the keywords in the article. This systematic arrangement helped us to apply the snowballing principle easily and filter them based on their title, abstract, and relevancy of the studies.

We defined elimination criteria while conducting the paper selection process. In each iteration of the paper selection process, we applied elimination criteria. The studies having similar findings and information, studies having a similar title, closely related studies which do not reflect current/latest information, and repeated studies were eliminated. We also marked the papers that fall under elimination criteria as “eliminated papers”. The following selection process was applied:

Step1: We collect relevant studies and store them on an excel sheet and endnote database. We selected 87 research papers as the candidate papers. [See Appendix B.](#)

Candidate papers were denoted as CP.

CP = 87

Step 2: We eliminated the studies that fall under the elimination criteria as per our protocol. We prioritized newly published papers was so that we could get current information related to our study. Selected papers from candidate papers were denoted as SP1.

SP1 = 87- eliminated papers from CP

SP1 = 87-46 i.e., SP1 = 41

Step 3: We again observed the SP1 set of papers thoroughly to eliminate studies that fall under the elimination criteria of the paper selection process. I thoroughly observed all the contents of the papers in this stage before eliminating papers from SP1. This process was applied to find out the quality and relevant papers for the study. In this stage, selected papers were denoted as SP2.

SP2 = SP1- eliminated papers in second round of observation

$$\text{SP2} = 41-15 \text{ i.e., SP2} = 26$$

Step 4: We applied to snowball backward technique to the SP1 set of papers in the first iteration to extract more relevant papers.

Step 5: We applied snowballing forward in the SP1 set of papers in the first iteration to extract more relevant papers.

Step 6: We stored newly selected papers from snowballing forward and backward in an excel sheet along with the endnote library. We denoted newly selected papers from snowballing forward and backward as SB1.

$$\text{SB1} = 9 \text{ (backward)} + 4 \text{ (forward)} = 14$$

Step 7: We eliminated studies that fall under elimination criteria from SB1 as well after reviewing the abstract and title of the paper. And denoted the selected set of papers as SB2. In this stage, we conducted a second iteration to select the relevant papers to form SB1.

Step 8: We applied the snowball backward and forward on the SB2 set of papers. And stored newly selected papers along with SB2.

$$\text{SB2} = 13 + 4 \text{ (1st iteration + 2nd iteration)} = 17$$

Step 9: In this step also, we applied the eliminated studies that fall under elimination criteria. We thoroughly observed all the articles collected from SB2 and eliminate papers from SB2 based on the title, abstract, future works, and conclusion of the articles. Indicated a new set of papers as SB3.

$$\text{SB3} = \text{SB2} - \text{eliminated papers i.e., } 17 - 7 = 10$$

Finally, after step 9 we collected (SP2+ SB3) i.e., $26 + 10 = 36$ papers. We conducted a review of 36 high-quality, relevant and latest papers to answer the research questions of our study. We indicated the final set of papers for the study as FS.

The simplified flowchart of the selection process is presented below:

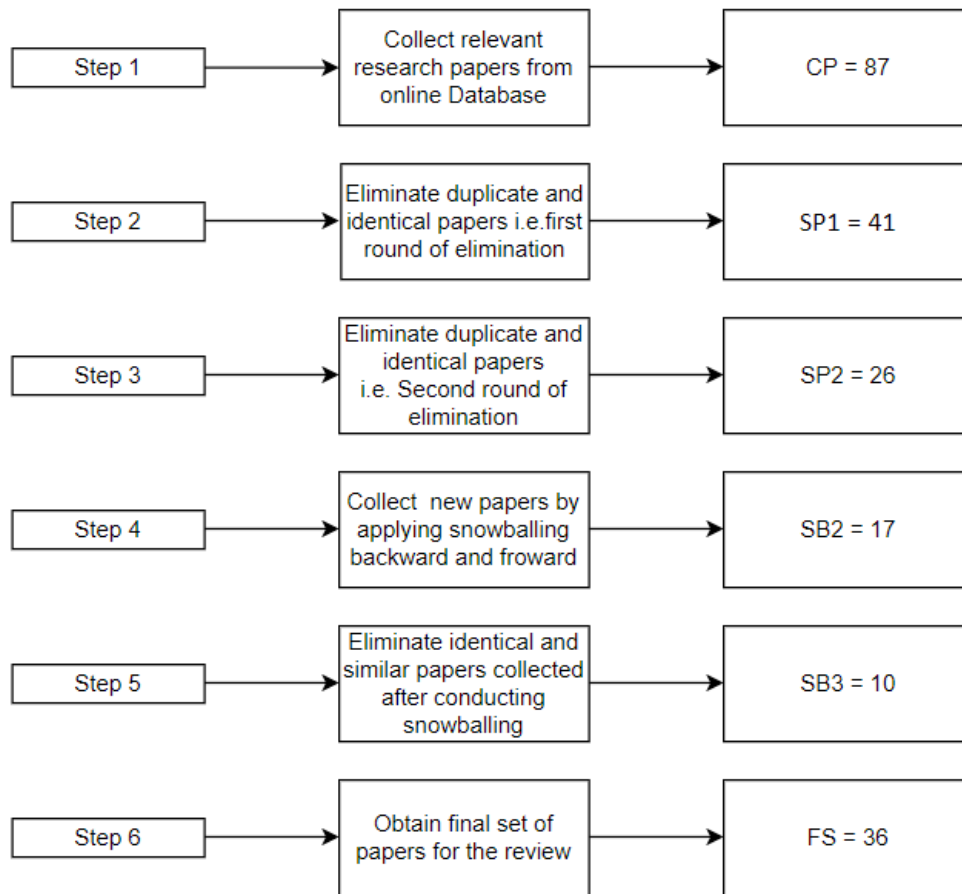


Figure 1: Stages of the study selection process

3.1.4. Quality Assessment

As per the guidelines provided by (Sayers, 2007) to find out the quality of papers selected for the review, We categorized those papers into three different criteria based on their relevancy, credibility, and rigor, considering these criteria four quality assessment criteria were developed to conduct this review(Dybbå & Dingsøy, 2008). Those four quality assessment criteria are listed below:

- i. Is the paper either related to social media, AI algorithms, or the relationship between the mental health of youth and adolescents with social media?
- ii. Is the paper able to provide relevant and latest data and information?
- iii. Is the paper able to describe the finding and analysis appropriately?
- iv. Does the aim of the paper is relevant to the aim of this study?

Following the QA guidelines, we reviewed all the papers individually and graded the quality of those papers. We graded the papers in three levels i.e., High, Medium, and Low as categorized in (Nidhra et al., 2013). The score for the high-quality paper was 5, Score for medium-quality papers was assigned 3, and the Score for the low-quality paper was assigned 1. To be selected as the highest quality paper, it should cover all the requirements for the review and that paper was assigned the rating of 5. Papers were graded as medium quality if they covered the fifty percent of requirements for the study and were assigned the rating of 3. Low-quality papers were assigned the rating of 1 and they must fulfill twenty-five percent of the requirement for the study.

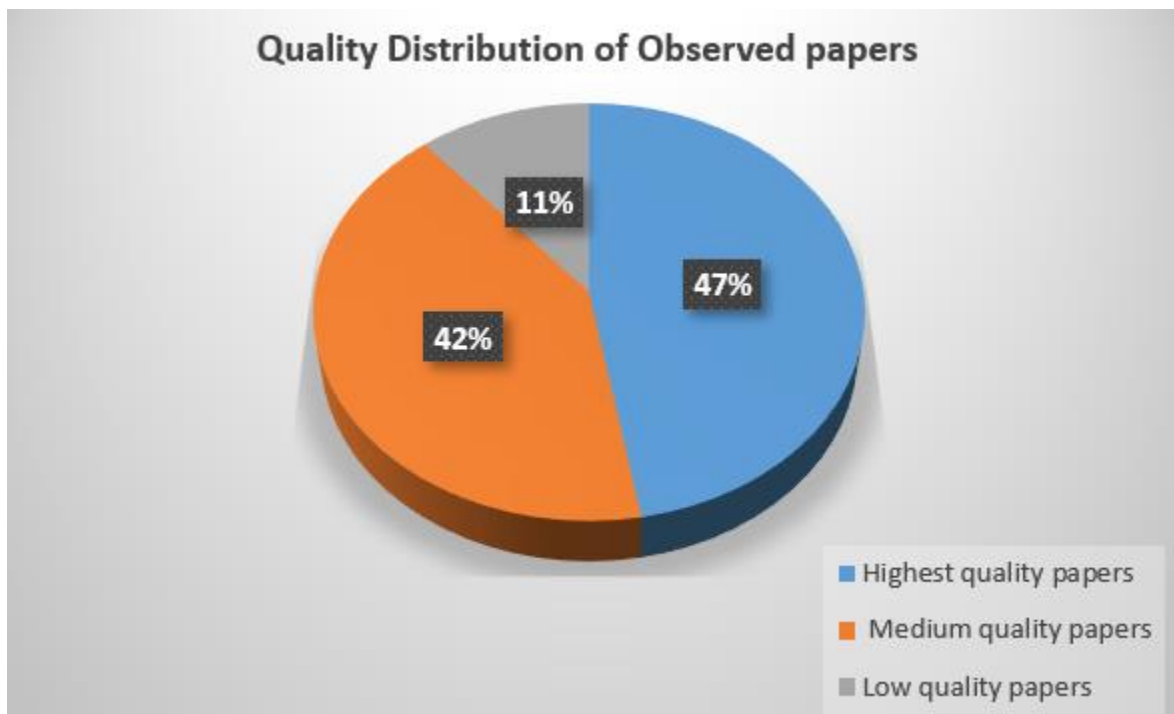


Figure 2: Quality distribution of table of papers being reviewed.

In this step, we did not eliminate any paper from the set of FS papers. During the paper selection stage, we conducted two rounds of selection based on the quality of the papers and eliminated papers having less importance for this study. We observed the quality of selected papers for the final study. The result of grading is shown in figure 2.

3.1.5. Data Extraction

We extracted data from all of the 36 papers that were included for the systematic review and prepared a separate excel sheet showing all the details of the study was formed. In the excel sheet, we mentioned information like the type of the study, motive, study population, number of references included, type of the study, name of the databases, types of the study, method of data analysis, data collection methodology, date of data extraction, and general terminologies used in the study. Such a systematic way of collecting information about the studies helped us to relate our research questions with the papers being reviewed.

3.1.6. Data Synthesis

We used narrative synthesis([Popay et al., 2006](#)) to answer the research questions of our study. Brief findings of all the 36 papers were mentioned in the narrative synthesis process. We also grouped the studies based on their finding and results. We also had a separate excel sheet to show the association between all the 36 studies and our research questions along with the topic our Systematic Review should cover. The final findings or the results from the narrative synthesis are presented in the next section as results.

The table below shows the sub details of 36 papers based on the title of the study, name of authors, year of the publication and name of the database, and the reference type. Similarly, we gave symbolic names to represent each of the final studies as Pap1, Pap2....., Pap36.

Symbol	Title	Authors	Conference Name/Name of Journal
Pap1	How do Norwegian Adolescents Experience The? Role of Social Media in Relation to Mental Health and Well-Being: A Qualitative Study	G. J. Hjetland, V. Schønning, R. T. Hella, M. Veseth and J. C. Skogen	BMC Psychology
Pap2	How algorithms see them audience: media epistemes and the changing conception of the individual	E. Fisher and Y. Mehozay	Media, Culture & Society 2019, Vol. 41(8) 1176–1191
Pap3	APL: Adaptive Preloading of Short Video with Lyapunov Optimization	H. Zhang, Y. Ban, X. Zhang, Z. Guo, Z. Xu, S. Meng,	Proceedings of the 2020 IEEE International Conference on Visual Communications and Image Processing (VCIP)
Pap4	The Reasons for Douyin's Success from the Perspective of Business Model, Algorithm and Functions	Baiyu Huang	Proceedings of the 6th International Conference on Financial Innovation and Economic Development (ICFIED 2021)
Pap5	Research on the Causes of the “Tik Tok” App Becoming Popular and the Existing Problems	L. Xu, X. Yan, and Z. Zhang	<i>Journal of Advanced Management Science Vol. 7, No. 2, June 2019</i>

Pap6	A Social Media Based Index of Mental Well-Being in College Campuses Mental Health Computing via Harvesting Social Media Data	S. Bagroy, P. Kumaraguru, and M. De Choudhury	In <i>Proceedings of the 2017 CHI Conference on Human factors in Computing Systems</i> (pp. 1634-1646).
Pap7	Exploring TikTok Use and Non-use Practices and Experiences in China	X. Lu, Z. Lu, and C. Liu	In <i>International Conference on Human-Computer Interaction</i> , pp. 57-70. Springer, Cham, 2020.
Pap8	"Stranger Danger!" Social Media App Features Co-designed with Children to Keep Them Safe Online	K. Badillo-Urquiola, D. Smriti, B. McNally, E. Golub, E. Bonsignore, and P. J. Wisniewski	In <i>Proceedings of the 18th ACM International Conference on Interaction Design and Children</i> (pp. 394-406).
Pap9	Visualizing Algorithmic Selection in Social Media	M. D. Muralikumar and M. J. Bietz	In <i>Conference Companion Publication of the 2019 on Computer Supported Cooperative Work and Social Computing</i> (pp. 319-323).
Pap10	Post-mortem digital forensic artifacts of TikTok Android App	P. Domingues, R. Nogueira, J. C. Francisco and M. Frade	In <i>Proceedings of the 15th International Conference on Availability, Reliability and Security</i> (pp. 1-8).
Pap11	A Framework for Understanding the Relationship between Social Media Discourse and Mental Health	S. Mendu, A. Baglione, S. Bae, C. Wu, B. Ng, A. Shaked, et al.	<i>Proceedings of the ACM on Human-Computer Interaction</i> , 4(CSCW2), 1-23.

Pap12	#Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression, and low self-esteem	H. C. Woods and H. Scott	<i>Journal of adolescence</i> , 51, 41-49.
Pap13	Social media? It's serious! Understanding the dark side of social media	C. V. Baccarella, T. F. Wagner, J. H. Kietzmann, and I. P. McCarthy	<i>European Management Journal</i> 36, no. 4 (2018): 431-438.
Pap14	Machine learning algorithms for social media analysis: A survey	Balaji T.K., Chandra Sekhara Rao Annavarapu, Annushree Bablani	<i>Computer Science Review</i> , 40, 100395.
Pap15	The relationship between highly visual social media and young people's mental health: A scoping review	McCrorry, Alanna Best, Paul Maddock, Alan	<i>Children and Youth Services Review</i> , 115, 105053.
Pap16	Negative consequences from heavy social networking in adolescents: The mediating role of fear of missing out	Eran Fisher, Yoav Mehozay	<i>Journal of adolescence</i> , 55, 51-60.

Pap17	"The Rise of TikTok: The Evolution of a Social Media Platform During COVID-19"	J. Feldkamp	<i>Digital Responses to Covid-19: Digital Innovation, Transformation, and Entrepreneurship During Pandemic Outbreaks</i> , 73-85.
Pap18	Exploring how and why young people use social networking sites	Laura Gray	<i>Educational Psychology in Practice</i> , 34(2), 175-194.
Pap19	Impact of social media on the health of children and young people	D. Richards, P. H. Caldwell, and H. Go	<i>Journal of paediatrics and child health</i> , 51(12), 1152-1157.
Pap20	The co-evolution of two Chinese mobile short video apps: Parallel platformization of Douyin and TikTok	D. B. V. Kaye, X. Chen and J. Zeng	<i>Mobile Media & Communication</i> , 9(2), 229-253.
Pap21	Investigating TikTok as an AI user platform "On the Psychology of TikTok Use: A First Glimpse From Empirical Findings"	C. Montag, H. Yang and J. D. Elhai	<i>Frontiers in Public Health</i> , 9, 62.
Pap22	Dancing to the Partisan Beat: A First Analysis of Political Communication on TikTok	Juan Carlos Medina Serrano, Orestis Papakyriakopoulos, Simon Hegelich	In <i>12th ACM conference on web science</i> (pp. 257-266).

Pap23	Security, Privacy and Steganographic Analysis of FaceApp and TikTok	A. Neyaz, A. Kumar, S. Krishnan, J. Placker, and Q. Liu	<i>International Journal of Computer Science and Security</i> , 14(2), 38-59.
Pap24	"Deep Learning-based Short Video Recommendation and Prefetching for Mobile Commuting Users "	Q. Li, Y. Zhang, H. Huang, and J. Yan	<i>International Journal of Computer Science and Security</i> , 14(2), 38-59.
Pap25	"Caching-aware Recommendations: Nudging User Preferences towards better Caching Performance"	L. E. Chatziefletheriou, M. Karaliopoulos, and I. Koutsopoulos	<i>IEEE INFOCOM 2017- IEEE Conference on Computer Communications</i> (pp. 1-9). IEEE.
Pap26	"An Ensemble Algorithm Used in Video Recommendation System"	L. Ma and X. Wang	<i>Journal of advanced management science</i> , 7(2).
Pap27	Exploring short-form video application addiction: Socio-technical and attachment perspectives"	Zhang, Xing Wu, You Liu, Shan	<i>Telematics and Informatics</i> , 42, 101243.
Pap28	Research Note: Spreading Hate on TikTok	G. Weimann and N. Masri	<i>Studies in Conflict & Terrorism</i> , 1-14.
Pap29	"User-Generated Short Video Content in Social Media. A Case Study of TikTok"	A. Shutsko	<i>International Conference on Human-Computer Interaction</i> (pp. 108-125). Springer, Cham.

Pap30	Context Recommender systems Context-aware Dimensionality reduction Contextual modeling User modeling	S. Raza and C. Ding	An overview. <i>Computer Science Review</i> , 31, 84-97.
Pap31	Uses and gratifications sought by pre-adolescent and adolescent TikTok consumers	C. B. Bossen and R. Kottasz	Emerald insight, <i>Young consumers</i> .
Pap32	A Study on the Characteristics of Douyin Short Videos and Implications for Edge Caching	Z. Chen, Q. He, Z. Mao, H.-M. Chung and S. Maharjan	In <i>Proceedings of the ACM Turing Celebration Conference-China</i> (pp. 1-6).
Pap33	Extending the Internet meme: Conceptualizing technological mimesis and imitation publics on the TikTok platform	D. Zulli and D. J. Zulli	<i>New Media & Society</i> , 1461444820983603.
Pap34	Watch, Share or Create: The Influence of Personality Traits and User Motivation on TikTok Mobile Video Usage	Bahiyah Omar, Wang Dequan	International Journal of Interactive Mobile Technologies (IJIM) · March 2020.
Pap35	Social Media Use and Mental Health and Well-Being Among Adolescents – A Scoping Review	V. Schønning, G. J. Hjetland, L. E. Aarø and J. C. Skogen	<i>Frontiers in psychology</i> , 11, 1949.

Pap36	Discursive contestations of algorithms: a case study of recommendation platforms in China	Jing Meng	<i>Journal of Communication</i> , 1-17.
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Table 1: Details of studies selected for SLR

Studies were grouped based on their association with the topics of the review.

Three focused topics of the review were:

- i. AI algorithm used in TikTok and other social media: Out of 36 FS sets of studies, 17 were included in this topic.
- ii. Studies related to the technical study of TikTok and reasons for the popularity of TikTok: Out of 36 FS sets of studies, 9 studies were included in this topic.
- iii. Effect of social media on the mental wellbeing of youth and adolescents: Out of 36 FS sets of studies, 10 papers were included in this topic.

4. Results from SLR

4.1. AI algorithm used in TikTok and other social media

Out of 36 selected studies, 16 studies were related to the study of AI algorithms used in social media and another type of digital media. I separated these studies based on the focus of the study. Some of the studies were focused on AI algorithms used in TikTok along with the reasons that are making TikTok so much popular among youth and adolescents. While other studies were focusing on other social media including TikTok.

Study	Study Aim
Pap2	Find out how algorithms are used in digital media grabs the attention of users and attracting users.
Pap3	To find out the effectiveness and efficiency of recommendation algorithms. Also, identify how users are attracted to social media using recommendation algorithms.
Pap5	Find out the reasons for the popularity of the “Tik Tok” APP based on the three aspects of a <i>marketing promotion strategy, user demand, and algorithm technology</i> , and identify problems seen in TikTok along with the solutions.
Pap8	Find out the perception of children users on the term “Stranger Danger” seen in social media like TikTok and co-designing online safety features in TikTok
Pap9	Find out the importance of graphics and <i>simple visualization</i> used in social media to find algorithmic awareness among users. Also, to find out the influence of visualization on user behavior.
Pap10	Study interactive features of TikTok and analysis of security level of TikTok
Pap14	Conduct a detailed survey to analyze social media and find a negative and positive impact of using machine learning in social media other apps/websites.

Pap17	Find out the reason for the popularity of TikTok and study the mechanism used by the TikTok algorithm.
Pap18	To find out how and why young people use social Media
Pap20	Find Similarities between Douyin and TikTok in the Technical aspect and highlight the strategies used by Douyin to operate in China and other countries.
Pap23	Technical evaluation of FaceApp and TikTok based on their data ownership, data management, privacy concerns, steganographic use, and overall security posture
Pap24	Evaluate the efficiency of recommendation algorithm used in Short Video creating applications
Pap25	Study of effectiveness of new caching-aware recommendation systems after integrating with recommendation systems in terms of speed, size, and user experience.
Pap26	Find out the importance of ensemble algorithms in video recommendation systems.
Pap29	Find out genres of the video mostly watched in TikTok based on age and gender.
Pap30	To differentiate between the algorithm used in context-aware recommendation systems and traditional recommendation systems.
Pap36	Study in the field of critical algorithm research by analyzing how discursivity interacts with the materiality of algorithms and influences algorithmic outcomes.

Table 2: Studies related to AI algorithm used in TikTok and other social media

Out of 17 studies mentioned in the table above, six studies (Pap3, Pap5, Pap10, Pap17, Pap20, Pap29,) were related to the technical study of TikTok only. They were particularly focused on describing the algorithmic part of TikTok along with the reasons for the popularity of TikTok. And remaining 9 studies were related to other social media including TikTok.

4.1.1. Studies related to the technical study of TikTok alone

Five out of six studies showed that most of the youth are attracted to use TikTok and most of the youth using TikTok in the present scenario. “Pap17” showed most of the TikTok users in the USA are between the age of 18 to 24 years old. 25.80% of users of TikTok in the USA are from the age of 18 to 24.

These five studies (Pap3, Pap5, Pap10, Pap20, Pap29,) also described the algorithmic/technical part of TikTok. They also have described that TikTok uses a recommendation engine to recommend videos to users. Due to the increasing use of social media platforms across the world, the rise of short video sharing applications, high rate of youth engagement in TikTok reflected the reasons for the popularity of the TikTok application from different aspects like the individual, social, business, and technical. Technical aspects of the study of TikTok included the powerful AI algorithm used in TikTok. “Pap5”, “Pap10”, “Pap20” focused on the study of the attractive features and function of the TikTok application were as “Pap3” focused on the study of techniques related to the video recommendation mechanism of TikTok. We have represented the aims of the study and their major findings in the table below:

Paper	Aim	Findings
Pap3	<p>To find out the effectiveness and efficiency of the <i>Adaptive Preloading mechanism for short videos based on Lyapunov Optimization (APL)</i> in recommendation systems used in short video applications like TikTok.</p>	<p><i>Adaptive Preloading mechanism for short videos based on Lyapunov Optimization (APL)</i> was faster, accurate, and less bandwidth-consuming for TikTok than previously used video preloading mechanism for recommendation system. APL used a greedy algorithm that was based on <i>Lyapunov optimization theory</i>. Because of low bandwidth and fast buffering time users can watch and upload more videos than they are intended. This action of users might pull them towards addiction to short video sharing platforms like TikTok.</p>
Pap5	<p>Find out the reasons for the “Tik Tok” APP being popular based on the three aspects of a <i>marketing promotion strategy, user demand, and algorithm technology</i>, and identify problems seen in TikTok along with the solutions.</p>	<p>Content recommendation system and human key point detection system used in TikTok, marketing strategies used in Tiktok, and the business model of TikTok were the reasons for the popularity of TikTok. As young users are targeted age groups most young users, as well as users from other age ranges, are attracted to the application. AI algorithm used in TikTok can recommend similar content to users their preferences. This recommendation ultimately encourages users to engage in an application for more time. Continue engagement of users on contents make users hooked to the application as a result, users have to face negative consequence like trauma because of fake information, exposure to unethical contents, cyberbullying, etc...</p>

<p>Pap10</p>	<p>Experimental study of interactive features of TikTok and analysis security level of TikTok App installed in Android operating system.</p>	<p>TikTok uses algorithmically controlled hashtags function to categorize the videos based on their genre. Similarly, TikTok recommends videos based on searches made through hashtags. Users can use the platform with or without making an account. Features like audio and video templates, filters, a big database of music, easy video editing features, audio-video mixing features, fast recommendation system have made TikTok popular. Similarly, functionalities like “follow”, following”, “likes”, “comments”, “add other users as a friend”, “messaging function” has added more value to the TikTok application. These features and functions of TikTok have made TikTok so much popular among young users. Those young users might get exposed to fake news, illegal activities, sexual content which might lead them to post-traumatic stress disorder.</p> <p>After the experiment made on the privacy issues, authors were able to retrieve the messages exchanged between the user, details of users, details of photos, and videos watched by a user in the TikTok application. This privacy issue might make TikTok users unsecured about their data. This insecurity might make users Digital phobic.</p>
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Pap17	Find out the reason for the popularity of TikTok and study the mechanism used by the TikTok algorithm.	<p>Users are attracted to TikTok because of features like <i>video challenging programs, video recommendation on for you page, and following page</i>. Due to these video challenge features most young users are encouraged to uploads videos on daily basis to express themselves on TikTok. They consume much time in creating and editing videos. Similarly,</p> <p>to identify user interests TikTok collects activities such as likes, the content they create, comments, views, types of video watched, and other information like contact details, location, browsing history, mobile carrier, time zone, operating system, platforms, IP address, and unique device identifier. After analyzing all the information of the user, the recommendation system makes users get excited and motivated to view videos of their choice without using any effort. This easy service encourages them to spend more time on applications by watching more videos. Overusing such applications on daily basis might lead to negative consequences.</p>
Pap20	Find Similarities between Douyin and TikTok in the Technical aspect and highlight the strategies used by Douyin to operate in China and other countries.	ByteDance, the parent company of TikTok and Douyin has got success in china as well as the rest of the world because of the customized platform provided by the company. Both TikTok and Douyin have a similar business model and machine learning algorithms used.

Pap29	Find out genres of the video mostly watched in TikTok along with the reasons for popularity among young users.	It was found that features of TikTok like shooting short videos, sharing videos, music filters and effects, networking functions have attracted younger users. Comedy, musical, dance, do it yourself and informative videos were the most popular genre in TikTok followed by musical performances.
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Table 3: Findings and aim of the studies related to the technical study of TikTok alone

H. Zhang, Y. Ban, X. Zhang, Z. Guo, Z. Xu, S. Meng, (Pap3) found that TikTok used to load videos on the recommendation queue to recommend the video as per user preference. This technique was used to reduce the duration to load video and maintain a smooth playback system in the application. But this recommendation queue technique was not quite efficient so the authors proposed an Adaptive Preloading mechanism for short videos based on Lyapunov Optimization (APL), the technique for short video sharing applications like TikTok. *Adaptive Preloading mechanism for short videos based on Lyapunov Optimization (APL)* was faster, accurate, and less bandwidth-consuming for TikTok than previously used video preloading mechanism for recommendation system. APL used a greedy algorithm that was based on *Lyapunov optimization theory*. Because of low bandwidth and fast buffering time users can watch and upload more videos than they are intended. This action of users might pull them towards addiction to short video sharing platforms like TikTok

The study conducted by Li XU (Pap5) showed that the Content recommendation system and human keypoint detection system used in TikTok, marketing strategies used in Tiktok, and the business model of TikTok were the reasons for the popularity of TikTok. Although young users are targeted age groups, most of the young users as well as users from other age ranges, are attracted to the application. Data shows that the TikTok application is also on the list of top 10 most downloaded smartphone applications all over the world between the years 2010 and 2019 ([Domingues et al., 2020](#)).

Features of TikTok like *Dance Dancer* function based on human body key detection technology to attract youth users. Human body key detection technology is an AI technology used to detect the size, posture, and movement of the body of a user to

generate a virtual image and record information ([Jalal et al., 2019](#)). In the Dance dancer function, the dancer can record his/her dance video of 15 to 60 seconds digitally. Then s/he can add sound as well as video effects based on the movement of the body made while dancing ([Xu et al., 2019](#)). Similarly, other features like video templates, filters, visual effects, add augmented reality in the video, audio effects, live streaming, follow and unfollow users, instant messaging, commenting on the post have made this application so much popular. Researchers state that TikTok has a powerful recommendation algorithm that can recommend videos based on user's interests and the hashtag's function is also an important component to recommend videos of a different genre to users. The algorithm directs a user to the category of a video s/he searching for, s/he don't have to search the videos manually. Videos are displayed automatically on the screen. The recommendation system, recommends videos to a user based on tags and keywords used while searching and uploading videos. These tags and keywords are particularly known as hashtags. Hashtags are analyzed by the algorithm and then used to classify the genre of video. For example, if a user searches for a #comedy video, the TikTok search function will retrieve all the videos related to the comedy genre([Xu et al., 2019](#)). Similarly, if a user uploads a video using #comedy, the video will be added to the collection of videos related to the comedy genre. Recommend engine stores and analyze such behavior of a user and recommends videos of similar genre. So, the AI algorithm used in TikTok can recommend similar content to users their preferences. This recommendation ultimately encourages users to engage in an application for more time. Continue engagement of users on contents make users hooked to the application as a result, users have to face positive consequences like increase in creativity, gain popularity, increased connection, economic benefit whereas negative consequence like trauma because of fake information, exposure to unethical contents, cyberbullying.

The study by D. B. V. Kaye, X. Chen and J. Zeng (Pap20) found out the similarity between the function of TikTok and Douyin and found that the popularity among the millions of teens and adults all over the world from 2019 because of their functions and feature ([Kaye](#)

[et al., 2020](#)). Users can create short videos of 15 seconds and 60 seconds. The main reason behind the popularity of this application all over the world is the functions, features, business model, and platform governance. TikTok has unique features than other social media. A user watches videos without creating an account on the platform. TikTok focuses on *user-generated content* (UGC). A user can watch videos of his/her interest without uploading any video, without following any users, and without being followed by anyone. In the discover panel recommendation engine recommends trending hashtags based on location and user online behavior. Similarly, the TikTok application automatically shows the list of top live streams. A streamer can receive virtual gifts and convert them into digital coins gifted by a viewer. A viewer has to buy digital coins to buy virtual gifts using a debit/credit/master card. Other popular short video sharing applications and social media like Facebook, Snapchat, and YouTube are not built with such features. So TikTok becoming more popular than other platforms. Other features like video editing, sharing, and uploading and the functions like attractive graphic user interface, *influencer marketing*, location-based content recommendations have attracted most of the users. Machine Learning algorithms control all of these features and functions in the backend of the TikTok application.

J. Feldkamp (Pap 17) found that TikTok is using a powerful Artificial Intelligence algorithm to recommend, display, and provide customized videos to the users by evaluating their choices and activities on the application. Users are attracted to TikTok because of features like *video challenging programs, video recommendation on for you page, and following page*. Due to these video challenge features most young users are encouraged to uploads videos on daily basis for self-expression. They consume much time in creating and editing videos. Similarly, to identify user interests TikTok collects activities such as likes, the content they create, comments, views, types of video watched, and other information like contact details, location, browsing history, mobile carrier, time zone, operating system, platforms, IP address, and unique device identifier. After analyzing all the information of the user, the recommendation system makes users get excited and motivated to view videos of their choice without using any effort. This easy service encourages them to spend more time on applications by watching more videos. Meanwhile because of attractive features and functions users of the younger generation

can use TikTok as a free tool to edit their videos and upload their videos. They can use their smartphone to capture, edit and upload short videos anywhere at any time. So younger users are much more attracted to use TikTok than other forms of cloud video editing applications. Overusing such applications on daily basis might lead to negative consequences.

A. Shutsko (Pap29) made a content analysis of TikTok to find out the type of videos that are most popular in TikTok and gender mostly attracted on TikTok. It was found that features of TikTok like shooting short videos, sharing videos, music filters and effects, networking functions have attracted younger users. Comedy videos were most popular in TikTok followed by musical performances. The researcher stated that users of the younger generation are much focused on content creation along with networking. Younger users are found to be involved in unethical and inappropriate content creation to become popular, show their feelings, earn money, and so on.

P. Domingues, R. Nogueira, J. C. Francisco, and M. Frade (Pap10) found TikTok is one of the most downloaded applications which is most popular among users who are less than 30 years old. TikTok app has various interactive features that a user can use but it has a more complex internal structure. TikTok uses secured cloud services to store the inner data which is very hard to access. Tiktok uses algorithmically controlled hashtags function to categorize the videos based on their genre. Similarly, TikTok recommends videos based on searches made through hashtags. Users can use the platform with or without making an account. Features like audio and video templates, filters, a big database of music, easy video editing features, audio-video mixing features, fast recommendation system have made TikTok popular. Similarly functionalities like “follow”, “following”, “likes”, “comments”, “add other users as friend friend”, “messaging function” has added more value to the TikTok application. These features and functions of TikTok have made TikTok so much popular among young users. Those young users might get exposed to fake news, illegal activities, sexual content which might lead them to post-traumatic stress disorder.

But after the experiment authors were able to retrieve the messages exchanged between the user, details of users, details of photos and videos watched by a user in the TikTok application installed in an Android operating system.

4.1.2. Studies related to the technical study of other social media including TikTok

Among 11 studies related to the technical study of other social media including TikTok, most of the studies stated that modern social media and digital media are using an algorithm that uses machine learning to recommend videos and content to the users. Authors have expressed their findings in different ways. Aims and major findings of these 11 papers are presented in the table below:

Paper	Aim	Major Findings
Pap2	How algorithms are used in digital media grabs the attention of users and attracting users.	Machine learning, deep learning, and AI algorithms used in digital media are used for the decision-making process. Algorithms see the user as a customer so that they analyze the personal data of a user to predict the online behavior of the user, categorize users, categorize content based on user behavior so that the recommendation engine can provide personalized. Personalization and segmentation made by algorithm attract more users to the platform and encourage exiting users to consume the content for more time.

<p>Pap8</p>	<p>Find out the perception of child users on the term “Stranger Danger” seen in social media like TikTok and co-designing online safety features in TikTok</p>	<p>Children were unknown about the possible threats that might be caused because of strangers connected from social media outlets. Children wanted to support and assistance from their seniors, parents as well as applications to minimize the online risk of strangers.</p>
<p>Pap9</p>	<p>Find out the level of algorithmic awareness among the users by using a prototype developed by using graphics and <i>simple visualization</i>. Also, to find out the influence of visualization on user behavior.</p>	<p>Algorithms are used by social media like Facebook and Twitter to analyze information of the user to provide customized content for the users. But users are unaware of the working principle of those algorithms so that they were motivated to use the application for more time. The habit of absorbing most of the contents recommended by the platform might lead to consequences like over-dependency on social media and over trust in the information of social media related to specific categories only.</p> <p>The prototype developed by authors by using graphics and visualizations to know algorithmic awareness of users did not lead to increased understanding of users about the algorithm.</p>

Pap14	<p>Conduct a detailed survey to analyze social media and find the negative and positive impact of using machine learning in social media and other app/websites.</p>	<p>The use of machine learning in social media and web apps can help systems to increase their speed, increase accuracy, understand the audience, be helpful to deploy new and attractive features, and also deal with big data. Recommender systems used in such apps/websites might make a user irritated because of similar recommendations. The authors concluded that social media analysis is important to solve mental problems caused by social media such as low self-esteem, anxiety, and depression.</p>
Pap18	<p>To find out how and why young people use social Media</p>	<p>Young people use social networking sites (SNS) to contact their family and friends, make plans for programs, share identity with others, watch the news, play games watch videos, make friends with strangers, and know them closely. SNS usage differs from user to user based on age and gender.</p> <p>Young people felt sad and agonizing because of activities in social media like fake friendship, cyberbullying, being trolled, unethical videos, a connection request from a stranger, and hate comments.</p>

<p>Pap23</p>	<p>Study on technical features of FaceApp and TikTok. Also evaluate data policy, security, and privacy issues of these apps.</p>	<p>TikTok uses an AI-enabled hashtags system, video editing, and sharing features with addictive filters like funny, sad, old, young, angry, and so on. These features might make young users addicted to the platform. TikTok does not support encryption of videos and photos exchange between users which has made the user a little bit unsecured about their data. Similarly, <i>facial recognition technology</i> and <i>deep fake</i> technology can create a threat to the user, as there is a chance of misuse of the face of the user uploaded in the photo.</p> <p>Users might get insecure about their data and might get feared by Stanger, and feel uncomfortable exposing themselves.</p>
<p>Pap24</p>	<p>Evaluate the efficiency of recommendation algorithm used in Short Video creating applications</p>	<p><i>Data recommendation</i> and <i>prefetching techniques</i> were found to be efficient enough and were able to forecast the user's behavior and make a recommendation with a <i>recall rate</i> of 100%. As a result, the system could recommend short videos based on user behavior. Because of decreased waiting time, users might use the application for more time by watching the recommended videos in that application.</p>

<p>Pap25</p>	<p>Study of effectiveness of new caching-aware recommendation systems after integrating with recommendation systems in terms of speed, size, and user experience.</p>	<p>The suggested <i>caching-aware recommender systems</i> provide a comprehensive change in performance of the current caching system in terms of cache size, size of content library, and scope of caches for better user experience. Better caching and recommender systems can determine the user demand for content to store the user's online behavior to make a further recommendation. Caching-aware recommender systems are designed to hook the user to the platform by consuming content, product, and services.</p>
<p>Pap26</p>	<p>Find out the importance of ensemble algorithm in recommendation algorithm.</p>	<p>As a result, newly developed algorithms had better performance in comparison to the other two algorithms individually in the video recommendation system. Newly developed algorithms boosted the efficiency and effectiveness of the recommendation system. The findings of this study have helped to better understand the recommendation algorithms used in social media.</p>

<p>Pap30</p>	<p>To differentiate between the algorithm used in context-aware recommendation systems and traditional recommendation systems.</p>	<p>After modifying traditional recommender systems <i>Context-Aware Recommender System (CARS)</i> was developed. CARS can observe the context of a user s/he using the application and after that algorithm can analyze his/her user profile to recommend the relevant contents. So, recommendation systems that are designed by incorporating a <i>context-awareness</i> system help a user for decision making and select products and services based on their interest which might reduce the content searching time and control information overload.</p>
<p>Pap36</p>	<p>Study in the field of critical algorithm research by analyzing how discursivity interacts with the materiality of algorithms and influences algorithmic outcomes.</p>	<p>TikTok has emerged as a unique platform that is based on only short videos as content and those videos are also only generated by users themselves. TikTok has attractive and unique features like infinite scrolling, auto play, video recommendation, sharing, a platform to earn digital currency, and audio-video editing that can make users addicted.</p> <p>After evaluating the preference and interest of each user after analyzing data like comments, shares, time consumed on video, dislikes, list of favorite videos, an algorithm generates a personalized list of recommended videos for each user in their account. Similarly, the algorithm used in TikTok helps to <i>monetize</i> the channel of users based on popularity which ultimately motivates users to spend more time watching and uploading creative, inspirational content. These unique features have made TikTok different than other social media platforms so that most of the young users are getting addicted to the platform.</p>

Table 4: Studies related to the technical study of other social media including TikTok

For social media analysis, T. Balaji, C. S. R. Annavarapu, and A. Bablan (Pap14) found most of the social networking sites and applications are using recommender systems. A user can use social media to share videos and photos but with the help of Machine learning and computer vision technology, social media can detect the details of the product s/he wear or use in that photo or video. After detecting the details of product social media platforms starts to recommend product of similar brands used by that user. Social Media can recommend personalized advertisements of products to every user. Authors also stated that nowadays social media are using machine learning technologies like anomaly detection, behavioral analysis, event detection, recommenders, sentiment analysis, business intelligence, image analysis, and reputation for business purposes as well as to make the user attracted towards such platforms. The use of machine learning in social media and web apps can help systems to increase their speed, increase accuracy, understand the audience, deploy new and attractive features, and also deal with big data. AI used a recommender system might make a user irritated because of similar recommendations.

E. Fisher and Y. Mehozay (Pap2) found digital media like Amazon, Netflix, or Spotify are using recommendation engines that are developed based on AI algorithms. The recommendation engine delivers the right and relevant content to the user after observing a user, identifying the interest and preference of the user. The algorithm is a new technique used by digital media to know their user. The authors assumed that Algorithm can identify the online behavior of the user, categorize users based on data and information provided by them so that the platform can recommend content and make the user attracted to use that platform. Modern digital media uses socio-technical features like “User-generated data”, “Data from interconnected platforms”, and “Algorithms” to know the behavior of the user. Personal data of the user and online behavior of user are recorded by traced and recorded to provide the personalized feed to the users. Digital media using AI algorithms can provide options of search and discover the contents. These

features help the platform to attract new users and encourage the existing user to consume the contents of the platform for more time.

L. E. Chatzieftheriouss et al (Pap25) studied the importance of recommendation systems and caching systems used in different video streaming applications using the experimental method. Recommendation systems are designed to provide content to the user based on their preferences and interest. This creates users to demand more and more contents because of the simplicity created by the recommendation system. Similarly, contents that are recommended at higher rates have a high chance of getting a greater number of views which is beneficial for the content sharing platform. While Caching helps recommendation system to increase its efficiency and accuracy. The authors conducted an experiment where they found that newly suggested caching-aware recommender systems provide a comprehensive change in performance of the current caching system in terms of cache size, size of content library, and scope of caches for better user experience. Better caching and recommender systems can determine the user demand for content to store the user's online behavior to make a further recommendation. Caching-aware recommender systems are designed to hook the user to the platform by consuming content, product, and services.

L. Ma and X. Wang (Pap26) in an experimental study showed the importance of ensemble algorithms in recommendation systems that are used in e-commerce platforms as well as video streaming systems. The new recommendation system was developed by merging *recommendation algorithms based on item clustering and matrix factorization*, with *a collaborative filtering algorithm based on data smoothing*. As a result, the newly developed algorithm had better performance in comparison to the other two algorithms individually in the video recommendation system. Newly developed algorithms boosted the efficiency and effectiveness of the recommendation system.

S. Raza and C. Ding (Pap30) conducted a literature review to differentiate between the algorithm used in context-aware recommendation systems and traditional recommendation systems. After modifying traditional recommender systems Context-Aware Recommender System was developed. CARS can observe the context of a user

s/he using the application and after that algorithm can analyze his/her user profile to recommend the relevant contents. Recommendation systems can automatically detect and suggest the type of data and information a user is searching for. Recommendation systems can be helpful for the user to find the contents of their choice easily and increase the user experience and user satisfaction. Recommendation systems are mostly used in e-commerce websites, social media, e-library, e-learning, e-governance, and e-business. Some of the most used algorithms in recommendation systems were Matrix Factorization Algorithm and the Learning to the Rank algorithm.

Q. Li et al (Pap24) used an experimental method to show the efficiency of a short video recommendation system. The authors used *data recommendation* and *prefetching techniques* to observe the efficiency and accuracy of the existing short video recommendation system used in short video application applications which is based on deep learning. This technique was found to be efficient enough and was able to forecast the user's behavior and make a recommendation with a *recall rate* of 100%. The algorithm was able to track datasets like user avatar, user nickname, user constellation, video ID, video release time, video image, video description, number of likes/comments/ shares, and video file. Such tracing ability of algorithm provides videos to the user based on their interest and preference. The recommendation algorithm is useful to minimize the waiting time of the user while browsing and searching the relative videos.

L. Gray (Pap18) conducted a survey and an interview of 412 young participants to find out the reason for using social media and their perception of social networking sites (SNS). Females are considered to be the frequent user of SNS then than males. The number of users increased based on increments made on the age of participants. Young people use SNS to contact their friends, make plans for programs, share identity with others, make friends with strangers, and know them closely. SNS usage differs from user to uses based on age and gender. Young users who consider online interactions are different from their real-life have more possibility of having online risks and engaging themselves in activities related to cyberbullying.

The majority of users insisted that they were using SNS for communication. Users of the highest and second-highest age groups concluded that SNS had mad made them

unhappy and uncomfortable. It was found that most of the young users were affected by the negative side of SNS which made them uncomfortable and unhappy.

Jing Meng (Pap36) has focused on the algorithmic property of the Chinese version of TikTok i.e., Douyin. TikTok has emerged as a unique platform that is based on only short videos as content and those videos are also only generated by users themselves. TikTok has attractive and unique features like infinite scrolling, autoplay, video recommendation, sharing, platform to earn digital currency, and audio-video editing might make users addicted. After evaluating the preference and interest of each user after analyzing detectable data like comments, shares, time consumed on video, dislikes, list of favorite videos, an algorithm generates a personalized list of recommended videos for each user in their account. This property of the recommendation algorithm shows that it is helping the user for a better user experience. Similarly, an algorithm is capable of developing users' interests and preferences in the platform. i.e., an algorithm used in the platform suggests every user do activities while signing in and using the application. Meanwhile, the algorithm creates an individual profile of each user in the backend, based on the user behavior and information provided by a user so that the application can recommend the personalized video. The user also follows some of the suggestions. The nature of the algorithm can be considered as it is creating the user's interest. Likewise, the algorithm used in TikTok helps to *monetize* the channel of users based on popularity which ultimately motivates users to spend more time watching and uploading creative, inspirational content. These unique features have made TikTok different than other social media platforms so that most of the young users are getting addicted to the platform.

The author also surveyed 760 comments on the Douyin algorithm on Weibo, 367 respondents showed negative feelings toward the algorithm. And 9% of respondents commented negative feelings considered the algorithm as addictive.

Research conducted by A. Neyaz, A. Kumar, S. Krishnan, J. Placker, and Q. Liu (Pap23) found a younger group of users are mostly attracted and are addicted to the TikTok application. They also explained TikTok is using a powerful Artificial Intelligence algorithm to recommend, display, and provide customized videos to the users by evaluating their choices and activities on the application. To identify user interests TikTok collects

activities such as likes, the content they create, comments, views, types of video watched, and other information like contact details, location, browsing history, mobile carrier, time zone, operating system, platforms, IP address, and unique device identifier. TikTok uses an AI-enabled hashtags system, video editing, and sharing features with addictive filters like funny, sad, old, young, angry, and so on. These features might encourage young users to engage in the platform for more time... TikTok does not support encryption of videos and photos exchange between users which has made the user a little bit unsecured about their data. Similarly, facial recognition technology and *deep fake* technology can create a threat to the user, as there is a chance of misuse of the face of the user uploaded in the photo. Users might get insecure about their data and might get feared by Stanger, and feel uncomfortable exposing themselves.

A study by P. Domingues et al (Pap9) found out that AI algorithms used in social media like Facebook and Twitter can filter information, interest as well as details of every user. Algorithms are so much power that they can recommend and display personalized posts for every user on their news feed section. But users are not aware of the operating mechanism of such. Similarly, video streaming applications and websites like Netflix and Amazon also use recommendation algorithms. The recommendation algorithm in Netflix and Amazon uses the location of a user to recommend different categories of videos like popular videos of that specific location, trending videos of that specific location, Top ten popular movies, and TV series of that specific location. As a result, it was found that Use of Visualization was not applicable to measure the level of the algorithm used in specific social media but somehow affects user behaviors.

K. Badillo-Urquiola et al (Pap8) studied the negative impact of social media on and children. The researcher used one of the popular terminologies “stranger danger” which means the risk that can be caused by the strangers/unknown person in the social media. It can be in different forms like receiving strange messages, inappropriate posts, and videos, stalking by strangers on social media like TikTok. Such online threats might bring a mental and psychological impact on the mentality of the children. The result from the

survey found out that some of the children were unaware of the risks they have to face after using social networking sites. Children were unknown about the possible threats of strangers connected from social media outlets. Children wanted to support and assistance from their seniors, parents as well as applications to minimize the online risk of strangers. Different strategies were concluded to assure online safety of children like systems/applications used by children can be easily monitored by their parents, notification systems (for both parent and children) about the possible online threat and social media applications should be built with an automated system that can inform the ways to minimize online risk.

4.2. Studies related to the technical study of TikTok and reasons for the popularity of TikTok

We grouped studies related to the technical study of TikTok along with the reasons for the popularity of TikTok among adolescents as well as another user group. 9 studies out of 36 studies selected for SLR were grouped in this group. Studies in this group relate the mental well-being of youth adolescents with the algorithm used in social media. Studies of this group also insisted that most youth and adolescents are engaged in certain types of social media like TikTok.

Paper	Aim of the Study	Major Findings
Pap4	<p>To study the reasons behind the popularity and success of TikTok in three different aspects i.e. Algorithmic property, Corporate structure, Features, and Functions.</p>	<p>The corporate model of TikTok such as monetization of the user account, tutorials to promote personal video of a user, online advertising system, football clubs, companies to use the TikTok application. Similarly, the recommendation algorithms used in TikTok suggest videos to users based on their online activities. Because of the easy user interface and fast recommendation system, users are spending more time watching short videos.</p>
Pap7	<p>Collect the views of three types of users of Douyin, the Chinese version of TikTok, and observe the effectiveness of its recommendation algorithm.</p>	<p>The recommendation algorithm works more efficiently and effectively if the users watch more and more videos. And in return recommendation system provides more similar content to the user. People who were not using Douyin were afraid of being addicted to the app. People using the app currently expressed their view on the recommendation system as they have a better user experience and their reason to get engaged on the platform is the recommendation system.</p>

<p>Pap21</p>	<p>Identify Why, How and Which group of people use TikTok and the impact of using Tiktok</p>	<p>Most of the very young users are attracted to TikTok to create, view, and comment on short videos. AI based interactive design of TikTok such as “likes”, for you page”, “infinite scrolling and content availability” lead a user to use the platform more than they were intended to use the application.</p>
<p>Pap22</p>	<p>Analyze the interactive features of TikTok and evaluate how TikTok is used for communicate in political purpose</p>	<p>Interactive features like the user-generated content sharing system of TikTok, duet functions, recommendations systems have attracted political activists to share their views and opinions. Tiktok stores a lot of information about the user which might make a user insecure regarding data protection issues.</p>

Pap27	Aims to find out the factors that create make users addicted to short -forms video apps.	<p>Overuse of short-form video applications might be seen as addictive to the user based on their age, sex, and the environment they are living in.</p> <p>It was found that short-form video app addiction is favorably influenced by interpersonal bonding between users.</p> <p>Users' addiction to short-form video is positively influenced by the emotional attachment of a user to the platform. <i>Similarly</i>, technical factors like <i>personalization, application design, and entertainment</i> are positively related between users and website/app attachment.</p>
Pap28	Provide a descriptive content analysis of TikTok videos posted in early 2020 and find out reasons for its popularity.	<p>AI algorithms used in TikTok can provide fresh, innovative, and relevant content to the user based on the user's interest and has hooked most of the young users. TikTok has unique features than other social media applications. Because of these unique features, TikTok is popular among youth and children.</p>

Pap32	<p>Study of characteristics of 260 thousand short videos of Douyin (Chinese version of TikTok) and find a relation between the number of views and number of likes in Video.</p>	<p>The recommendation algorithm evaluates the attributes of the video, activities of the user, and details of the users, to match with the user's interest and recommended videos based on their interest. Among Likes comments, shares, and Views, it was found that there is a good association between Likes and Views to determine the popularity of TikTok/Douyin videos.</p>
Pap33	<p>Conduct a critical analysis of TikTok in the technical part.</p>	<p>Design of TikTok like “<i>default for you page</i>”, “<i>easy sign-up process</i>”, video editing features” “automatic grouping of user-generated contents”, and norms for video creation and consumption” has affected the pattern of user engagement and encouraging users to use the application directly or indirectly. TikTok uses a powerful <i>personalization algorithm</i> that can filter and recommend content based on user patterns.</p>

Pap34	Identify the usage behavior of TikTok users in various aspects such as consumer behavior, participating nature, and producing behavior. And find out the association between personality traits of users and TikTok usage behavior.	Users were self-motivated to use TikTok to express themselves in digital media, express their talent out into the world, interact with new people, and get entertained/get out of their boring life. But there was no association between personality traits and usage behaviors of a user.
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Table 5: Studies related to the technical study of and reasons for the popularity of TikTok

X. Zhang, Y. Wu and S. Liu (Pap27) researched to find out the possible factors of social media addiction including TikTok. The authors used 10 hypotheses and conducted a survey to answer those hypotheses. The hypothesis was intended to relate social system, technical system, interpersonal attachment, neuroticism site attachment with short-form video app addiction.

Overuse of short-form video applications might be seen as addictive to the user based on their age, sex, and the environment they are living in. It was found that short-form video app addiction is favorably influenced by interpersonal bonding between users. Users' addiction to short-form video is positively influenced by the emotional attachment of a user to the platform. *Similarly, technical factors like personalization, application design, and entertainment are positively related between users and website/app attachment. Similarly, social factors like social interaction anxiety and social isolation are directly affecting interpersonal bonding between the users.* Thus, it was concluded that socio-technical functions and features used in short-video applications like TikTok like design interface, user interface, recommendation systems, easy video editing features have attracted users to these applications. Users are being dependent on the features and functionalities of the application. The attraction of the user with the short-video application has influenced them to be addicted to those applications. Ultimately, the user being addicted to short video applications and social media like TikTok seems to be affected mentally and psychologically.

X. Lu, Z. Lu, and C. Liu (Pap7) researched the Chinese version of TikTok (Douyin) showed that the recommendation algorithm used in Douyin recommends videos after identifying the user's pattern of using the application. The effectiveness of the recommendation algorithm depends on the number of videos watched by users and the increased efficacy of the algorithm ultimately helps users to browse videos of their interest and region. Young users are the targeted user group of Douyin so there is a high probability of young users being addicted.

The researcher divided users/respondents into four groups i.e., currently using, avoided using permanently, avoided using temporarily, and never used. Respondents who are currently using Douyin stated that they are using it for entertainment, music, commercial, social and positive energy. Current users were also attracted by the intelligent recommendation system used in Douyin. And those who never used responded that it is a total waste of time and resource, might be an addiction, lack of privacy, useless videos and might be vulnerable for society and youth. Some of the respondents also said that Douyin might put the relationship between couples in danger.

Bahiyah Omar, Wang Dequan (Pap34) conducted an online survey of 385 TikTok users using TikTok actively to find out their reasons for using TikTok. Researchers concluded that users were self-motivated to use TikTok to express themselves in digital media, express their talent out into the world, interact with new people and get entertained/get out of their boring life. A person can express their talent, joy, and sorrow with other people out in the world in the form of video via TikTok. People are using TikTok to get out of their boring life and get entertained by comedy videos, dance, and funny videos. Personality traits of the users have a lesser effect on the usage behaviors. Authors found multiple features of TikTok like messaging, comment, like, and share encouraged users to interact and communicate with another unknown user. Similarly, a user can watch videos posted by him/her in the future. TikTok can be a good platform to store memories in form of videos. Authors say users are motivated to use TikTok because it provides a free platform to store thousands of videos. This study has mostly focused on finding different motivations of a user to find out their TikTok usage behaviors.

G. Weimann and N. Masri (Pap28) researchers state that TikTok selected teenagers as their targeted users it is the most popular application among children and teenagers. Data shows that 41% of the TikTok users are between the ages of 16 and 24. Social media like TikTok are built with unique algorithms. AI algorithms used in social media can provide fresh, innovative, and relevant content to the user based on the user's interest and has hooked most of the young users. TikTok has unique features than other social media applications. Because of these unique features, TikTok is popular among youth and children. TikTok features like the "For You" page, following page, uses an algorithm that can recommend videos to users based on their browsing history as well as personal details. The recommendation algorithm used in TikTok might also push the young user to be hooked on the application because they don't have to waste time searching videos of their interest and can watch unlimited videos.

C. Montag, H. Yang, and J. D. Elhai (Pap21) conducted a narrative review describing the Social Media Platforms' use and Mental well-being. The author suggested that one has to find out answers related to who, why, and how people use social media and study the design pattern of that social media to relate social media use along with human psychological processes and mental wellbeing.

The author also insisted that social media platform is designed attractively and provides services to attract user and spent maximum time on that platform. Features and functions such as "like", "infinite scroll", "for you page", "following page", are controlled by AI algorithms that attract users to use TikTok for a longer time than s/he was intended to use. Such activity might drag a user towards TikTok addiction. TikTok attracts young users so that most of the TikTok users are young and adolescents. They are the most vulnerable group of users and have the chance of getting psychologically influenced positively or negatively after using the platform.

more focus.

D. Zulli and D. J. Zulli (Pap33) Research made on critical analysis of the technical structure of TikTok using grounded theory and walkthrough method concluded that TikTok has attracted users of different age ranges but most of the women aged 18-24 are mostly influenced by TikTok. The author suggests naming TikTok as an encyclopedia of short and creative videos filled with audio-visual effects. Design of TikTok like "default for

you page”, “easy sign-up process”, video editing features” “automatic grouping of user-generated contents”, and norms for video creation and consumption” has affected the pattern of user engagement and encouraging users to use the application directly or indirectly. TikTok uses a powerful personalization algorithm that can filter and recommend content based on user patterns.

Baiyu Huang (Pap4) researched the reasons behind the popularity and reasons for TikTok being popular than other social media in three aspects i.e., Algorithms used internal business structure and design. One of the reasons TikTok being popular is the algorithm and design used in TikTok. An algorithm is designed in such a way that it can recommend video after observing the user signup process and default pages, services used by the user like video-editing, and types of video a user watches and upload. Similarly, the recommendation algorithm used in TikTok can suggest videos to users based on their activities in TikTok like genres of videos watched, search history, videos liked, influencers followed, trends followed, videos shared, and so on. TikTok has the special feature that videos can be shared across other platforms as well as the messaging function of TikTok. TikTok algorithms automatically make a user watch videos but users are unknown that algorithms are manipulating their choice so that they spend a lot of time on the application. The business model of TikTok like monetization of user account based on their content, system to provide online tutorial for an e-commerce company, tutorial to promote personal video of a user, online advertising products of other companies has attracted many celebrities, football clubs, companies to use the TikTok application. TikTok is easy to use and everything is automatically controlled by algorithms so that most of the young users are attracted to use the application for entertainment, kill boredom and kill time.

Z. Chen, Q. He, Z. Mao, H.-M. Chung and S. Maharjan (Pap32) The authors also studied the properties and attributes of 260 thousand short videos uploaded by users on Douyin (Chinese Version of TikTok). Applications like Douyin, TikTok, Instagram, and YouTube are focusing on User Generated Content. Douyin is using a decentralized system for

delivering content to the user. Similarly, Douyin collects the information and attribute of the short videos like tag used in the video, video id, location, size, upload date, number of viewers, bit rate, play duration, verification type, an official certification of the user, number of comments, likes and share and video popularity. Along with the video attributes Douyin also tracks the user's profile, other social media they are using, the number of users they are following, and the number of users following them. Factors such as Like, comment, share, and view are used to measure the popularity of TikTok videos. It was found that there is a good association between Likes and Views to determine the popularity of TikTok/Douyin videos. The recommendation algorithm evaluates the attributes of the video, activities of the user, and details of the users, to match with the user's interest and recommended videos based on their interest. The authors also found that popular videos are highly recommended by the recommendation system and are also cached on the servers.

Machine learning and artificial intelligence algorithm used in TikTok recommend different genres of video to the first-time user during the signing-in process. Genres of videos like animals, comedy, art, beauty, sports, food, and travel are provided. After this process user is automatically moved to the "For You" page. Videos on the "For You" page are presented based on the user's topic of interest and engagement pattern. The personalization Algorithm used in TikTok is capable to filter users' details, genres selected by a user, liking, commenting, and sharing activities of the users. TikTok provides the details like the number of followers a user has, number of videos liked and commented by him/her to classify the type of user. This classification motivates a user to upload more videos which ultimately gets the users hooked to the platform.

Similarly, video effects, sound effects, and video labeling features like "Trending," options to add to favorites", sharing in other social media, "notifications of newly uploaded videos," "Green Screen facility," "Editing feature," "recommending videos of different categories like beauty, Funny, World, Animal", and so on are also generated with the help of Artificial Intelligence system integrated with the application. These interactive features have also attracted most of the young users to use TikTok. The authors concluded that TikTok is encouraging users to use the platform via different viewpoints like algorithmically, digitally, and socially.

Juan Carlos Medina Serrano, Orestis Papakyriakopoulos, Simon Hegelich (Pap22) researched TikTok from a political perspective and found that TikTok is becoming an interactive platform to share political views. Interactive features of TikTok have attracted political activists to share their views and opinions. Tiktok stores a lot of information about the user which might make a user insecure regarding data protection issues. One can distinguish a video creator based on political party s/he supports after watching videos shared by him/her. It is becoming the platform to share political views in the audiovisual medium. Interactive features such as duet video, hashtags, like, share a comment, Livestream, and discovery have attracted users. People are using the duet video function to share political content. TikTok uses a machine-learning algorithm that can identify content related to politics and recommend those content to the user interested in political content with the help of the recommendation system. TikTok stores a lot of information about users like personal details, appearance, voice, creativity which makes recommendation system easier to recommend videos of their interest but there is a greater risk of exposure to those data as well.

4.3. Effect of social media on the mental wellbeing of youth and adolescents:

Out of 36 selected studies for the systematic review, 10 studies were related to the study of the effect of social media on the mental wellbeing of youth and adolescents all around the world. We considered the findings of those studies to answer the research question that is related to the study of the effect of social media on the mental wellbeing of youth and adolescents. The research was conducted from different perspectives and locations.

Studies	Study Aim	Major Findings
Pap1	Aims to find out the positive and negative aspects of Social media among adolescents through a qualitative approach.	Positive aspects: Get connected and increase social support. Negative aspects: Chances of getting addicted to social media, development of mentality to compare with other, low self-esteem, sleeplessness, <i>fear of missing out</i> (FOMO), an increased level of stress.
Pap6	Identify the effectiveness of using the Mental Well Being Index (MWI) to Measure the mental wellbeing of several university students by using data generated from social media.	The mental wellbeing Index is a perfect tool to find out significant forms of mental well-being of students on campus based on size, type, and students' density of students on the campus.
Pap11	Link messaging function used in social media with mental health, mental wellbeing, and personality of a user.	Authors conclude social media is one of the major factors that affect the mental wellbeing of users but depends on the nature of the individual user.

<p>Pap12</p>	<p>To examine how nighttime use of social media and emotional investment in social media related to sleep quality, self-esteem, anxiety, and depression in adolescents.</p>	<p>Adolescents who had the habit of using social media more frequently both during the day and night time and who were emotionally attached to it were found to have the worst sleep quality, lower self-esteem, greater anxiety, and sadness level. Users who are emotionally connected to social media might feel troubled, lonesome, upset, disconnected, feels like they are out of the digital world if they are unable to social media. These feelings also affect the mental well-being of the adolescent user.</p>
<p>Pap13</p>	<p>This paper illustrates the negative roles of social media on society and individuals.</p>	<p>Unwise use of social media like cyberbullying, addictive use, trolling, scamming, the spread of fake news, data misuse can bring threat to an individual, societal as well as organizational levels. As a result, an individual might have poor mental wellbeing, an organization might have degraded performance and goodwill whereas society might be separated into several groups in social media digitally.</p>

<p>Pap15</p>	<p>This study is focused on finding the relationship between high social media and the mental health of youth by conducting a scoping review.</p>	<p>Highly visual social media provides a platform for users to share their daily activities in the form of an image. Adolescents are mostly engaged in social media sites. The relationship between highly visual social media and the mental wellbeing/mental health of young people seems to be unclear because of the lack of adequate qualitative research and the lack of an accurate tool to measure highly visual social media behaviors.</p>
<p>Pap16</p>	<p>Study the role of fear of missing out. Show relationship between We analyzes the role of fear of missing out (FOMO) and show the relationship between psychopathological symptoms, the impact of social networking sites, and level of social media usage.</p>	<p><i>Networking Intensity scale (SNI)</i> and Fear of missing out (FOMO) both intercede the relationship between the study of mental illness. One might use social media for many hours on is a mobile device because of easiness which might lead to mental problems like anxiety and depression. Girls that are more depressed tend to use more SNS whereas boys with a higher level of anxiety lead to increased use of SNS.</p>

Pap19	Aims to find out the impact of social media on the health of children and young people.	Social media has a greater impact on the mental health of children and young users. It has affected the mental aspects like self-esteem and the well-being of children and young users.
Pap31	Find out the online behavior or pre-adolescents and adolescents' group in TikTok.	It was found that both pre-adolescents and adolescents who are consuming TikTok for identity-creation, social networking, fame-seeking, talent presentation, and entertainment are not aware of the negative impacts of using TikTok.
Pap35	Scooping review to show the relationship between Social Media use and mental health and well-being of adolescents.	Most of the pieces of literature found an overt connection between social media and mental health. The majority of the pieces of literature found a positive relationship between more regular use of social media and poor mental well-being and mental health of adolescents.

Table 6: Studies related to the effect of social media on the mental wellbeing of youth and adolescents

S. Mendu, A. Baglione, S. Base, C. Wu, B. Ng, A. Shaked, et al (Pap11) state over 35% world population are engaged in a certain type of social media platform. Facebook Messenger, Twitter, and WhatsApp are the form of Digital text communication (DTCs) popular among young adults. In this study, researchers introduced a framework (SocialText) to identify features and extract datasets of such DTC to relate with the mental

wellbeing of the user aged between 18 and 22. To identify the level of mental illness researchers used different mental traits like anxiety, loneliness, and personality. After observing the social media messages of participants researchers were able to find out that social media also can alter the mental state of the users. Authors conclude social media is one of the major factors that affect the mental wellbeing of users but depends on the nature of the individual user.

C. B. Bossen and R. Kottasz (Pap31) aims to find out the online behavior or pre-adolescents and adolescents' group in TikTok. But pre-adolescents were more active than adolescents. It was found that both pre-adolescents and adolescents who are consuming TikTok for identity-creation, social networking, fame-seeking, talent presentation, and entertainment are not aware of the negative impacts of using TikTok. The survey conducted on the Danish population showed that most of the users of TikTok are from the age of 11 to 16 years.

M. De Choudhury et al (Pap6) studied the mental health issues and mental wellbeing index of 100 universities/college students in the USA using social media (Reddit). Health issues like depression and anxiety were addressed. It was used to analyze the mental wellbeing index of university students. A study showed that mental health problem in university students is increasing every year. Mental health expression seems to be increasing during the academic period and tends to decline during summertime. Similarly, the mental wellbeing index was lower for the students of public and large universities also with a large number of female students whereas the mental wellbeing index of students studying in popular, expensive, and highly ranked universities was higher.

H. C. Woods and H. Scott (Pap12) found that 54% of young people in the world spend their time using social media and 90% of them are using it during the day and night. Researchers hired 467 Scottish students aged 11 to 17 to study the relationship between social media usage and their sleep quality, mental wellbeing, and self-esteem. Users who are emotionally connected to social media might feel distressed, isolated, upset, disconnected, feels like they are missing content if they are unable to social media. These feelings also affect the mental wellbeing of an adolescent user in the form of anxiety, depression, and poorer sleep quality. Adolescents who had the habit of using social

media more frequently both during the day and night time and who were emotionally attached to it were found to have the worst sleep quality, lower self-esteem, greater anxiety, and sadness level. Similarly, excessive use of social media might increase the level of depression, decrease sleep quality and self-esteem.

Richards et al (Pap19) researcher conducted a literature review of related research papers published between 2010 and 2015 to find out the effect of Social media on the health of children and young people. It was found that adolescents from 43 countries had a higher level of depression after being the victim of cyberbullying. The number of suicide cases among young people increased in the USA and Australia as a result of cyberbullying. Social media has a greater impact on the mental health of children and young users. It has affected the mental aspects like self-esteem and the well-being of children and young users.

C. V. Baccarella et al (Pap13) focused on the study of negative aspects of social media like Facebook, Twitter, Instagram, and Snapchat. Researchers found activities like cyberbullying, trolling, the spread of fake news, issues related to privacy abuse, catch fishing, using other's identity to connect with other people in social media are common in social media. Such activities are affecting users at an individual, societal and organizational level. They also found that social media functionalities can also bring negative impact to the society, individual and organizational level. These functionalities are mostly common in social media such as sharing, presence, conversations, identity, relationships, groups, and reputation ([Kietzmann et al., 2011](#)).

Researchers regarded sharing as the most powerful and addictive functionality of social media. These all seven functionalities can create problems in their form. Conversation functionality can be in the form of inappropriate and offensive messages and comments. Presence functionality can help to track the location of another user which might affect the privacy issues. Sharing functionality might bring the problem of inappropriate content sharing and unethical sharing of contents. Identity functionality might bring problems if someone doesn't want to share his/her identity. Relationship functionality can bring the problem of cyberbullying, online harassment, and stalking. Reputation functionality can

bring risk to reputed users like celebrities, football players, or politicians because of their only offensive or unusual post. Group functionality lets users create several groups in social media based on interests, location, religion, race, and so on. This groupism can bring might bring digital revolution or fights among these groups. Nowadays social media are more than the user thinks about it.

G. J. Hjetland et al (Pap1) was intended to find out the negative and positive impact of social media on Norwegian adolescents. As major findings participants expressed both negative and positive views related to their mental health and well-being. As positive findings, social media helped to get connected, increment in virtual society and support from members. Some major negative aspects of social media were found such as chances of getting addicted to social media, chances of being compared with others or compare own self with other users (this comparison might lead to poor mental wellbeing and low self-esteem), lack of proper sleep and rest, a user might be unable to focus on the studies, fear of missing out (FOMO) and increased level of stress.

But this positive and negative side of social media depends on the nature of an individual.

V. Schønning et al (Pap35) researched to show the relationship between social media use and mental health and well-being among adolescents by conducting a scoping literature review of pieces of literature published between 2014 and 2019. Most of the pieces of literature found an overt connection between social media and mental health. The majority of the pieces of literature found the relation between more regular use of social media and poor mental well-being and mental health of adolescents. Most young people are using social media and reports related to mental health problems like anxiety, psychiatric problems, eating disorders, and depression among youth are increasing day by day over the past 20 years. So, the author concluded that social media usage and the mental wellbeing of youth and adolescents are somehow related.

A. McCrory, P. Best, and A. Maddock (Pap15) studied the relationship between highly visual social media and young people's mental health. A study found that most of the users of such platforms are adolescents and youth. Research conducted in the UK in 2018 found out that 99% of youth people age ranging from 12 to 15 years use social media and are online for 20.5 hours per week([Ofcom, 2019](#)). The researcher focused on

three platforms i.e. Facebook, Instagram, and Snapchat. These platforms are attracting youth using features like “stories”. The research was conducted using themes like studying the time spent on social media, positive and negative relationship between social media and mental health of youth, online presentation, and activities of youth, and the level of using the functions available in social media like upload, share, using filters, editing and so on. Though, highly visual social media provides a platform for users to share their daily activities in the form of an image. Adolescents are mostly engaged in social media sites. The relationship between highly visual social media and the mental wellbeing/mental health of young people seems to be unclear because of the lack of adequate qualitative research and the lack of an accurate tool to measure highly visual social media behaviors.

E. Wegmann et al (Pap16) studied the role played by fear of missing out (FOMO) to relate three terminologies i.e., *Psychopathological symptoms*, level of use of social networking sites, and negative impact of social networking sites. An online survey of 1468 Spanish-English speaking social media users age ranging from 16 to 18 years old was conducted. It was found that FOMO played a vital role in developing negative consequences of social media use for adolescents. FOMO was regarded as the catalyst between mental wellbeing and social media engagement. *Social Networking Intensity scale (SNI)* and *Fear of missing out (FOMO)* both intercede the relationship between the study of mental illness and the study of negative consequences of using SNS via mobile device in different ways. *Girls that are more depressed tend to use more SNS whereas boys with a higher level of anxiety lead to increased use of SNS.*

The authors have provided an example that is similar to the example mentioned here. For example, one might feel he/she missed an event with his/her friends after viewing the photos and videos posted by his/her friends. After feeling of missing out s/he tries to know every detail of the event using social media and get engaged in social media for a long time. This could affect the mentality of that person who feels s/he is missed out. Similarly, some psychopathological symptoms such as depression and anxiety are seen in

adolescents was the main reason that adolescents think they are missed or dropped out from the event.

5. Discussions

From the results of the above systematic literature, we categorized the studies based on their outcomes to relate to our research questions in the following way.

Study outcome related to the research questions.	Number of Studies	Symbol of the Studies
Studies Stating <i>Recommendation System</i> is used in TikTok and other social media.	18	Pap3, Pap5, Pap4, Pap7 Pap20, Pap14, Pap24, Pap25, Pap26, Pap30 Pap36.
Studies stating attractive, interactive, easy user interface design, features, and functions as reasons for the popularity of social media along with the motivation of users to use the platform.	17	Pap4, Pap5, Pap7 Pap10, Pap17, Pap18, Pap20, Pap21, Pap22 Pap23 Pap29, Pap27, Pap28, Pap31, Pap32, Pap33, Pap34.
Studies stating Social media and TikTok use other AI and ML algorithms like <i>adaptive preloading, simple visualization, facial recognition, and prefetching technique</i> .	5	Pap2, Pap9, Pap21, Pap28 Pap33.

Studies stating privacy issues in social media like the problem of stranger danger and data misuse,	3	Pap10, Pap8, Pap23
Studies Showing Most of the Users of TikTok and Social media are adolescents and youths	8	Pap8, Pap11, Pap12, Pap13, Pap18, Pap19, , Pap28, Pap31
Studies stating social media has positive aspects like easy communication, self-presentation, a useful tool to measure mental well-being index, a platform to share daily activities.	4	Pap1, Pap6, Pap13, Pap15
Studies stating social media harms mental health and wellbeing like poor sleep quality, anxiety, fear of missing out, social comparison, and so on.	8	Pap1, Pap6, Pap12, Pap9 Pap13, Pap15, Pap31, Pap35.

Table 7: List of studies showing outcomes that are related to the research questions

From the above table, we can derive that, eighteen studies were related to the technical study of TikTok and other social media, showed that a recommendation system commonly used an algorithm to recommend content to the users in most of the social media. Recommendation systems are designed by using AI algorithms that can recommend custom-built content in the form of audio, video, story, fleet, reels, news feeds

after analyzing the user's profile. This recommendation system works based on the nature of the platform or the type of content it is delivering to the user. Studies also suggest other AI-enabled features like easy video editing, applying filters to audio, video, and image, automatic tools to count likes, shares, followers, following, and subscribers. Similarly, other five studies showed social media platform uses AI algorithms like *adaptive preloading*, *simple visualization*, *facial recognition*, and *prefetching technique*. Other technologies like face detection, live streaming, gaming, and social monitoring tools are also used in TikTok and other social media. These AI and ML-enabled systems can help the users to recall their past events shared in the form of stories, highlights, and videos on the application.

Seventeen studies found out the reason for the popularity of TikTok as well as other social media. AI and ML used in social media have made social media so interactive with an easy user interface. The interactive and unique features of the application have made the application so much popular among users all around the world. And users have different motives to use TikTok and other social media. Some of the motivations are self-expression, increasing social contact, kill time, exploration, watch and upload videos, get information about the current trends, imitate the impressions of the influencer, and so on. Eight studies showed that youth and adolescents are the most engaged user groups in different social media platforms. Youth and adolescent users use social media outlets to achieve the motivations of using them without knowing their consequences. As a result, they spend a lot of time using social media which makes them so much obsessed and anxious about the contents of the social media platform they are using. That obsession and anxiousness results in positive and negative results on their mental well-being and mental health.

Four studies showed the positive outcome from responsible social media use. Some of the positive aspects of social media mentioned in those studies were easy communication, a platform to share feelings and confession to get solutions, increase friend circle, a useful tool to measure mental well-being index, share and learn creative ideas, beneficial for business organization and so on. Along with these positive aspects of social media eight

studies showed the negative impact of social media on the mental health and the wellbeing of young and adolescent users.

Those eight studies had a common theme regarding the excessive use of social media outlets and their effect on the level of mental wellbeing and mental health of young and adolescents. Young and adolescent users might have to get fear strangers on social media platforms. Users who spend a lot of time on social media staying inside their house might also have problems with social anxiety disorder. Problems of social comparison in form of body image, talent, followers, subscribers, and so on can be seen among the youth users who get easily influenced by the contents. This social comparison might affect their level of self-esteem. Similarly, young and adolescents users have the trend of sharing more content of their daily life and events on social media. This sharing can give happiness to some users and some users might fear missing out from their family and friend circle. The use of social media during bedtime for a long period might degrade the user's sleep quality. Unethical activities in social media like cyberbullying, the spread of hate comments and speech, sexual abuse, digital war among several groups in social media might create post-traumatic stress disorder (PTSD) in the young users which might affect the level of their mental well beingness and the way they perceive social media ([Salzmann-Erikson & Hiçdurmaz, 2017](#)). Users who are victims of catfish scams and gold-diggers from social media might make them emotionally distressed. Three papers included privacy issues to show that users might be afraid to share data or are insecure about shared data which can result in the problem of digital phobic. These negative effects of overuse of social media might lead a young user towards digital dementia, anxiety, and even depression.

From the above discussion, we developed a hypothesis to relate AI algorithms used in Social Media and their effect on mental wellbeing and mental health of youth and adolescents. The hypothesis is presented in the form of the diagram below:

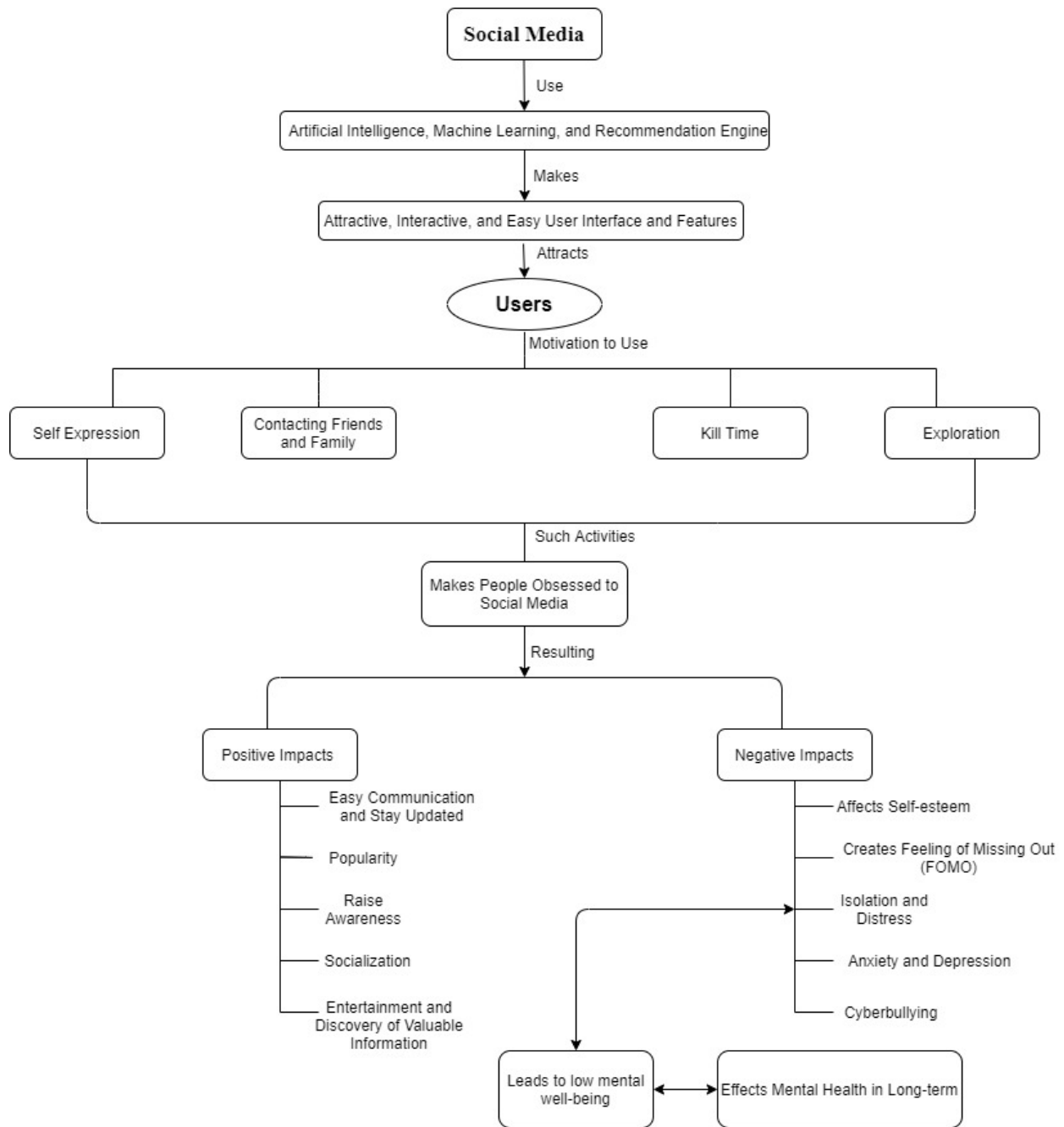


Figure: 3 Hypothesis to show the relation between AI algorithms used in social media and mental health and wellbeing of youth and adolescents.

From the hypothesis presented above, we could answer our research question in the following ways.

What mechanisms are used in social media to attract youth and teenagers of age ranging from 12 to 24?

From the above studies, we could say social media attracts youth because of the following reasons:

- Social media have an easy user interface, interactive design, and multiple functions. Person, organizations, and people of the society can enjoy social media by creating corporate accounts, public/private groups, social media has become the platform for posting the digital advertisement.
- Has provided a customized dashboard for public figures like influencers, politicians, and players to share their opinions and content.
- Social media provides easy access to the content by recommending the contents to the user after analyzing the user profile.
- Social media are the platform where a user can enjoy the content generated by another user. The one is not interested to create the content can also enjoy social media platform without creating any contents.
- Social media are free platforms to get a connection with new friends.
- Social Media provide users with daily trending content from all around the world. Similarly, users all around the world can participate in activities like daily challenges and hashtags trends. Users get chances to share their creative ideas, information, views, and knowledge via social media platforms.
- Social media provides easy as well as free audio and video editing tools.
- Notification systems of social media, notify users about the events and content.
- Social media provides a platform to share daily activities in the form of pictures, audio, animation, and video.
- Social media facilities a user with a bundle of attractive features to represent emotion like emojis, a cartooned form of the picture like avatar, and beauty enhancing features like image and video filter.

- Users with verified accounts can earn money from the platform from the process of monetization. Similarly, a user can also earn digital currency from live streaming services. This account verification system and live streaming service have attracted most youth and teenage users.
- Social Media provides free cloud storage for videos, photos, and other uploaded content.

What type of AI algorithms is being used in TikTok?

As we already mentioned previously, 18 studies stated that most social media use **recommendation systems**. The majority of studies states that TikTok mostly uses a recommendation system to recommend videos to the users along with other AI-embedded systems. Some of the most used AI algorithms in TikTok are listed below:

- *Adaptive Preloading mechanism*
- *Content recommendation system*
- *Digital advertisement campaigns*
- *Unique device and user identifier system*
- *Auto Language translation and video captioning*
- *Body image detection system*
- *Face detection system*
- *Image filtering algorithm*
- *Deepfake Technology*
- *Video streaming and editing feature*
- *Natural Language Processing system*
- *Huge audio and video database*
- *Machine Learning to analyze information from the video.*

What are the effects of Tiktok on the mental well-being and mental health of (Norwegian) youth and teenagers?

Most young and teenagers are attracted to use TikTok because of AI algorithms uses in TikTok. Similarly, AI-enabled features and functions provide multiple types of services to the user, which motivates them to use them regularly in their daily lives by spending many hours in the application. Though there are many positive and negative aspects of using TikTok., negative aspects might be problematic for the good mental wellbeing and mental health of youth and teenagers. Researches showed that regular and excessive use might make the user obsessed with the application. Ultimately overconsumption of TikTok videos might expose users to videos from acquaintances, popular person, successful as well as unsuccessful people, unethical trends, sexual content, hateful comments, fake speech, fake users, might lead users towards social comparison, body image dissatisfaction, the possibility of being bullied, fear of missing out, poor sleep quality, fear of the stranger and even being catfished. These consequences might affect the mental wellbeing of the young and teenage users in the form of social anxiety disorder, low self-esteem, anxiety, depression, and post-traumatic stress disorder.

What is the relationship between AI algorithms used in TikTok and the mental well-being of (Norwegian) youth and teenagers?

The majority of users of TikTok are youth and teenagers. We found that AI algorithms and AI-enabled features of social media including TikTok are the reason to make applications interesting, attractive, and multifunctional. Because of AI-enabled features, more and more users are attracted to use TikTok. From the above studies, we got to know that youths and teenagers who are using social media platforms carelessly for more time are having problems of poor mental wellbeing and poor mental health. Whereas youths and teenagers who are using social media carefully in an optimal way have good mental wellbeing and good mental health.

Normally we only see the effect of social media on mental wellbeing but we don't consider the internal mechanism and AI algorithms used in social media. So, in this systematic

literature review, after deeper understanding, we also knew that TikTok/Social Media operates on the working principle of AI algorithms. AI used in social media is capable to analyze user behavior, monitor them, evaluate the time spent on a specific category of content and categorize them to recommend content based on their interest and profile. As per other studies, social media is positively associated with poor mental wellbeing and mental health of youth and teenagers. And TikTok works on the working principles defined by AI systems developed by using AI algorithms. Therefore, we can consider AI algorithms as the brain of TikTok and conclude that AI algorithms used in TikTok are positively related to the poor mental well-being and mental health of youth and teenagers. AI algorithms used in social media are the hidden reasons for the attraction of users towards the platform. Excessive usage of TikTok results in negative consequences whereas responsible/minimum usage of TikTok has no negative effect on the sound mental wellbeing and health of youth and teenage user.

6. Conclusion

In this thesis, we conducted a systematic literature review to find out the relationship between AI algorithms used in TikTok along with other social media and the mental wellbeing/health of youth and teenager users. The study shows that most of the social media-consuming users are youths and teenagers. They are mostly attracted by the functions and features provided by the social media platform which are based on AI and machine learning algorithms. Users enjoy using social media based on these functions and features on daily basis. Automatic video recommendation systems, location tracking, facial detection, body image detection, etc. are the functions provided by most social media platforms. Furthermore, users also get hooked on algorithmically controlled features provided by social media platforms like unlimited video uploading and sharing, video challenge program, hashtags trends, video, and audio editing features, photo filters, avatars, emojis, etc. These features and functions, based on AI algorithms, make social media platforms easier to use, attractive, and multifunctional. AI algorithms used in social media can analyze the user behavior to monitor the activities to recommend them contents as per their choice or interest. As a result of excessive use, users start to get addicted to the platform and get exposed to videos from acquaintances, popular people, motivational speakers, fake news, fake identity, scammers, videos related to sexual abuse, hateful comments, and so on. The exposure to several categories of content and addiction to the platform brings several positive and negative consequences depending on the level of use of the platform. First, the positive consequences of the AI algorithms used in social media lead to the fulfillment of motivation of the user to use the platform. Second, the negative consequences of the AI algorithms used in social media can be seen in the form of low self-esteem, PTSD, anxiety, and even depression because of the activities like cyberbullying, fear of missing out, stranger danger, social comparison, and body image dissatisfaction. The negative consequences affect the mental health of youth and teenage users. From this study, we can conclude that there is a positive connection between AI algorithms used in social media and the poor mental wellbeing and poor mental health of children and young adults.

7. Future works

In this thesis, we have conducted a systematic literature review and an in-depth interview of 5 participants from Norway ages ranging from 12-24. We concluded the systematic literature review by developing a hypothesis. But there is still some room for improvement to make this of the project more scientific. Firstly, the systematic review part contains more words, which might make a reader spend more time reading this thesis. Likewise, papers selected for systematic review included a study population of users from youth to old although, our focused group was users from ages ranging from 12-24. This thesis was initiated to research the mental wellbeing and mental health of Norwegian youth and Teenagers. It was a difficult task to recruit more youth and teenagers as -participants for this project in a limited time.

Secondly, due to the limitation of time, We were not able to analyze the transcripts of the interview to answer the hypothesis developed from the systematic literature review. We took TikTok as a sample of social media to answer our research questions but Snapchat is also emerging as one of the most popular social media among youth and teenagers in Norway. In future research, I will also conduct an online survey to support the results generated from the in-depth interviews to find out more concrete results. We will use axial coding based on grounded theory to code the data generated from the transcripts of the interview. We will also include the technical study of Snapchat as well to find out the type of AI algorithms and AI embaded systems that Snapchat is using.

Appendices

Appendix A: [Protocol for Systematic Literature Review](#)

Appendix B: [Details of 87 candidate articles selected for the study along with the details of 36 articles selected for the SLR](#)

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