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**HALLGATÓK MÉDIAFOGYASZTÁSI SZOKÁSAI A SZÉCHENYI
ISTVÁN EGYETEM KÖZÖSSÉGI MÉDIA PLATFORMJAIN**

**STUDENTS' MEDIA CONSUMPTION HABITS ON THE SOCIAL
PLATFORMS OF SZÉCHENYI ISTVÁN UNIVERSITY**

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Table of Contents

1.Introduction.....	1
2.Systematic Literature Review.....	4
2.1. Methodology.....	4
2.2. Results of mapping study	6
2.3. Discussions	9
2.3.1. Website	9
2.3.2. Facebook	10
2.3.3. Instagram.....	11
2.3.4. Twitter	11
2.3.5. LinkedIn	12
2.3.6. TikTok	12
2.4. Summary	13
3.Széchenyi István University.....	15
3.1. History	15
3.2. Website analytics	16
3.2.1. Domain overview.....	16
3.2.2. Official website overview	20
3.3. Facebook analytics	21
3.3.1. Descriptive Statistics	23
3.3.2. Post Text Statistics.....	24
3.3.3. Monthly and Daily Engagement	25
3.3.4. Correlation.....	27
3.3.6. Regression	29
3.4. Instagram analytics.....	30
3.4.1. Descriptive Statistics	31
3.4.2. Post Text Statistics.....	32
3.4.3. Monthly and Daily Engagement	33
3.4.4. Correlation.....	35
3.4.5. Regression	36
3.5. Twitter analytics	38
3.6. LinkedIn analytics	39
3.7. TikTok analytics	40

3.7.1. Descriptive Statistics	41
3.7.2. Hashtag and Topics Statistics	41
3.7.3. Daily Engagement.....	43
3.7.4. Correlation.....	44
3.7.5. Regression	45
3.8. Summary	47
3.8.1. Website	47
3.8.2. Facebook	47
3.8.3. Instagram.....	47
3.8.4. Twitter	48
3.8.5. LinkedIn	48
3.8.6. TikTok	48
4. Python Codes.....	50
5. References.....	58

1.Introduction

The term 'Web 2.0' was first introduced in 2004 by O'Reilly Media, which led to the development of social media (SM) (*Kaplan and Haenlein, 2010*). SM platforms use a Web 2.0 format that provides users a dynamic environment for personal interaction where they can interact with like-minded people, as opposed to a Web 1.0 format where the user is a passive recipient (*Chandran, 2016; Schroeder, 2014*). The Web 3.0 format represents the next phase in the evolution of the Web/Internet and could potentially be as powerful a paradigm shifts as Web 2.0. Web 3.0 is based on the core concepts of decentralization, openness, and increased user value through artificial intelligence, which can also have a major impact on social networking sites (*Sridhara and Dr. Raghunandana 2019*).

Social media can be considered a style of electronic or online communication where the shared content is manipulated or created by the users themselves. User-Generated Content (UGC) can cause higher engagement (*Hamm et al., 2013*). Examples of common social media channels/platforms include blogs, social networking sites such as Facebook, Instagram, and LinkedIn; microblogs such as Twitter, wikis; and collaborative information projects such as Wikipedia; and content communities such as YouTube and TikTok (*Risiling et al., 2017*).

The aim of this study is to fill the research gap by reviewing the recent academic literature on social media marketing, especially for HEI marketing. It also aims to investigate the potential of the Széchenyi István University's academic social network sites (SNS) with the goal of increasing student engagement and ultimately student satisfaction. The University has been using 5 social media platforms (SMP) which includes Facebook, Instagram, Twitter, LinkedIn and TikTok.

The research questions the study seeks to answer are:

RQ1.: How do universities use websites and social media platforms to reach current students?

RQ2.: How does Széchenyi István University use its website and social media platforms to reach Hungarian and international students?

Methods: For the RQ1., the author has conducted a systematic literature review to gain a broad and up-to-date overview of the recent researches in the academic social media's field. For the

observation Scopus and Science Direct databases have been used. The chosen researches have been analysed by Excel.

For RQ2, the author examined the website of Széchenyi István University and SNSs (Facebook, Instagram, Twitter, LinkedIn, and TikTok). With the help of the Facepager Version 4.5.3 program, the SM posts' content, their comment- and reaction numbers were imported into a CSV file and analysed using Excel and the Python programming language.

Organizations have recognized the importance of SM in communicating and engaging audiences. As the number of active users on these platforms continues to grow, universities have also come to realize the need to establish their presence. This enables them to connect and effectively engage with prospective students, current students, and alumni. Regarding academic SM marketing articles, there is currently relatively little research about the Higher Education Institution (HEI) SM marketing effectiveness (*Brauer and Bernrioder 2015; Fong et al., 2020*).

SM platforms are immensely important for higher education institutions since they can effectively convey the university's mission and core values to students and staff members. Universities use a variety of social media strategies, using images, blogs, and polls as gamification tools to effectively engage students (*Al-Daihani and Abrahams 2018*). Visual storytelling and multimedia content create an immersive experience that fosters community and active participation. Blogs facilitate in-depth communication and encourage insightful discussions, while polls and quizzes add interactivity while fun, and UGC provides subconsciously satisfaction for the user (*Hanus et. Al. 2015., Sanmugan et al., Kuo et al., 2016; Damico and Krutka D. G. 2018*).

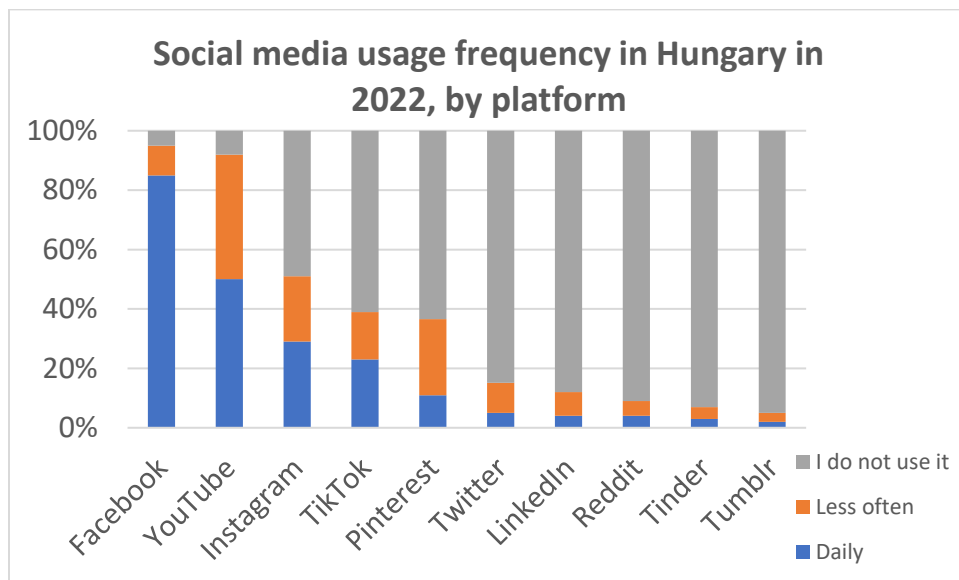
Discussing content in the comments section can also generate ideas and responses, leading to the formation of social capital and social networks (*Fong et al., 2020*). By integrating these elements, the university increases student engagement, effectively communicates its mission, and increases a strong sense of identity and connection within the student body. Based on *Hall and Witek's (2016)* research, the future of higher education marketing involves outreach to students through social media networks such as Facebook, YouTube, or Twitter. The authors argue that social media is a cost-effective and efficient way to reach the target market, which in this case the college students. Therefore, universities can use social media as an important marketing tool to establish and build relationships with students.

The data which can be seen on *Figure 1* was collected from a survey of 4,000 respondents aged 16 years and older, who were internet users in Hungary. The survey was conducted in November 2022, using computer-assisted web interviews (CAWI). The respondents were asked to indicate how often they used various social media platforms, such as Facebook, YouTube, Instagram, TikTok, Pinterest, Twitter, LinkedIn, Reddit, Tinder, and Tumblr. The response options were: daily, less often, or I do not use it. The data was weighted to reflect the demographics of the internet population in Hungary.

The results show that Facebook was the most widely used social media platform in Hungary in 2022, with 85 percent of the respondents accessing it on a daily basis. This was followed by YouTube, with 50 percent of daily users, while Instagram ranked third as 29 percent of survey participants used it every day. TikTok, Pinterest, Twitter, LinkedIn, Reddit, Tinder, and Tumblr had lower daily usage rates, ranging from 23 percent to 2 percent. The results also indicate that a significant proportion of respondents did not use some of the social media platforms at all, especially Reddit, Tinder, and Tumblr, which had more than 90 percent of non-users.

The 5 examined platform used by Széchenyi István University have been listed in the 10 most used SM platforms which indicates the university up-to-datedness.

Figure 1. Social Media Usage Frequency in Hungary in 2022, by platform



Data source: <https://www.statista.com/statistics/1401610/hungary-social-media-usage-frequency-byplatform>

2. Systematic Literature Review

A systematic literature review (SLR) is a method of conducting research that aims to answer a specific question by collecting, evaluating, and synthesizing all the relevant studies on that topic. An SLR follows a clear and rigorous process that reduces the risk of bias and produces more trustworthy results and conclusions for decision making. An SLR includes all the empirical evidence that meets the criteria defined beforehand (*Tranfield et al., 2003; Briner and Denyer, 2012; Denyer and Tranfield, 2009*).

2.1. Methodology

The rapid systematic review is a type of SLR that uses faster and simpler methods to produce a literature review in a shorter time. A rapid systematic review may use a narrower search strategy, search fewer databases, limit the time period for finding articles, skip checking the references and journals related to the topic, or involve fewer reviewers in the process of selecting, extracting, and assessing the data (*Reyen et al., 2017; Hamel et al., 2020*).

During keyword identification, the research study also took into account the most common synonyms and alternatives for HEI Social Media Marketing. Based on this approach the following keywords were identified and used in the research:

Student, University Student, University, Higher Education, Social Media, Marketing, Communication, Website, Facebook, Instagram, Twitter, LinkedIn, TikTok, Engagement, Retention, Interaction, Satisfaction, Effectiveness

The PEO (Population, Exposure, Outcome) framework is used to categorize the keywords into three main groups (see Table 1) to help structure the database search and obtain more relevant research results. (*Saltikov, 2012*).

Three major questions help us to separate the keywords are:

- Population (P): Who are you studying?
- Exposure (E): What is your population exposed to?
- Outcome (O): What is the result of the exposure on your population?

Table 1. Keywords categorized based on PEO (Population, Exposure, Outcomes)

Population	Exposure		Outcomes
Student	Social Media	Website	Engagement
University Student	Marketing	Facebook	Retention
University	Communication	Instagram	Interaction
Higher Education		Twitter	Satisfaction
		LinkedIn	Effectiveness
		TikTok	

Source: Created by the author

Population is the category in which the research question is focused, which is in this case the higher education institution and the university students. The Exposure category refers to anything that influences the Population category. Outcome is the category that specifies the effects of exposure on the population (*Buics et al., 2021*). To improve the search for relevant literature, complex keyword combinations were created using Boolean operators to combine three or four keywords. However, ScienceDirect has a limit of eight Boolean connectors, so only the keyword combination of two were used for this database. For Scopus, combinations of three or four keywords were operated.

During the preparation of the systematic literature review, the following inclusion and exclusion criteria were formulated:

1. The articles have to be related to Social Sciences/Psychology/Business/Computer Science fields.
2. The articles have to be freely accessible.
3. The articles have to be written in English.
4. The articles have to be published between 2012 and 2023.
5. The articles which are present in both databases have to be eliminated to avoid duplication.
6. The articles have to be related to the research question (RQ1.).

2.2. Results of mapping study

The number of articles collected and selected is shown in *Table 2*, where, after the initial search with the different combinations of keywords, each row shows the results of applying the inclusion and exclusion criteria one by one. For a more visual presentation, *Figure 2* shows the selection results step by step in a column chart.

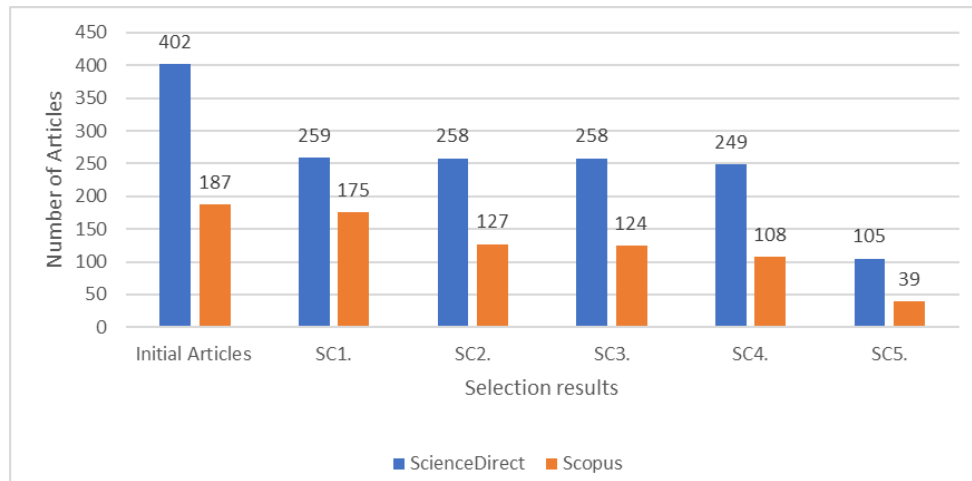
401 papers from the ScienceDirect database and 187 studies from the Scopus database were initially gathered with the usage of the above-mentioned keyword combinations. This finding may also indicate the research gap in this field, as the total number of articles available on Scopus is 44,737 and on ScienceDirect 39,516 on 13/10/2023. After the articles were chosen based on the four criteria, there were 357 papers left. 249 papers, or 42.35% of all the papers chosen from the ScienceDirect database, and 108 papers, or 18.34% of all the papers chosen from the Scopus Database. In addition, a thorough analysis of the titles and abstracts of the papers was conducted in accordance with the study questions, resulting a total of 144 articles from both databases. A total of 134 papers were left after 10 duplicated studies were eliminated.

Table 2. Details of the Number Selection

Criteria	Keyword Queries in Science Direct	Keyword Queries in Scopus
Initial Articles (with keywords combination)	402	187
SC1.: Social Sciences/ Psychology/ Business/ Computer Science fields	259	175
SC 2.: Free Access	258	127
SC 3.: Publication Language is English	258	124
SC 4.: Publication Year between 2012-2023	249	108
Articles after SC 4.	357	
SC 5.: Related to Research Questions	105	39
Removal of Duplication Articles	10	
Final Paper Number to Review	134	

Source: Created by the author

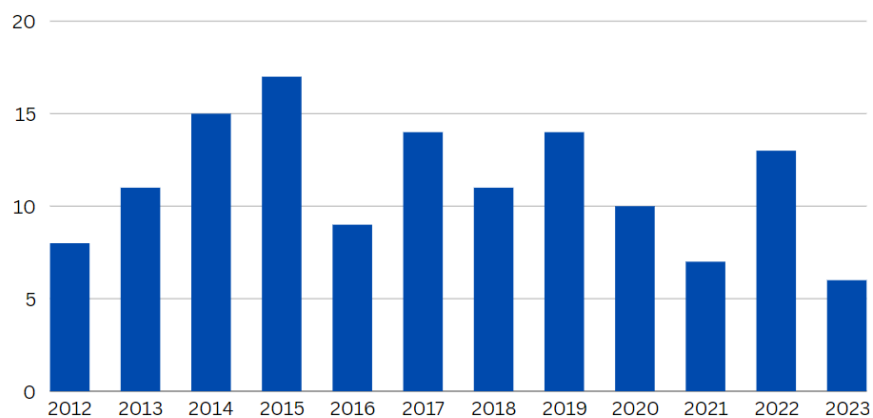
Figure 2. Selection results



Source: Created by the author

The 134 selected articles have been analysed by the publication year and publication topics. The *Figure 3* demonstrates the published articles between 2012 and 2023. In general, the number of the publication in HEI Social Media Marketing is low in the examined period of time. The publication figures indicate a huge research gap that would be beneficial to fill, as in the context of higher education, SMPs play an important role in mobilizing information through interactive communication, such as engaging students, raising awareness of faculty research, and gaining media coverage for university recruitment, thereby creating a competitive advantage (*L. Duque. 2016*).

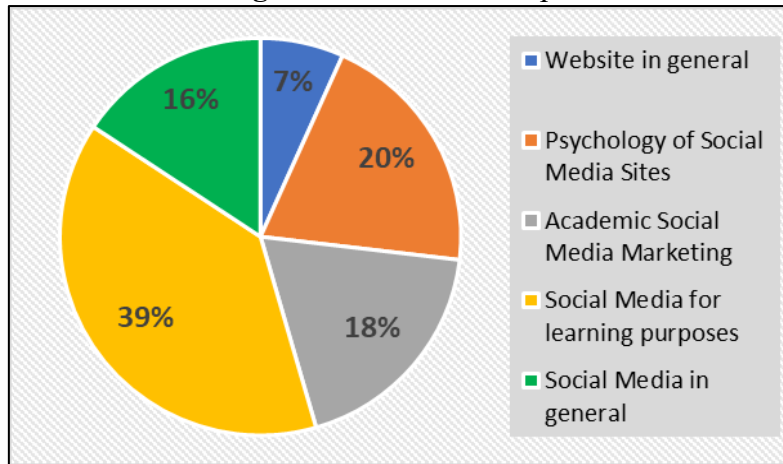
Figure 3. Number of Articles per Year



Source: Created by the author

Figure 4 informs the publication topics of reviewed articles. The research papers were divided into five groups, determined by the author based on the content of the paper. The five groups are *Website in general*, *Social Media in general*, *Psychology of Social Media Sites*, *Academic Social Media Marketing*, and *Social Media for learning purposes*.

Figure 4. Publication Topics



Publication Topics	Number of Articles
Website in general	10
Psychology of Social Media Sites	27
Academic Social Media Marketing	24
Social Media for learning purposes	52
Social Media in general	21

Source: Created by the author

Website in general: This group of studies examined the key aspects of website design that influence user experience and satisfaction. The studies covered topics such as web interface design, navigation and visibility, brand management, and promotion of triple helix. These topics were relevant to this research paper and were addressed by 10 articles (7%) in the literature review.

Psychology of Social Media Sites: The articles in this group examined the psychological effects of SMPs, with researchers highlighting the importance of their potential impact on academic pursuits and the different types of disorders these platforms can cause. The topic was investigated by 27 articles (20%) that were useful for this research paper.

Academic Social Media Marketing: This group of articles is the most closely related to the research questions of this paper. They explore the role of social media marketing in enhancing the reputation

and attractiveness of HEIs. They also suggest ways to improve the effectiveness of SM marketing by increasing brand value and measuring student engagement and social media consumption. Out of the reviewed articles, 24 research papers (18%) addressed the topic of social media marketing in the academic context. Among them, 11 articles focused on how higher education institutions' libraries can use social media to promote their services, while 13 articles discussed the promotional strategies and outcomes of social media marketing for HEIs.

Social Media for learning purposes: In this group, articles explored the possible impact of learning by using SMPs in higher education. The researchers examined how different SMPs were used for learning purposes, such as Facebook (14 studies), Twitter (13 studies), Instagram (3 studies), LinkedIn (3 studies) and TikTok (1 study). Some researchers also explored how different features of social media, such as gamification, videos, and Facebook groups, influenced the learning effectiveness and engagement of the college students. 52 articles (39%) were relevant to this topic, making it the largest group of articles that matched the keywords and databases used.

Social Media in general: In this group, the articles focused on specific social media platforms such as Facebook, Instagram, and Twitter. In addition, some studies discussed the algorithm of SMPs, the website and the design and visualisation of SMPs. Out of the 134 articles reviewed, 21 (16%) related research papers have remained after the application of keyword combinations.

2.3. Discussions

The author summarised the main results and key findings for universities' website and for each of the five SMPs that were relevant to the research questions. These SMPs were Facebook, Instagram, Twitter, LinkedIn, and TikTok.

2.3.1. Website

The visibility and accessibility of higher education websites is essential to effectively attract and convert prospective students into current students. Students can also find out about the latest news from the university and important information about their studies. The standards for evaluating university websites are often unclear and unfamiliar to many developers, resulting in a poor user experience for students navigating these sites (*M. Manzoor et al., 2019*).

The website of a university serves a diverse range of users, who can be classified into internal and external categories. Internal users are those who belong to the institution, such as prospective and

current students, faculty members, and administrative staff. External users are those who access the website for information purposes, such as parents, industry partners, and the general public. The usability requirements of different users vary according to their goals and interests. For instance, students may seek information on admissions, scholarships, syllabus, contacts, and other relevant topics. Faculty members may look for information on current events, class schedules, seminars, workshops, and so on. External users may search for potential academic collaborators to address an industry problem or to learn more about the institution's achievements and offerings (Çerri 2014; Roy et al. 2014).

The paper from Li Y et al. (2018) studies how small firms' growth is affected by their networks with businesses, governments, and universities (Triple Helix). It uses a new method of analysing company websites to measure these networks. It finds that Triple Helix networks are good for firm growth and that firm size, website size, and low-carbon applications also matter.

2.3.2. Facebook

Facebook is the biggest platform among all SMPs; therefore, it is a beneficial opportunity for marketing experts to promote businesses and their products/services on Facebook. Meanwhile, advertisers are taking advantage of the opportunity to generate more business profits due to the huge number of page views on Facebook. It is therefore worth analysing the reasons for using Facebook for digital advertising (Wang, 2019).

The study from Ertugan (2017) focused on university students, who are among the most active users of Facebook, and who are exposed to a wide range of advertisements on this platform, where promotions may not align with their lifestyles, desires, and values. Facebook advertising is a pervasive phenomenon that influences this segment of users. Most advertisements are designed to reach large diverse audiences, rather than targeting specific demographics.

Soares, J. C. et al. (2020) has examined the impact of interactivity and vividness on user engagement with Facebook posts in the context of higher education institutions. The results indicate that there is a negative correlation between the level of interactivity of the posts and the amount of likes they receive from the users. Moreover, the posts that exhibit high vividness attract more likes, but fewer comments and shares from the users.

2.3.3. Instagram

Instagram is an image-based SMP that enables users to share their life experiences through photographs in real time. The initial intention of Instagram was to provide a platform for users to narrate their life stories through visual media. Previous studies have indicated that social interaction is one of the main motivations for using Instagram. (*Geurin-Eagleman, and Burch 2016.; Pittman and Reich., 2016*).

Besides social interaction, another significant motivation for using Instagram is self-expression. Instagram offers users the opportunity to express themselves and manage their impressions through high-quality photographs, which are more effective than plain text in conveying visual information (*Marwick, 2015*).

The researchers, *Rosa-Castillo et al., (2022)*, experimented on the gamification on Instagram by creating an Instagram-based game. The game was implemented for the subject “Dietetics and Nutrition” where bachelor nursing students had to give diet and nutrition advice to help fictional astronauts choose the most appropriate diet given their individual needs. The majority of the respondents (71.7 %) expressed positive views on the gamification experience and its impact on their learning outcomes. They indicated that the gamification activities enhanced their understanding of the course content and reinforced their learning process. Furthermore, they suggested that gamification could be beneficial for other courses as well.

2.3.4. Twitter

Twitter is a micro-blogging SNS which allows users to create posts with a limited number of characters. Twitter is considered as a useful tool for direct communication among peers. Recent studies demonstrated that it also improves active learning and enhances learning incentives. Students gain confidence, fluency in expressing ideas and they also enhance their social skills. Collaborative learning process can be courage by using Twitter (*Chen and Chen, 2012; Gao, Luo and Zhang, 2012*).

Prestridge (2013) researched the usage of Twitter in order to support first-year students and identified the types of interaction that emerged, such as connectivity, academic culture, and resourcefulness. The professor established a connection with the students by using a traditional approach to responding to their tweets. However, the interaction between the students was limited. Students also cultivated academic culture by summarising the content of lectures, sharing images

and links, and retweeting relevant posts. However, students faced some challenges in using this technology, such as managing multiple tasks, adopting academic protocols, and getting used to the 140-character limitation (the maximum tweet length increased to 280 in 2023).

The study from *Pérez-Bonaventura and Rodríguez-Llorente (2023)* examined 83 Spanish universities' Facebook, Instagram, Twitter, and YouTube platforms. The article found that the student population was a significant predictor of their social media performance, as it was positively correlated with the number of followers on all platforms and the engagement rate on Facebook, Twitter, and YouTube. Universities' ranking also influenced their follower count on all examined platforms except YouTube. In addition, the university's number of followers on each platform was positively associated with its ranking position and engagement rate on Facebook and Twitter.

2.3.5. LinkedIn

LinkedIn has emerged as the most convenient and effective website for employers and job seekers, according to several studies. A study researched by *S. del Cerro (2017)* revealed that LinkedIn (94%) was the most preferred platform among SNSs for recruiting candidates for vacant job roles, followed by Facebook (65%) and Twitter (55%).

López-Carril, Añó et al. (2020) explored the potential of LinkedIn in creating a learning environment for blended and online learning, where students can develop both content and their professional profile. They emphasized the convenience of integrating LinkedIn with other social media platforms such as YouTube and other educational resources such as TED Talks.

The study by *López-Carril, S. (2022)* investigated the effectiveness of blended learning in sports management using LinkedIn. Students were able to master the use of LinkedIn through video tutorials. They had to work together in private LinkedIn groups on specific content of the course. The conclusion of the study is that most students did not have a LinkedIn account prior to the course or were inactive users. This finding suggests a lack of familiarity with the use of SM from a professional perspective, as LinkedIn was mostly unused by the students.

2.3.6. TikTok

TikTok is a leading destination for short-form videos on mobile. In 2016 TikTok launched in China and reached the international market in 2017. It was the most downloaded mobile application in both the United States and worldwide in 2020 (*Nakafuji, 2021*).

TikTok is a SMP that enables users to create and share short videos, varying from a few seconds to up to 10 minutes since February 2022. It offers a diverse range of content, including practical advice, motivational messages, dance challenges, queries and responses, and humorous or unusual videos (*Alley and Hanshew. 2022*).

In the study by *Alley and Hanshew (2022)*, the authors investigated how academic libraries in the United States use TikTok by conducting a content analysis. They had originally planned to select a sample of peer libraries with active TikTok accounts, but there were not enough libraries available; therefore, they had to change their approach. Instead, they searched for TikTok user accounts using terms such as 'academic library', 'college library', and 'university library' (or 'libraries'). They then analysed the fifteen libraries with the highest number of TikTok followers. The content analysis showed that the most common type of content in these libraries was categorized as 'humanization/fun', making up 61.4% of the videos. This suggests that the main purpose of using TikTok among these users is to consume engaging and entertaining content.

2.4. Summary

The research findings highlight the need for a comprehensive and in-depth examination of the marketing strategies employed by higher education institutions (HEIs). This systematic literature review has revealed not only the available articles but also a noticeable research gap in the area of HEI marketing strategies.

The majority of the articles reviewed focused on the use of websites and specific social media platforms such as Facebook, Instagram, Twitter, LinkedIn, and TikTok in the context of teaching and learning. However, only 24 articles on HEIs' social media strategies met the five selection criteria for this review, indicating a lack of research on this topic.

This gap is significant because the digital world is constantly evolving, with a variety of platforms that offer different features, target different audiences, and require different engagement strategies. It is not enough to acknowledge the presence of HEIs on social media platforms; it is essential to understand how they can leverage the power of online interaction to build meaningful relationships with potential students, alumni, and other stakeholders.

Moreover, the effectiveness of marketing strategies on social media platforms in the context of higher education remains a topic of considerable research interest. There are many unanswered

questions about how different types of content, posting frequencies, interactive elements, and multimedia formats affect user engagement, brand perception, and ultimately, enrolment rates. Therefore, this review calls for more empirical studies that can provide insights and guidance for HEIs to develop and implement effective social media marketing strategies.

In summary, addressing the research gap in higher education institutions' social media strategies is essential for adapting to the evolving digital sphere. By conducting more empirical studies, we can unlock valuable insights, enabling institutions to craft effective and impactful online marketing strategies for fostering meaningful connections with their audience.

3. Széchenyi István University

This research paper examines the digital presence of Széchenyi István University on various social media platforms. The second research question (RQ2) investigates the website and social media usage patterns of university students. By SLR the literature on the examined platforms were analysed and utilized practically in the section of website and SM platform analytics.

3.1. History

The predecessor of today's Széchenyi István University, the College of Transport and Telecommunications, was founded in 1968. Its focus was on the training of engineers specialising in transport and telecommunications infrastructure, but the range of courses on offer has expanded continuously over the past decades, especially since the regime change. The institution has been named after István Széchenyi since 1986, first as the István Széchenyi College of Transport and Telecommunications Engineering, and then as the István Széchenyi College since 1990, when the range of courses was expanded. Economic, health and social education were introduced in the first half of the 1990s, followed by legal education a few years later - initially as an affiliated programme of a university in the capital, and from 2002 as an autonomous programme. Music education was also integrated into the institution. These developments increased the number of students, enhanced the academic qualifications of the teaching staff and diversified the range of training programmes offered by the institution. Consequently, the institution obtained university status on January 1, 2002.

The institution offers all levels of higher education from assistant to undergraduate, specialist training, and master's degrees to doctoral studies. Currently, there are 9 faculties, 5 doctoral schools belonging to the university in Győr, and it is also the maintainer of a primary and secondary school institution. The undergraduate programs (BA, BSc) are usually 7 semesters long, after which students can continue their studies in master's programs for one and a half or two years. More than twelve thousand students' study at some program in full-time, correspondence or distance learning mode in Hungarian or in some cases in English.

Regional competitiveness is at the core of the university development program, and the key to this is primarily the development of innovation capacity and R&D&I (Research and Development and Innovation) potential. The planned investments will ensure an efficient two-way flow of knowledge between business and education, promoting the continuous renewal of human resources, the market

orientation of the institution's training offer, and the increased international integration of its research activities (*Széchenyi István University, 2023*).

Faculties of Széchenyi István University

- Apáczai Csere János Faculty of Humanities, Education and Social Sciences
- Audi Hungaria Faculty of Automotive Engineering
- Faculty of Agriculture and Food Sciences
- Faculty of Architecture, Civil Engineering and Transport Sciences
- Faculty of Health and Sport Sciences
- Faculty of Mechanical Engineering, Informatics and Electrical Engineering
- Faculty of Law
- Faculty of Performing Arts
- Kautz Gyula Faculty of Business and Economics

Doctoral Schools

- Doctoral Program in Business Administration Sciences
- Doctoral School of Law and Political Sciences
- Doctoral School of Multidisciplinary Engineering Sciences
- Doctoral School of Regional- and Economic Sciences
- Wittmann Antal Multidisciplinary Doctoral School of. Plant, Animal and Food Sciences

3.2. Website analytics

The Széchenyi István University's domain (sze.hu) investigation was conducted using specialised tools, in particular the DomainTools website, which is designed to facilitate enquiries about specific domains. In addition, Semrush, a comprehensive digital marketing analytics platform, was used to gain valuable insights into website usage patterns, including metrics such as pages per visit and average visit duration. These methodologies were integral to the comprehensive analysis of the domain under review.

3.2.1. Domain overview

Figure 5 shows the domain profile of sze.hu and *Table 3* informs about the history of the domains owned by the university. In addition to sze.hu, there are 2 other domains operating on the IP address 193.224.128.1. The oldest domain is szif.hu, where the second level domain is called "szif"

(abbreviation of Széchenyi István Főiskola). In 2002, the institution changed status from a college to a university; therefore, the domain name was changed to "sze" (abbreviation of Széchenyi Egyetem). In 2006 the domain university-gyor.hu was created, but at the time of publishing this research, it cannot be reached. The szif.hu URL (Uniform Resource Locator) navigates to the uni.sze.hu website.

Figure 5. Domain Profile for sze.hu



Whois Record for SZe.hu	
Domain Profile	
Registrar Status	
Dates	8,013 days old Created on 2001-11-15
IP Address	193.224.128.1 - 2 other sites hosted on this server
IP Location	Gyor - Gyor - Szechenyi Istvan Egyetem
ASN	AS1955 HBONE-AS KIFU (Governmental Info Tech Development Agency), HU (registered Sep 01, 1993)
Hosting History	1 change on 2 unique name servers over 6 years

Source: <https://whois.domaintools.com/sze.hu>

Table 3. History of Széchenyi István University's Website Domains

Domain	Date of Creation
szif.hu	02-05-1995
sze.hu	05-11-2001
university-gyor.hu	17-03-2006

Source: Created by the author

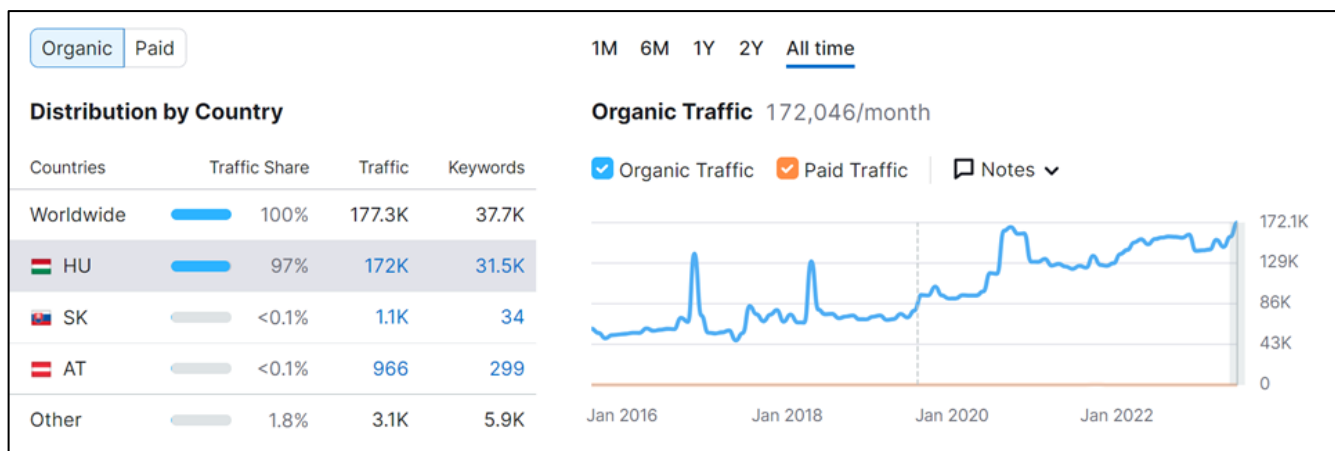
The domain sze.hu was also analysed by Semrush. *Figure 6* shows the distribution of the domain's organic traffic with SEO (Search Engine Optimisation) keywords by country can be seen in September 2023 and the organic traffic from 2016, because the free version of Semrush did not show the traffic information between 2001 and 2016. SEO keywords are the words and phrases that online marketing experts use in their web content to help people find the site through search engines (Erdmann and Ponzoa 2021).

People from Hungary, Slovakia and Austria searched the most for one of the pages in the domain sze.hu. There is almost 2% traffic share (3.100 visitors) from other countries. The used keywords are discussed later. The organic traffic graph indicates changes in the amount of estimated organic and paid traffic driven to the analysed domain (Semrush 2023).

Organic traffic refers to the number of visitors who land on the website through unpaid search results. This means that the website is found by typing a query on a search engine and then clicking

on one of the links that appeared in the search results (Semrush 2023). Széchenyi István University has not spent any money on online advertising and its' organic traffic has been steadily increasing, indicating the growing popularity of the university. Outlier periods occurred in the months of March and August due to major academic events. In March there are 2 main relevant happenings for students: the electronic examination day and the choice of specialisation. In August there are also several relevant events for students, including the registration process through the Neptun system, choosing subjects, enrolment and Freshers' Week (*Schedule of Academic Year 2023/24*). Students seek information about these important events and other programmes on one of the websites of the sze.hu domain during these months. Only the schedule of academic year 2023/24 was examined as the university's website with this information was uploaded with the new academic year and these academic events have been held in the same month for years.

Figure 6. Distribution by Country and Organic Traffic for sze.hu domain



Source: <https://www.semrush.com/analytics/traffic/overview/?q=sze.hu>

The *Figure 7* informs about the traffic metrics in September 2023. The websites of the sze.hu domain was reached approximately 782,400 times which was 115.4% more, than in August 2023. This includes all types of traffic, including organic traffic, direct traffic (when someone types the website URL directly into their browser), referral traffic (when someone clicks on a link to the website from another website), and paid traffic (when someone clicks on an ad to get to the website). The unique visitor represents an individual's interaction with the website over time (Google 2023), which in the case of sze.hu was approximately 174,000 users. Visitors opened 6.21 pages and spent an average of 12.27 minutes on these pages via the domain and time period under review. Bounce rate refers to the proportion of visitors who exit a website after only viewing a

single page. It measures how often users access a site without engaging or exploring further. A desirable bounce rate is approximately 40% or lower, whereas a bounce rate of 60% or higher may suggest a review of the content to make it more useful and appealing for users. (Semrush 2023). The bounce rate for the domain sze.hu is excellent as it was 26.36% in September and has decreased by 25.09% since August.

Figure 7. Traffic Metrics for sze.hu in September 2023

Visits	Unique Visitors	Pages / Visit	Avg. Visit Duration	Bounce Rate
782.4K	174K	6.21	12:27	26.36%
↑115.4%	↑69.09%	↑31.2%	↑25.13%	↓25.09%

Source: <https://www.semrush.com/analytics/traffic/overview/?q=sze.hu>

The keyword overview is an important tool for analysing how Google evaluates and ranks a website based on the queries that users enter. *Table 4* shows the 10 most frequent keywords that led users to one of the pages on the sze.hu domain from any devices. The position indicates the rank of a webpage on the search engine results page (SERP) for a given query. A higher SERP position means a higher visibility and click-through rate for the website. 8 of the top 10 keyword queries are in position 1, meaning that the corresponding URL is the first result displayed for them. Traffic represents the number of visits to the URL per month using the keyword as a query. The traffic has been monitored by Semrush over the last 12 months and calculated a monthly average. The 3 most visited pages of the sze.hu domain were the Neptun system, the official website and szelearning. The traffic (%) shows the percentage of the total traffic generated by each keyword. The volume is the average number of times per month that users search for a given keyword. Semrush estimated this value by averaging the monthly searches over the last 12 months.

Table 4. Estimated Keyword Overview for sze.hu

Keyword	Position	Traffic	Traffic (%)	Volume	URL
neptun sze	1	26.500	15.39	31.000	netw6.nnet.sze.hu/
széchenyi istván egyetem	1	14.500	8.41	18.100	uni.sze.hu/
szelearning	1	9.700	5.62	12.100	szelearning.sze.hu/
sze neptun	1	6.500	3.76	8.100	netw5.nnet.sze.hu/
Neptun	10	5000	15.39	165.000	netw6.nnet.sze.hu/
Sze	1	5.300	3.06	6.600	uni.sze.hu/
sze learning	1	4.300	2.51	5.400	szelearning.sze.hu/
eberjegyzek	8	2700	1.57	90.500	e-berjegyzek.sze.hu/
moodle sze	1	2.300	1.34	2.900	szelearning.sze.hu/
hatar sze	1	1.900	1.11	2.400	user.sze.hu/

Source: <https://www.semrush.com/analytics/traffic/overview/?q=sze.hu>

3.2.2. Official website overview

The official website of the university, uni.sze.hu, and some of its subpages were overviewed. The website offers three language options: Hungarian, English and Chinese. The website adopts a multi-page layout; however, the navigation bars vary across the language versions and some Hungarian pages do not have equivalent English/Chinese translations, which is especially evident on the faculty subpages. The Hungarian site can be accessed at uni.sze.hu, while the English and Chinese sites can be found at admission.sze.hu. A flag icon at the top right corner of the page allows the user to switch the language. The design and branding of the university are consistent among the language sites. However, there is some white space between the content on the Hungarian and English sites when viewed from the desktop (*Figure 8*), which reduces the user-friendliness of the sites (*Manzoor et al., 2019*).

Figure 8. White space on the official Hungarian and English SZE webpage

Source: <https://www.uni.sze.hu>



Source: <https://admissions.sze.hu/welcome>

The mobile versions of the Hungarian, English, and Chinese websites were also overviewed for usability. A common issue identified on all three sites was the excessive use of white space, which hide the amount of information displayed on the screen. Furthermore, the Hungarian mobile site lacked a, which could pose a challenge for foreign users who wanted to access the English or Chinese versions of the site. In addition, browsers do not show the university's English and Chinese sites among the search results for the above-mentioned 10 most frequently used keywords related to the site's content; therefore, it would be beneficial to include the language button on the Hungarian site as well.

Figure 9. Hungarian, Chinese, English website in the sze.hu domain



Source: <https://www.uni.sze.hu/>; <https://admissions.sze.hu/chinese-home>; <https://admissions.sze.hu/welcome>

3.3. Facebook analytics

Széchenyi István University has several official Facebook pages which includes the main page, pages of certain faculties, pages of certain departments, page of the fresher's week, pages of college of advanced studies, pages of the Student Union, alumni page, page of the Scientific Students' Association, page of certain courses, and pages of the university's libraries. Mainly Facebook groups have been created for the courses because of the community. In these groups students help each other to answer academic questions.

During the Facebook reviewing it was found that not every faculty and department has page on the examined platform making the university image a bit inconsistent. Only 4 faculties utilize the benefit of a Facebook page such as the Apáczai Csere János Faculty of Humanities, the Education and Social Sciences; the Faculty of Agriculture and Food Sciences; Faculty of Law; and the Kautz Gyula Faculty of Business and Economics.

For this research paper, the main official Facebook page, called *Széchenyi István Egyetem*, was analysed since it reaches the most college students. The page has approximately 27.000 likes and 28,000 followers in October 2023.

This study collected data from a Facebook page using Facepager version 4.5.3, a tool that can fetch publicly available data from YouTube, Facebook, and other websites based on APIs (Application Programming Interface) and web scraping (Jünger, and Keyling, 2019). The data collection period was from September 1, 2022, to September 31, 2023. The data was stored in a SQLite database and exported to a CSV file for analysis. The analysis was performed using the Python programming language. Below are the column names that were included in the study:

- *Message* (post text),
- *created_time* (when was the post published),
- *like.summary.total_count* (number of likes on the post),
- *love.summary.total_count* (number of love reactions on the post),
- *haha.summary.total_count* (number of haha reactions the post),
- *wow.summary.total_count* (number of wow reactions the post),
- *sad.summary.total_count* (number of sad reactions the post),
- *angry.summary.total_count* (number of angry reactions the post),
- *comments.summary.total_count* (number of comments on the post),
- *shares.count* (number of shares on the post),
- *message_tags.0.name, message_tags.1.name, message_tags.2.name, message_tags.3.name, message_tags.4.name, message_tags.5.name* (occurring hashtags in the post)
- *permalink_url* (link of the post).

Four additional columns have been added to the csv file for further analysis: *engagement_rate*, *message_number_of_char* (length of a post), *number_of_hashtags*, and *topics*. The engagement rate was calculated by adding the number of likes, reactions, comments, and shares together and dividing by the current number of page followers. The topics column only examined the most engaging month based on the engagement rate. The *created_time* was broken down into *year*, *month*, and *day* (from 1 to 31), *day_of_the_day* (from Monday to Sunday) columns for more detailed time correlations.

3.3.1. Descriptive Statistics

In the examined period 514 posts were published. The descriptive statistics, *Table 5*, offer valuable insights into the Facebook data. On average, posts were made in the latter half of the year, predominantly during the middle days of the month, with most posts published on weekdays. The length of the post messages varied widely (standard deviation is 314) with a mean character count of approximately 501. Regarding user engagement, posts received an average of around 47 likes, 3 love reactions, and occasional haha, wow, sad, and angry reactions. Additionally, the data shows a wide range in the number of comments, suggesting that certain posts had more extensive discussions than others. The presence of hashtags in posts was relatively infrequent, with an average of around 1.8 hashtags per post. The engagement rate, the key metric, ranged widely, indicating varying levels of user interaction across different posts. These findings highlight the diverse nature of user interactions on the platform, with posts eliciting a range of emotional responses and differing levels of engagement.

Table 5. Facebook Data Descriptive Statistics

	year	month	day	day_of_the_week
mean	2022.645914	6.70428	15.90856	3.570039
std	0.478701	3.408809	8.569712	1.80533
min	2022	1	1	1
max	2023	12	31	7

	message_number_of_char	like.summary.total_count	love.summary.total_count	haha.summary.total_count
mean	500.708171	47.389105	3.114786	0.344358
std	314.25888	104.924777	7.599916	4.643226
min	0	0	0	0
max	3294	1896	86	101

	wow.summary.total_count	sad.summary.total_count	angry.summary.total_count	comments.summary.total_count
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mean	0.276265	0.044747	0.009728	1.439689
std	3.868393	0.471344	0.132095	19.605596
min	0	0	0	0
max	87	8	2	439

	shares.count	number_of_hashtags	engagement_rate
mean	4.297665	1.838521	11.073218
std	9.541278	2.152834	24.056186
min	0	0	0
max	127	6	392.412451

Source: Created by the Author

3.3.2. Post Text Statistics

In this section the posts' texts were analyzed by Python. A code was written which shows the 20 most frequent words occur in the posts in the examined one year period.

The *table 6* shows the word 20 most occurred word frequency of the university's Facebook posts. Hungarian words dominate the content, indicating a strong focus on the local audience. Words like "az" (723), "és" (660), "széchenyi" (539), "istván" (476), and "egyetem" (463) are frequently used, reflecting the university's emphasis on its Hungarian identity. The presence of words like "https" (344), "hu" (330), and "www" (212) suggests a high number of references and links shared in the posts, indicating a focus on providing external resources and information. The word "uni" (190) also appears, likely referencing the university itself. English word "the" (445) is present, possibly indicating some content aimed at international students. However, the overall dominance of Hungarian words in the posts highlights the university's primary focus on the local audience, with an emphasis on sharing references and information through links (https, hu, and www).

Table 6. Word frequency of Facebook posts

Index	1	2	3	4	5	6	7	8	9	10
Word	a	az	és	széchenyi	istván	egyetem	the	sze	https	hu
Frequency	2339	723	660	539	476	463	445	430	344	330
Index	11	12	13	14	15	16	17	18	19	20
Word	is	további	and	híreink	sze hírek	www	of	uni	post	részletek
Frequency	305	255	228	223	223	212	209	190	181	179

Source: Created by the Author

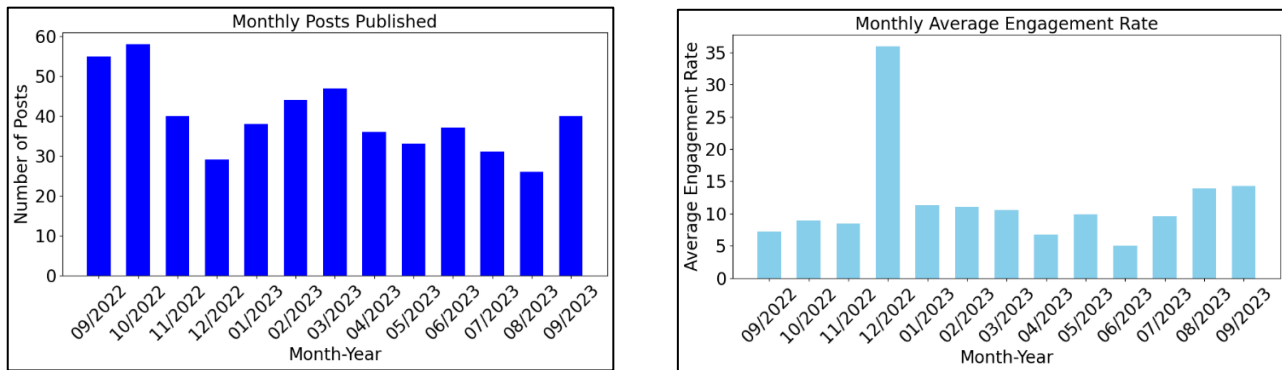
3.3.3. Monthly and Daily Engagement

As it can be seen on the *figure 10*, the monthly posts and the average monthly engagement of students in Széchenyi István Egyetem Facebook page was analyzed using Python. Two bar charts were created to visualize the posting frequency and monthly average engagement values from September 2022 to September 2023. The bar chart shows that the monthly average engagement values vary significantly over the time period.

The data shows a recurring trend in the University's Facebook posts over the twelve-month period. There was a steady increase in posts from September onwards, peaking in October with 58 posts, but declining until December. The pattern repeated in 2023, with 38 posts in January, a slight increase in February and March, and a decrease in April and May. The frequency of posts remained stable in June and July but dropped to 26 posts in August. These data correspond to the typical structure of an academic year, as the autumn semester starts in September and ends in December, and the spring semester starts in February and ends in May. The higher number of posts in the early months, particularly in October and March, can be compared to the high volume of information and communication at the beginning of the semester. Conversely, the decrease in posts from December to February corresponds to the winding down of activities and reduced communication as the semester progresses. This pattern suggests a correlation between the university's online engagement and the academic calendar, highlighting the influence of the semester structure on its social media activity.

The highest value was observed in December 2022, which was 35.95, while the lowest value was observed in June 2023, which was 4.98. The bar chart also reveals some seasonal patterns, such as higher engagement values in the winter months and lower engagement values in the summer months. It is surprising that posts in December received much higher engagement compared to other months, despite being the second lowest in terms of quantity, with only 29 posts. This highlights the quality of content shared in December. To find the reasons for these patterns, the posts published in December 2022 were examined by topic.

Figure 10. Monthly Posting Frequency and Engagement



Source: Created by the Author

After reviewing the University's Facebook posts in December, four topics were defined and the posts allocated to them. The topics were: *success of organisations, students, teachers, enhancing the image of the university*; *opportunities and news for students*; *university-related news for general audience*; and *university-related information for secondary school students*. The author also calculated the mean engagement rate for each topic (table 7).

The results showed that the most frequent topic was the success of organisations, students, teachers, enhancing the image of the university, with 10 posts, followed by opportunities and news for students, with 9 posts. The least frequent topics were university-related news for general audience and university-related information for secondary school students, with 5 posts each. However, the mean engagement rate revealed a different pattern. The highest mean engagement rate was for the topic of *university-related information for secondary school students*, with 71.71, followed by *opportunities and news for students*, with 54.13. The lowest mean engagement rate was for the topic of *success of organisations, students, teachers, enhancing the image of the university*, with 11.91, followed by university-related news for general audience, with 15.53. In order to better match the interests and preferences of the target audience, a detailed review of the content strategy would be needed.

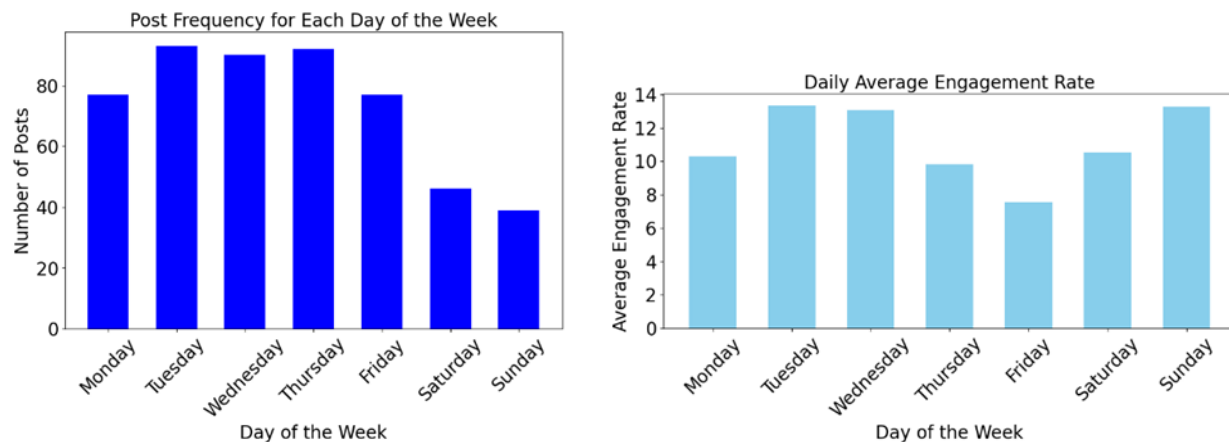
Table 7. Topic Frequency and Engagement Rate

Topics	Frequency (December)	Engagement Rate
University-related information for secondary school students	5	71.71
Opportunities and news for students	9	54.13
University-related news for general audience	5	15.53
Success of organisations, students, teachers, enhancing the image of the university	10	11.91

Source: Created by the Author

The results on *figure 11* showed that the frequency of posts varied throughout the week, with the highest number of posts on Tuesday (93 posts), followed by Wednesday (90 posts) and Thursday (92 posts). The lowest number of posts was on Sunday (39 posts), followed by Saturday (46 posts) and Monday (77 posts). The engagement rate also varied throughout the week, with the highest average engagement rate on Sunday (13.26), followed by Tuesday (13.35) and Wednesday (13.05). The lowest average engagement rate was on Friday (7.52), followed by Thursday (9.81) and Monday (10.28).

Figure 11. Daily Posting Frequency and Engagement



Source: Created by the Author

3.3.4. Correlation

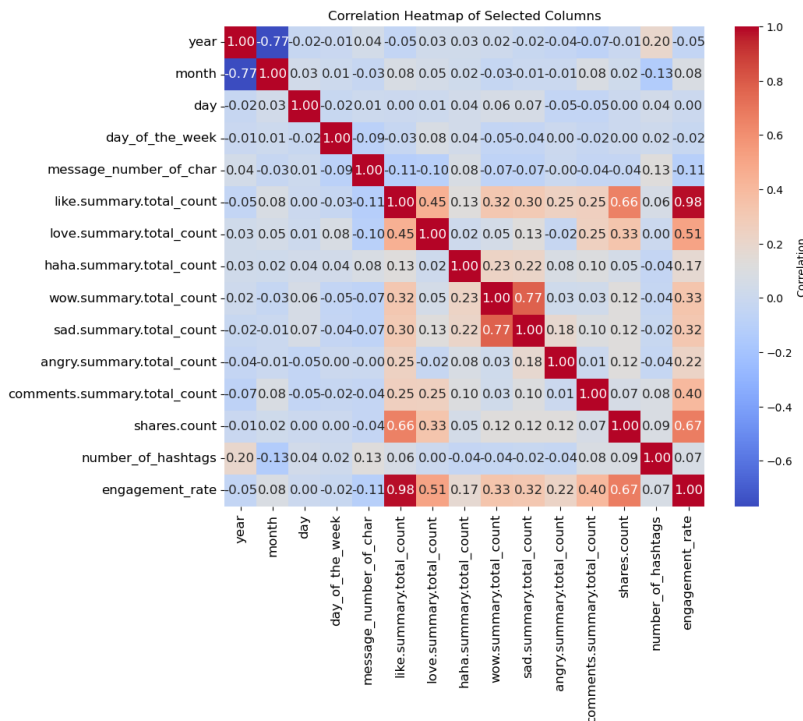
The Pearson correlation coefficient was used to measure the strength and direction of the linear relationship between examined variables. The results were calculated with the assistance of Python programming language.

The correlation was applied the relation between the daily post frequency and daily average engagement rate on the university's Facebook page. The result was $r = -0.074$, indicating a very weak negative correlation between the two variables. This suggests that higher post frequency is associated with lower engagement rate, but the relationship is not statistically significant

A correlation heatmap was applied to the available columns using Python code. The heatmap shows the potential correlation of all the column's data with other variables (*figure 12*).

The findings revealed several key insights. Firstly, there was a strong negative correlation between message length and most reaction types, indicating that shorter messages tend to receive more engagement. In addition, the analysis demonstrated a significant positive correlation between the number of hashtags used and engagement rate, suggesting that strategic hashtag utilization can boost user engagement. Moreover, the data highlighted a high positive correlation between various reaction types (like, love, haha, wow, sad, and angry) and engagement rate, particularly likes, shares, and comments, indicating that these interactions play a pivotal role in enhancing overall engagement.

Figure 12. Facebook Correlation Matrix



Source: Created by the Author

3.3.6. Regression

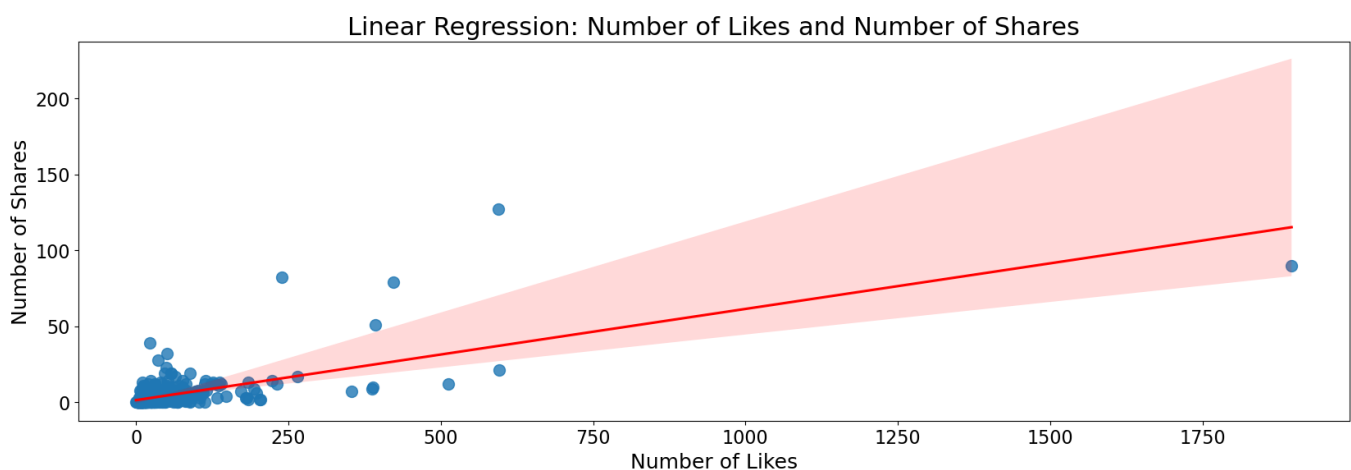
Based on the correlation results, one of the relevant most and least correlated variables were also used to measure regression (*see figure 13 and figure 14*).

The first linear regression analysis was conducted to explore the relationship between the number of likes (x) and the number of shares (y) on the Széchenyi István University's main official Facebook page. The regression equation derived from the analysis is as follows: $y=0.06x+1.46$

The regression analysis found a coefficient of approximately 0.06, meaning that on average, for every additional like a post receives, there is an expected increase of 0.06 shares. This finding suggests a positive and significant relationship between likes and shares, meaning that higher levels of user approval, as indicated by likes, correspond to increased sharing behaviour, all other factors remaining constant. Furthermore, the intercept of 1.46 suggests that even if a post does not receive likes, there is a baseline level of sharing activity.

In addition, the mean squared error (MSE) of 51.34 indicates the average squared difference between the observed and predicted values. While the model provides useful information, there is inherent variability in the data that cannot be completely captured, highlighting the complexity of social media engagement dynamics.

Figure 13. Linear Regression: Number of Likes and Number of Shares



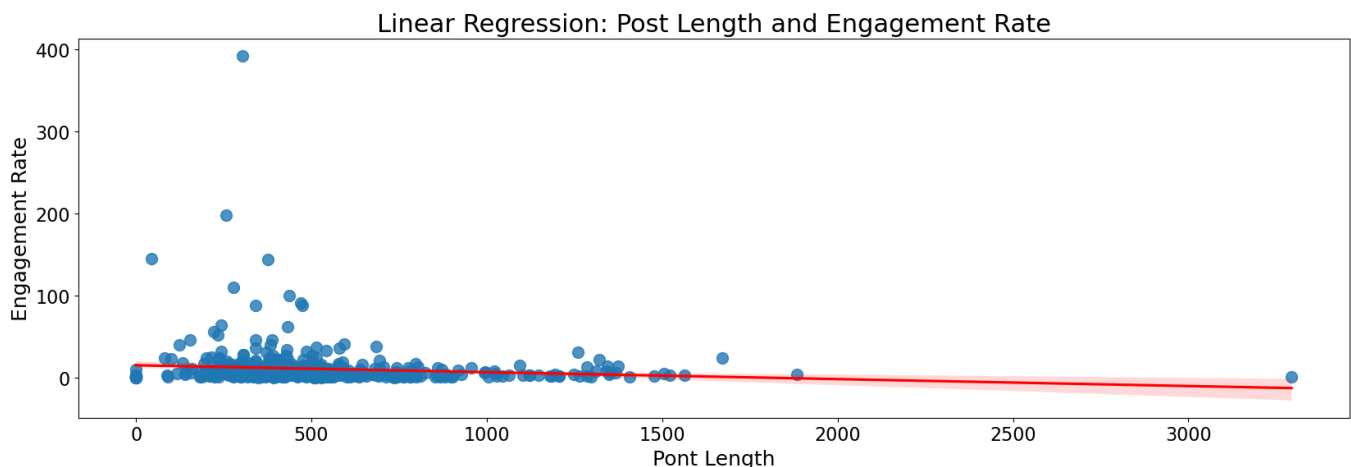
Source: Created by the Author

The second linear regression analysis summarizes the relationship between post length (x) and engagement rate (y) on the Széchenyi István University's main official Facebook page. The regression equation, $y = -0.01x+15.30$

The coefficient for post length is approximately -0.01. It indicates that for each unit increase in post length, the engagement rate is expected to decrease by 0.01 units, and the baseline engagement rate when post length is zero is 15.30 (intercept). There is a small negative effect, indicating that longer posts are associated with slightly lower engagement rates.

The MSE of 570.54 suggests that there is a moderate amount of variability in engagement rates that is not explained by post length alone. This variability could be due to other factors not considered in the current analysis, or it could reflect the inherent complexity of the relationship between post length and engagement rate.

Figure 14. Linear Regression: Post Length and Engagement Rate



Source: Created by the Author

Monitoring engagement metrics over time is valuable. Identify trends and adjust content strategy accordingly. If a particular type of content, posting time, post length, or the number of hashtags is consistently performing well, focus more on those aspects.

3.4. Instagram analytics

Széchenyi István University has several official Instagram accounts as well which includes the main account (*szechenyi.istvan.egyetem*), account for the international students (*szeinternational*), accounts of faculties, accounts of the fresher's week, accounts of college of advanced studies, account of the Student Union, page of the Scientific Students' Association, and page of the university's campus library.

It is worth noting that every faculty has an Instagram account, which is maintained by the Student Union, and the university has an Instagram account for international students, which is maintained by the Student Committee of Foreign Affairs.

For this article, the main official Instagram account, called *szechenyi.istvan.egyetem* was analysed since it reaches the most college students. The account has 7,387 followers in 1 November 2023.

This study collected data from the Instagram page using a python library called Instaloader. The data collection period was from September 1, 2022, to September 31, 2023. The analysis was performed using the Python programming language. Below are the column names that were included in the research:

- message (post text),
- created_time (when was the post published),
- like (number of likes on the post),
- comment (number of comments on the post),
- permalink_url (link of the post).

The CSV file now contains four more columns for analysis: engagement_rate, message_number_of_char (post length), number_of_hashtags, and topics. The number of likes and comments combined was added, and the result was divided by the total number of page followers to determine the engagement rate. Based only on the engagement rate, the topics column looked at the month that was the most engaging. For more in-depth time-based correlations, the created_time was divided into columns for the year, month, and day (from 1 to 31) and day_of_the_day (from Monday to Sunday).

3.4.1. Descriptive Statistics

In the one-year period 157 posts were published. The descriptive statistics of the year shows a mean year of 2022.69 reflecting that more posts were created between January and September 2023 than between September and December 2022. On a monthly basis, the mean of 6.57 suggests a steady flow of content throughout the year, while the mean day of 16.24 highlights a consistent posting schedule within each month. Looking at the day of the week, the mean of 3.61 suggests an even distribution of posts, indicating that the University's Instagram team maintains a balanced presence across weekdays and weekends. In terms of content characteristics, the mean message length of 530.58 characters shows that a significant amount of information is shared in each post. The

average number of likes of 295.98 indicates a moderate level of engagement, with posts receiving varying degrees of attention from the audience. In addition, the data shows an average of 1.34 comments per post and 4.68 hashtags, highlighting the interactive nature of the content. The calculated engagement rate, with an average of 4.02, shows a positive response from the audience, despite the wide variability in engagement between posts. These findings provide valuable insights into the University's Instagram strategy, suggesting areas for optimisation and highlighting the impact of post timing and content composition on user interaction and engagement.

Table 8. Descriptive Statistics

	year	month	day	day_of_the_week
Mean	2022.69	6.57	16.24	3.61
Std	0.46	3.47	8.58	1.89
Min	2022	1	1	1
Max	2023	12	30	7

	message_number_of_char	like	comment	number_of_hashtags	engagement_rate
Mean	530.58	295.98	1.34	4.68	4.02
Std	356.78	196.33	11.82	3.43	2.66
Min	72	19	0	0	0.26
Max	1564	910	148	14	12.32

Source: Created by the Author

3.4.2. Post Text Statistics

The analysis of word frequency (*table 9*) in the university's Instagram posts reveals interesting patterns in the use of words. Among the most frequently occurring words, "a" dominates the list with a frequency of 720, followed by common articles such as "the" (248) and Hungarian equivalents such as "az" (226) and "és" (226), highlighting the bilingual nature of the university's communication. Furthermore, specific terms related to the university community are prominent, including 'sze' (185), 'győr' (117) and 'széchenyi' (101), emphasising the local and institutional context of the posts. Furthermore, the presence of "unisz" (96) and "széchenyiegyetem" (80) underlines the university's efforts to brand itself on social media platforms. Interestingly, the inclusion of words such as "hogy" (84) indicates the prevalence of informative or explanatory content, while the frequent appearance of personal pronouns such as "you" (78) suggests an interactive approach, possibly engaging directly with the audience. This analysis provides valuable

insights into the university's communication strategies and audience engagement on Instagram, shedding light on the linguistic nuances used in their online interactions.

Table 9. Instagram Word Statistics

Index	1	2	3	4	5	6	7	8	9	10
Word	a	the	az	is	sze	is	győr	széchenyi	of	unisce
Frequency	720	248	226	226	185	121	117	101	98	96
Index	11	12	13	14	15	16	17	18	19	20
Word	hu	hogy	and	szechenyiegyetem	you	istván	to	egyetem	in	egy
Frequency	87	84	81	80	78	75	75	70	56	55

Source: Created by the Author

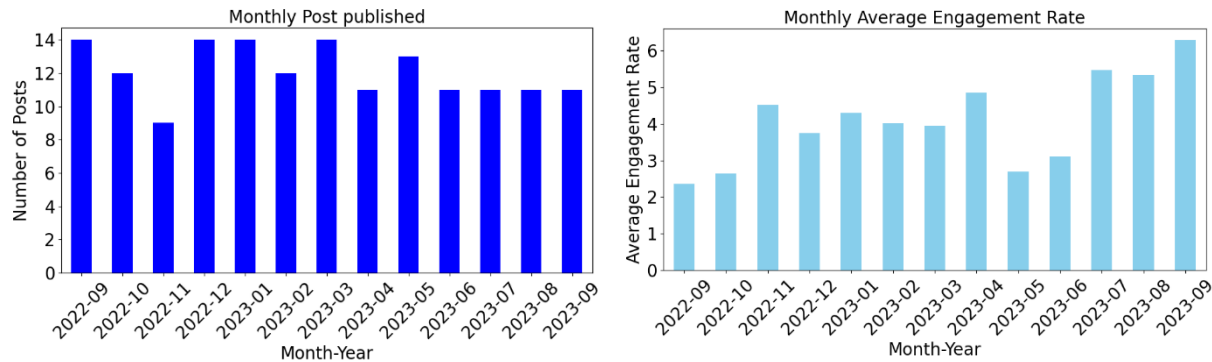
3.4.3. Monthly and Daily Engagement

The *figure 15* and *figure 16* highlights the significance of analyzing posting frequency in conjunction with engagement rates across different months and days of the week.

The university maintained a consistent posting frequency throughout the study period. The number of posts published per month varied slightly, ranging from 9 to 14 posts. This consistent posting strategy reflects a structured approach to content dissemination, ensuring regular engagement with the audience.

Analysing the data, there is a potential correlation between posting frequency and engagement rates. Months with higher posting frequencies, such as September 2022, January 2023 and July 2023, coincided with peaks in engagement rates. This correlation suggests that a consistent and frequent posting schedule could have a positive impact on audience engagement, creating a community and interaction among followers.

Figure 15. Monthly Posting Frequency and Engagement



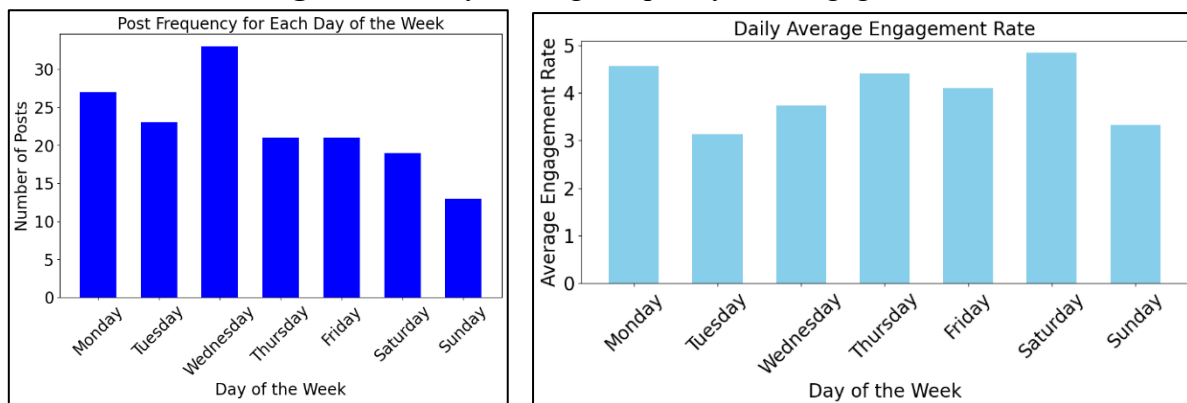
Source: Created by the Author

The most engaged month was September 2023 with 11 posts. These posts were mainly about Freshers' Week and some other university events. The pictures were taken at the university, using the logo colours and design that symbolise the university's image.

The university posted most frequently on Wednesday (Day 3) with 33 posts, followed closely by Monday (Day 1) with 27 posts. In contrast, Sunday (Day 7) recorded the lowest posting frequency with 13 posts. This disparity in posting frequency provides an initial insight into the university's content dissemination strategy.

Examining engagement rates corresponding to each day of the week, it is evident that posts made on Wednesday received the highest engagement rate (4.85), closely followed by posts on Thursday with an engagement rate of 4.41. In contrast, posts made on Sunday received the lowest engagement rate at 3.33.

Figure 16. Daily Posting Frequency and Engagement



Source: Created by the Author

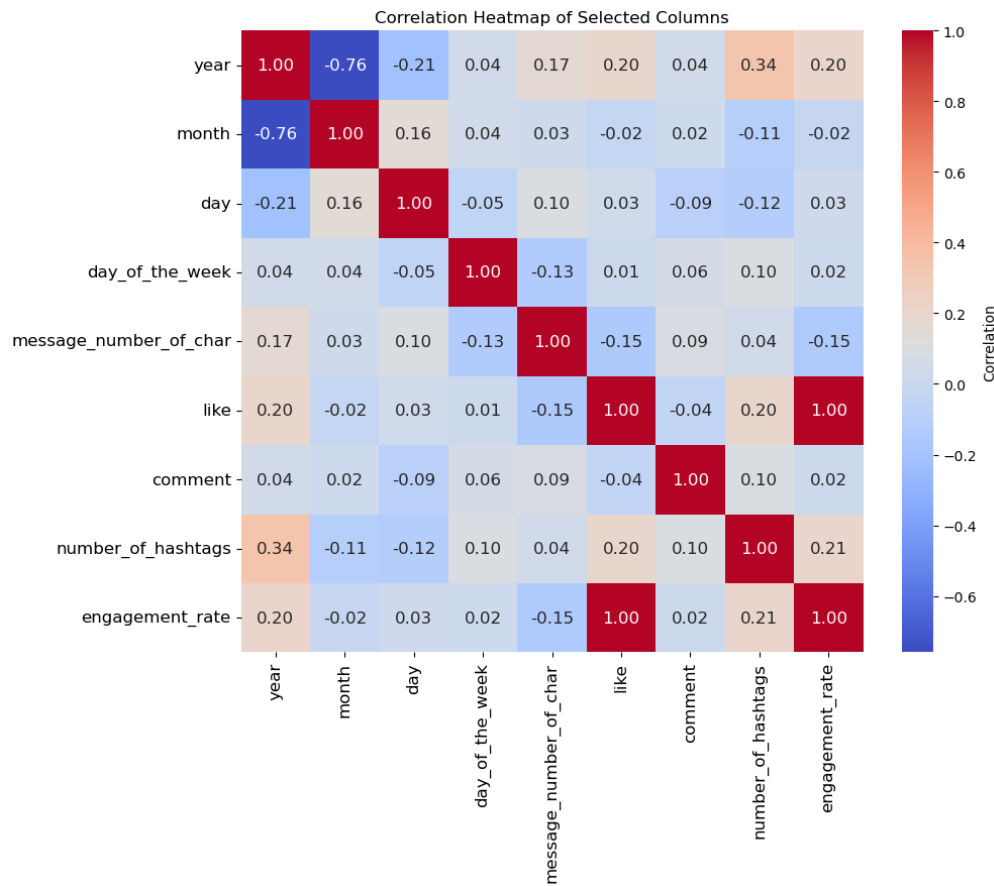
The findings suggest that mid-week posts, particularly on Wednesday and Thursday, tend to garner significantly higher engagement from the audience. This indicates a potential preference among followers for content during the middle of the week, possibly aligning with their online activity patterns.

3.4.4. Correlation

The heatmap was also applied for the Instagram data in order to get a comprehensive picture about the possible relations (*figure 17*).

The strong negative correlation between 'year' and 'month' (-0.76) indicates a consistent monthly pattern in the university's Instagram activity over this period. This suggests that the university's social media team maintained a stable posting schedule, possibly aligning their content strategy with specific events or academic calendars. Furthermore, the positive correlation between 'number_of_hashtags' and both 'year' (0.34) and 'engagement_rate' (0.20) suggests a growing trend in hashtag usage, potentially reflecting the university's efforts to increase visibility and engagement. The correlation matrix also shows a significant positive relationship between 'like' and 'engagement_rate' (1), confirming the crucial role of likes as a primary driver of overall engagement during this period. In addition, the negative correlation between 'message_number_of_char' and 'engagement_rate' (-0.15) highlights the trend that could be seen on Facebook as well. It suggests that shorter messages may have contributed to higher engagement rates in 2022 and 2023, suggesting that concise and impactful content resonated well with audiences.

Figure 17. Instagram Correlation Matrix

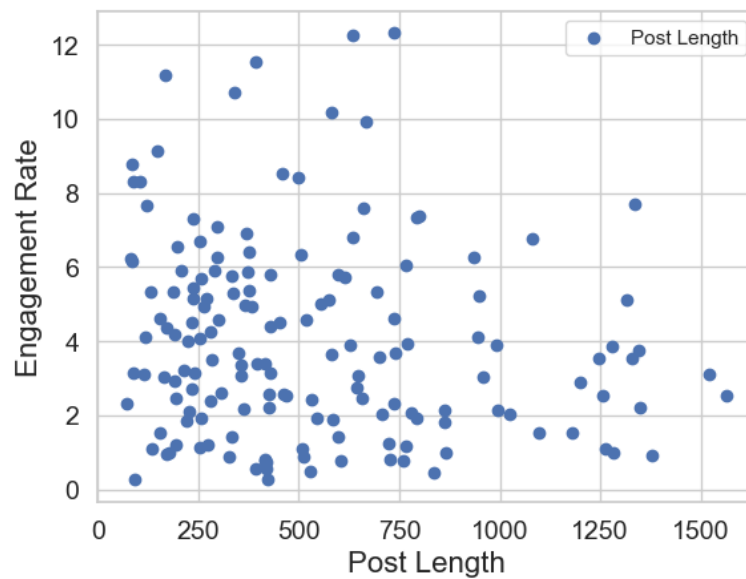


Source: Created by the Author

3.4.5. Regression

Regarding the regression between the post length and engagement rate was not measured because of an extremely high MSE which would be 6.856 indicates the average squared difference between the actual engagement rates and the engagement rates predicted by the regression model. Since the engagement rate scattered between 0 and 12, it can be concluded that the linear regression model would not fit in this case. Other variables have not examined regression-wise since these one of the most relevant and correlated variables. The points can be seen on *figure 18*.

Figure 18. Representation of Engagement Rate and Post Length



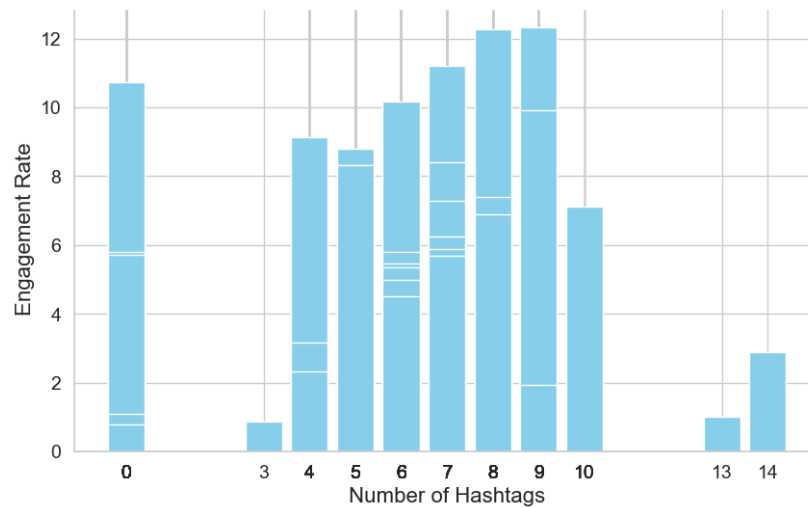
Source: Created by the Author

The *figure 19* reveals a remarkable trend in Instagram engagement in relation to the use of hashtags. The empirical evidence suggests that there is a positive correlation between the number of hashtags used and the engagement rate, up to a point. Specifically, the engagement rate seems to peak when around 8-9 hashtags are used. This finding suggests that a moderate number of hashtags can be strategically advantageous for maximising engagement on social media platforms.

However, it is also observed that beyond this optimal range, the engagement rate experiences a decline. This drop in engagement when using more than 9 hashtags could be due to various factors, such as perceived spamming or a dilution of content focus. As a result, the data cautions against the excessive use of hashtags, which can be counterproductive.

In conclusion, the data highlights the importance of a balanced approach to hashtag use in social media marketing strategies. By optimising the number of hashtags, content creators and marketers can potentially increase audience interaction and engagement with their posts.

Figure 19. Engagement Rate and Number of Hashtags



Source: Created by the Author

3.5. Twitter analytics

The university utilizes its Twitter page to disseminate updates regarding its activities, achievements, and events. Currently, the page boasts 132 followers while following 35 other accounts. However, following Elon Musk's acquisition of the company and his transformation into X, the free scraping service for academic research is no longer available (*Twitter 2023*).

During the examined period, the Twitter page could not be analyzed without API commands. Nevertheless, it was reviewed, and an overall report was generated.

The site mainly shares news, events, achievements, and opportunities related to the university and its faculties, students, staff, and partners. It also retweets relevant posts from other accounts, such as the Hungarian Ministry of Innovation and Technology, the European Commission, and Audi Hungaria. The site uses the hashtag #SzéchenyiEgyetem to promote its brand and identity. It also uses other hashtags related to its topics, such as #AudiHungaria, #ErasmusPlus, #HorizonEurope, and #SportForumHungary. The page posts mostly in Hungarian, but occasionally in English or German, depending on the target audience and the content. It also uses emojis, images, videos, and links in order to make the posts more engaging and informative. The site has a consistent and professional tone and style, and follows the Twitter's guidelines and best practices. It responds to comments and mentions from other users, and engages with its followers and the wider community.

The university's Twitter page only has 135 followers, despite having a good content strategy. This may indicate that a significant percentage of the page's intended audience is not being reached. Furthermore, by replying to comments and retweeting relevant tweets, the university could gain additional exposure from its followers.

The online platform could benefit from better use of visual components to highlight the university's impact, creativity and research, using infographics, charts, graphs and animations. This could help to attract more interest and attention from potential funders, partners and students. It could also explore additional opportunities for networking and collaboration with other relevant audiences, such as alumni, media, business, academia or civil society. In addition, this could increase the university's visibility and reach, while adding value and impact for all its stakeholders.

3.6. LinkedIn analytics

LinkedIn's terms and conditions prohibited the scrapping of posts into a CSV file, therefore an overview was adapted on the University's LinkedIn profile, as well as on Twitter (*LinkedIn 2023*).

The Széchenyi István University's LinkedIn page witnessed steady growth, reaching 9,000 followers in October 2023, indicating a strong and expanding online community interested in the institution's activities and updates. The alumni network also experienced growth, with 9,232 past students engaging with the university's LinkedIn content in November 02.

The university shared posts showcasing notable achievements, such as faculty research breakthroughs, student accomplishments, and innovative projects. These posts served to highlight the institution's academic excellence and contributions to various fields.

Regular updates about the university's programs, events, and initiatives were shared to keep the audience informed. These posts included details about upcoming seminars, workshops, and conferences, providing valuable information to current and prospective students, alumni, and other followers.

To strengthen the connection with the alumni community, the university featured alumni spotlights, sharing success stories and career achievements of notable graduates. These posts celebrated the accomplishments of past students, fostering a sense of pride among the alumni network.

Considering the university's global audience, all posts were primarily in English, ensuring accessibility and understanding for followers from diverse linguistic backgrounds. This approach allowed the institution to effectively communicate its message to a broader international audience.

3.7. TikTok analytics

Széchenyi István University also has a few official TikTok accounts, including the main account (*university_gyor*) and the accounts of the College of Advanced Studies.

It can be seen that the appearance of the university and its organisations is much lower than in other social media sites. It might be worthwhile to create more TikTok accounts, as a lot of views can be gained in a short period of time.

For this article, the main official TikTok account, called *university_of_gyor*, was analysed since it reaches the most college students. The page has approximately 3644 followers and 765.000 likes on its posts in October 2023.

This study collected data manually as no TikTok scrapper programme was available and only 34 video was published in the examined period of time. The analysis was performed using the Python programming language. Below are the column names that were included in the study:

- message (post text),
- created_time (when was the post published),
- topics (what is the post about),
- video_length (length of the published video post),
- message_number_of_char,
- number_of_hashtags
- views
- like
- comment
- repost (number of shares on the post)
- saved_video
- engagement_rate
- year, month, and day (from 1 to 31), day_of_the_day (from Monday to Sunday)

3.7.1. Descriptive Statistics

34 video posts were published between September 2022 and September 2023. The university's TikTok accounts exhibit noticeable temporal patterns, with an average of 2.68 videos posted daily, peaking around the 15th of the month and slightly favouring Thursdays for uploads. These videos typically have a length of around 25.18 seconds and receive an average of 20,867 views, 1,163.15 likes, 7.06 comments, 114.59 reposts and 82.32 saves. The video messages that accompany these posts contain an average of 184.21 characters and are accompanied by an average of 8.71 hashtags. The engagement rate, calculated as the ratio of total interactions to views, is 5.46%. There is considerable variability in the engagement metrics, as shown by the standard deviations of views, likes, comments, reposts and saved videos (*table 10*). This comprehensive analysis provides valuable insights into the dynamics of the university's TikTok account, providing a foundation for further research and strategic planning.

Table 10. TikTok Data Descriptive Statistics

	year	month	day	day_of_the_ week	coded_topics	video_length_s	views
Mean	2022.76	6.32	15.56	3.35	2.68	25.18	20866.94
Std	0.43	3.55	7.25	1.55	1.15	16.91	37149.19
Min	2022	1	1	1	1	4	3417
Max	2023	12	30	6	5	78	183600

	like	comment	repost	saved_video	message_number_ of_char	number_of_ hashtags	Engage- mentrate
Mean	1163.15	7.06	114.59	82.32	184.21	8.71	5.46
Std	2475.48	18.15	268.58	211.87	61.19	2.56	2.05
Min	91	0	1	2	89	0	1.89
Max	13600	102	1467	1112	342	12	9.81
Mean	1163.15	7.06	114.59	82.32	184.21	8.71	5.46

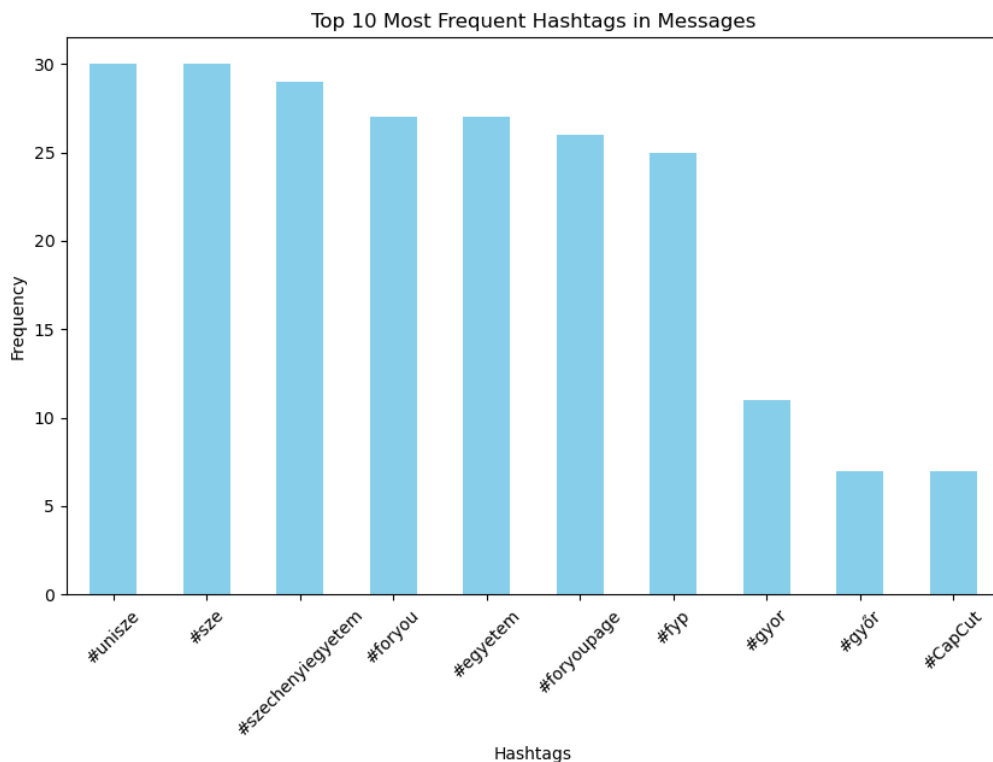
Source: Created by the Author

3.7.2. Hashtag and Topics Statistics

Analysis of the hashtag usage of the university's TikTok account revealed several key findings that shed light on the engagement dynamics of the platform (*figure 20*). Among the top ten hashtags, '#unisze' and '#sze' emerged as the most frequently used, each appearing in 30 videos, indicating a

consistent branding effort by the university community. In addition, the hashtag #szechenyiegyetem appeared in 29 videos, highlighting the importance of the university's full name in online discourse. The popular TikTok trends "#foryou" and "#foryoupage" were also prominently featured, with 27 and 26 occurrences altogether, indicating the university's active participation in broader TikTok trends. The hashtag #fyp was used in 25 videos, indicating an alignment with the platform's viral content strategy. In addition, the location-specific hashtags '#gyor' and '#győr' were used in 11 and 7 videos respectively, highlighting the regional connection of the university's content. These findings not only demonstrate the university's ability to capitalise on popular TikTok trends, but also reflect its strategic use of location-based hashtags to engage with a wider audience.

Figure 20. Top 10 Most Frequent Hashtags in Messages (Posts)

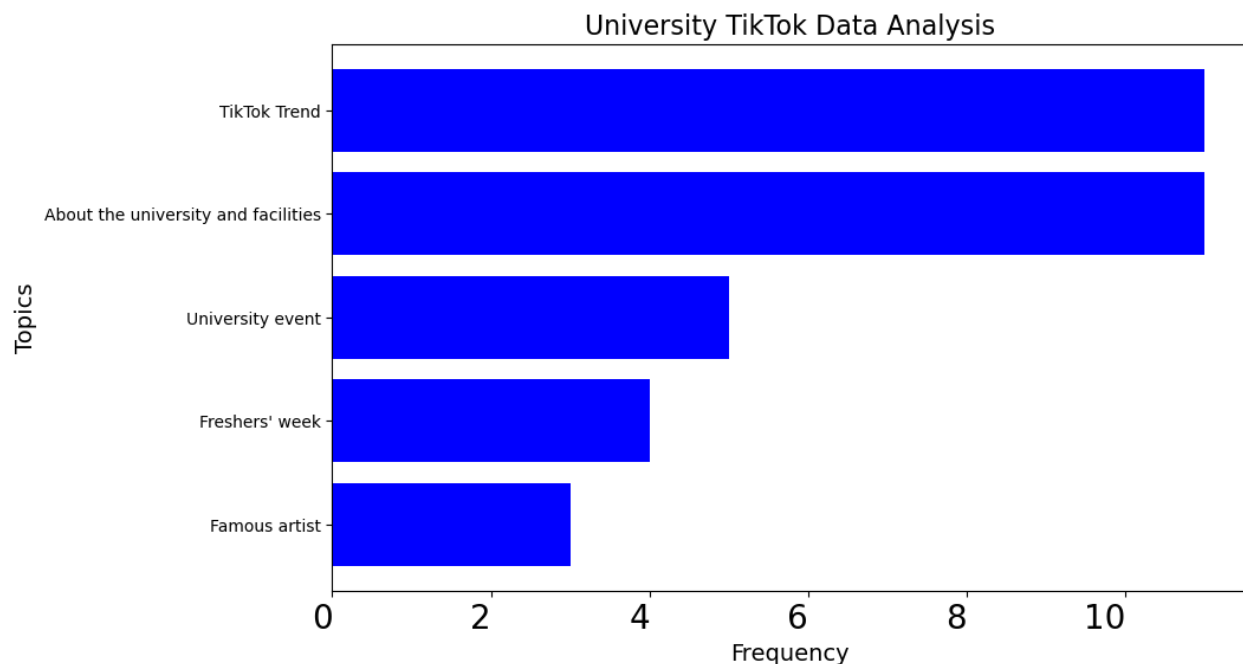


Source: Created by the Author

The analysis of the university's TikTok topics frequency during the period under study reveals several notable findings (*figure 21*). First and foremost, it is important to note that a total of 34 videos were published during this period. This relatively small number of videos is indicative of the university's modest presence on the TikTok platform. The data therefore provided a unique

opportunity to examine the content in more detail. It was found that the videos were distributed across five distinct themes, each with varying frequencies. Notably, 'About the University and Facilities' emerged as the most prevalent theme, with 11 videos dedicated to showcasing the institution and its resources. In addition, "TikTok Trend" also received 11 video representations, highlighting an engagement with popular trends on the platform. 'Freshers' week' and 'University event' were also significant, with 4 and 5 videos respectively, indicating a focus on student life and university events. Furthermore, the inclusion of 'Famous artist' content, with 3 videos, suggests an effort to capitalise on the appeal of celebrities such as Valmar and DJ Metzker Viktória.

Figure 21. Topics Frequency



Source: Created by the Author

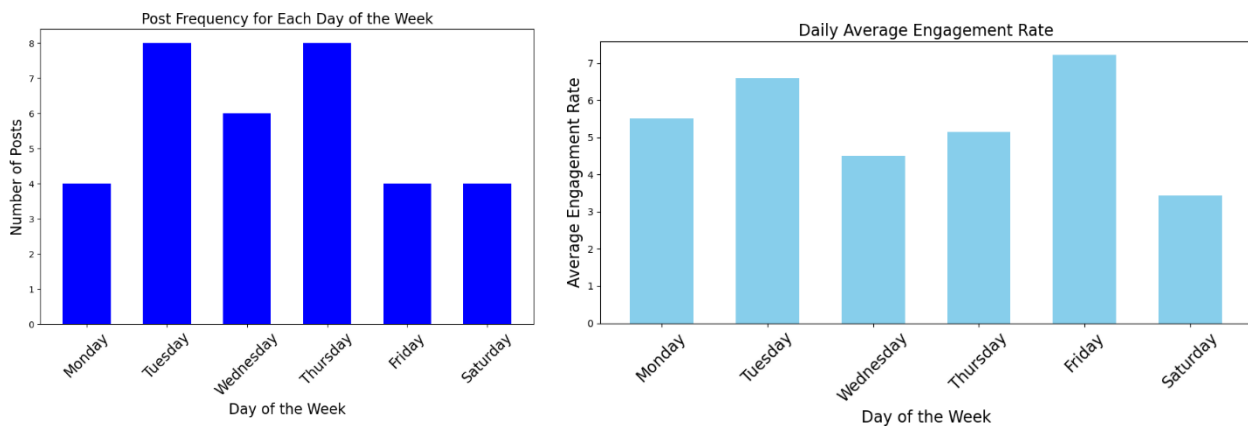
3.7.3. Daily Engagement

Due to the few numbers of post was published in the examined period only the frequency of each day of the week and its engagement rate was measured.

Analysing the TikTok engagement and posting data provided by the university, it is clear that there are discernible patterns in user activity and content distribution throughout the week. The engagement data for each day of the week illustrates the average frequency of engagement, ranging from 1 (Monday) to 6 (Saturday), with varying levels of user interaction. Notably, Saturday (day 5) has the highest engagement frequency at 7.21, indicating a peak in user activity, while

Wednesday (day 3) has the lowest engagement frequency at 4.5. On the other hand, the post frequency data shows the number of posts made by users on each corresponding day of the week. Interestingly, Mondays (Day 1) and Thursdays (Day 4) have the highest posting frequency, with 8 posts each, while Saturdays (Day 6) and Tuesdays (Day 2) have the lowest posting activity, with 4 posts each. These findings provide valuable insights into user behaviour on TikTok and highlight potential opportunities for targeted content creation and engagement strategies aimed at maximising user interaction across different days of the week.

Figure 22. Daily Posting Frequency and Engagement

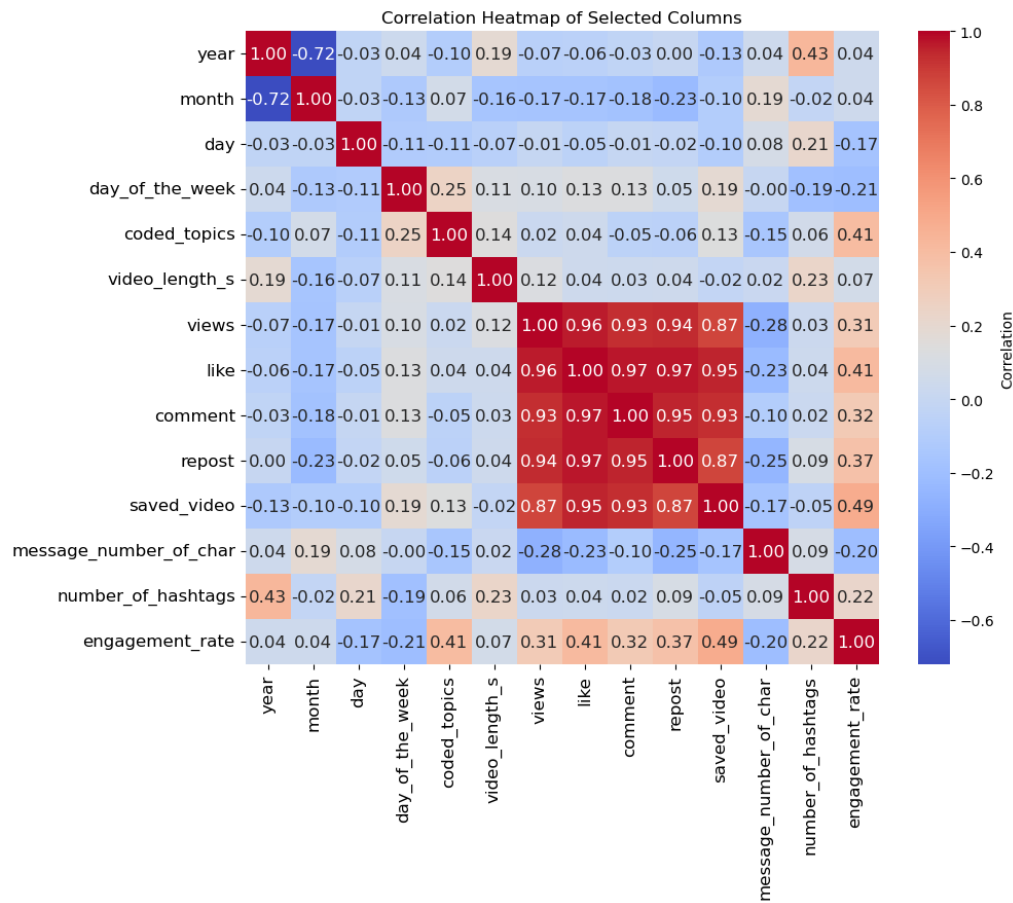


Source: Created by the Author

3.7.4. Correlation

Analyzing the matrix, several interesting patterns emerge. For instance, there is a strong negative correlation between the month and year, suggesting a cyclical trend in the university TikTok activities over the months and years. Additionally, "views," "like," "comment," and "repost" are highly correlated with each other, indicating that videos with more views tend to have more likes, comments, and reposts. Additionally, the number of hashtags used in a video exhibits a strong positive correlation with the coded topics, suggesting that certain topics are associated with the use of hashtags. On the other hand, post text length ("message_number_of_char") and engagement rate have negative correlations with several other attributes, implying that shorter messages and lower engagement rates are linked to certain video characteristics.

Figure 23. TikTok Correlation Matrix



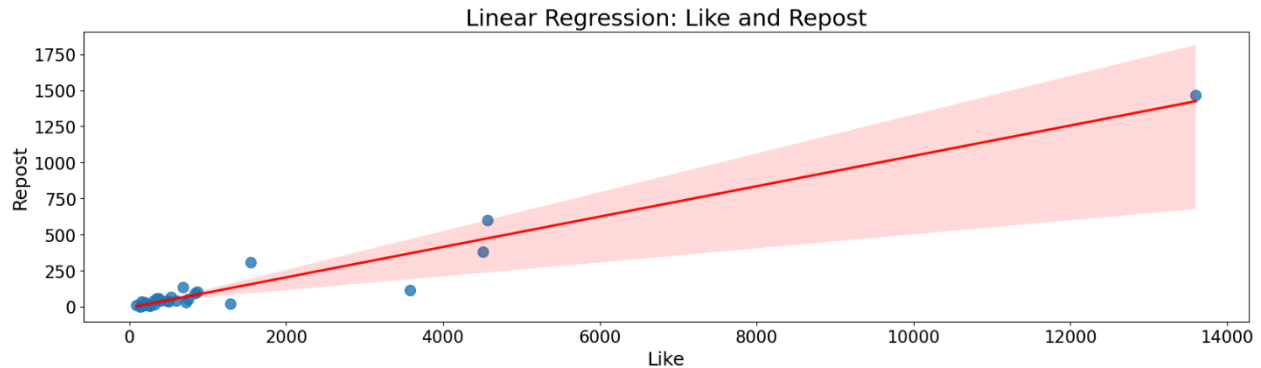
Source: Created by the Author

3.7.5. Regression

The relationship between the number of likes and the number of reposts of the university's TikTok videos was investigated using simple linear regression analysis which is showcased on *figure 24*. The results showed that there was a positive and significant correlation between the two variables, with a coefficient of 0.11 and an intercept of -7.92. This means that for every additional like, the expected number of reposts increases by 0.11, and if there are no likes, the expected number of reposts is -7.92. The regression equation can be written as $y = 0.11x + -7.92$, where y is the number of reposts and x is the number of likes. The mean square error of the regression model was 4033.26, which is the average deviation of the observed values from the predicted values. The regression model explained 10.53% of the variation in the number of reposts, as indicated by the coefficient of determination (R-squared). The results suggest that the university's TikTok videos are more likely to be reposted by viewers if they receive more likes, and that the number of likes is a good predictor of the number of reposts. However, the results also suggest that there are other factors

that influence the number of reposts, such as the content, quality and timing of the videos, which are not captured by the regression model.

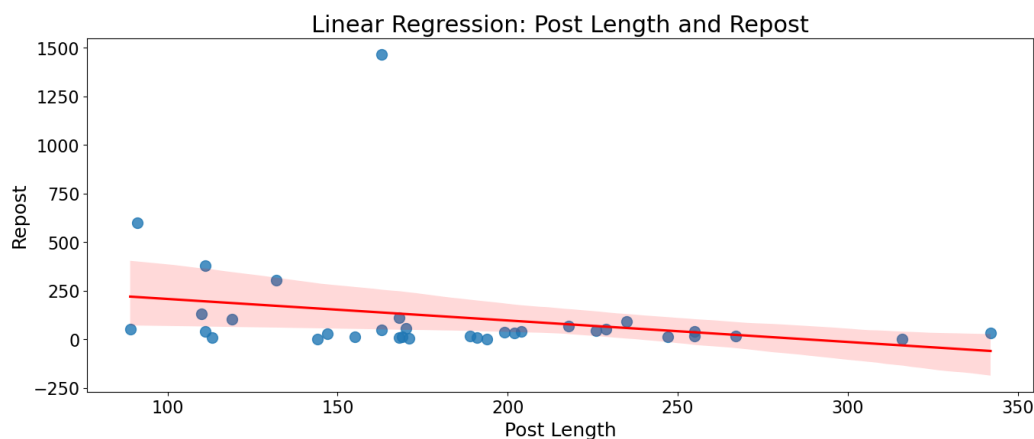
Figure 24. Linear Regression: Like and Repost



Source: Created by the Author

This relationship between the post length and the reposts is clarified by the regression analysis (*figure 25*), which has coefficients of $[-1.11]$ and an intercept of 318.31. The examined variables are inversely correlated, as indicated by the negative coefficient, with fewer reposts occurring for longer posts. This research implies that content on TikTok may become more viral if it is shorter. In addition, the regression model's accuracy is measured by the MSE of 6565.84, which shows how closely the model's predictions match the actual data points. The key aspect of this relationship is captured by the regression equation, which can be briefly written as $y = -1.11x + 318.31$. This equation offers a quantitative basis for comprehending the dynamics of user involvement on the university's TikTok platform.

Figure 25. Linear Regression: Post Length and Repost



Source: Created by the Author

3.8. Summary

In this part, the findings have been summarised and some recommendations and conclusions have been added for the website and each of the platforms.

3.8.1. Website

In conclusion, the investigation of Széchenyi István University's domain (sze.hu) was carried out using specialized tools, notably the DomainTools website and Semrush, a comprehensive digital marketing analytics platform. These tools provided valuable insights into website usage patterns, enabling the analysis of metrics such as pages per visit and average visit duration. The findings indicated that the website has successfully attracted a significant number of users, with keyword analytics identifying key terms driving traffic to the site. Furthermore, the analysis suggested areas for improvement, specifically enhancing mobile responsiveness and adding a language button to the main Hungarian site on mobile devices. Overall, these methodologies were crucial in conducting a thorough examination of the domain, offering valuable recommendations for its further development and optimization.

3.8.2. Facebook

For a clear and consistent image of Széchenyi István University, each department and faculty would use a Facebook page and each course would have a Facebook group. As the university is internationalizing, all the posts should be translated into English, as the information could be useful for foreign students as well. It is very important to emphasize the quality of the posts rather than the quantity. December showed high engagement despite fewer posts, indicating that well-curated, relevant content captures the audience's attention. Tuesdays, Wednesdays, and Thursdays consistently had higher post counts. It is recommended to focus on important announcements, events, and engaging content on these days when audience activity is at its peak. Despite lower post counts, engagement rates were higher on Sundays. Posting important updates or engaging content on Sundays would be beneficial as it would capture the attention of a more engaged audience. Writing concise posts, using more strategic hashtags, and encouraging likes, shares, and comments to increase social media engagement are also recommended.

3.8.3. Instagram

The Instagram account of Széchenyi István University (@szechenyi.istvan.egyetem) is an effective way of promoting the university's brand, values, and achievements to a wide and diverse audience.

The account posts high-quality photos and videos that showcase the university's modern facilities, academic programs, research projects, student life, and social events. The account also engages with its followers by asking questions, sharing stories, and using hashtags. The account has almost 8000 followers and receives hundreds of likes and comments on each post. The account's marketing strategy reflects the university's motto: "Széchenyin tanulni jó!" (It is good to study at Széchenyi!)

The research highlights the dynamic nature of audience interaction on Instagram, exemplified by the interplay between posting frequency, seasonal patterns and engagement rates. This insight enables the university to effectively tailor its content strategies, increase audience engagement, and foster a vibrant online community. In particular, the study suggests that universities could optimise their social media posting schedules by focusing on mid-week content on Instagram, particularly on Wednesdays and Thursdays, to maximise engagement rates. The findings highlight the key role of consistent posting schedules, efficient use of hashtags, concise messaging and active audience engagement through likes during the specified years. Adapting to these patterns appears to have positively influenced the University's social media marketing strategies, fostering increased engagement and interaction within its online community.

3.8.4. Twitter

The Széchenyi István University's Twitter page effectively uses a mix of content to engage with its audience. However, with only 135 followers, there is potential for growth in the university's Twitter presence. By increasing audience engagement, promoting the Twitter page, and using hashtags, the university could significantly enhance its online presence and reach a larger audience.

3.8.5. LinkedIn

In November 2023, the university successfully leveraged its LinkedIn platform to engage a global audience of approximately 9,000 followers and a growing alumni network of 9,232 past students. By consistently sharing achievement highlights, informational updates, and alumni spotlights in English, the university effectively communicated its message to a diverse audience. Through strategic content creation and active engagement, the university will further enhance its online presence, fostering meaningful relationships with its audience and alumni community.

3.8.6. TikTok

In conclusion, the analysis of TikTok engagement and posting data provided valuable insights into user behaviour and content distribution at the university. The study revealed clear patterns in user

activity throughout the week, with distinct levels of engagement observed from Monday to Saturday. Furthermore, the research identified intriguing correlations and regressions, including a cyclical trend in university TikTok activities over months and years, and the strong interconnections between views, likes, comments, and reposts, indicating the interconnected nature of user interactions. The use of hashtags was found to be associated with specific topics, and shorter messages and lower engagement rates were linked to certain video characteristics. These findings provide a comprehensive understanding of the university's TikTok dynamics, offering valuable information for future content strategies and user engagement efforts.

4. Python Codes

```
In [181]: 1 import pandas as pd
2 szefacebook = pd.read_csv("SZE_Facebook.csv", header=0, encoding="utf-8")
3 pd.set_option('display.max_columns', None)
4 szefacebook
```

object_id	object_type	query_time	query_type	message_number_of_char	message	topica	created_time
344311955	data	51:24.2	Facebook/<page-id>/posts	231	Digitalizáció a fókuszban: építőipari workshopot rendezett a Széchenyi István Egyetem Részletek: https://www.uni.sze.hu/post/digitalizacio-a-fokuszb-an-epitoipari-workshopot-rendezett-a-szechenyi-istvan-egyetem #SZE #Digitalizáció	NaN	2023-09-19
391035987	data	51:24.2	Facebook/<page-id>/posts	250	Évi egymillió forint támogatás – már lehet pályázni a Széchenyi István Egyetem Gólya-ösztöndijára Részletek: https://www.uni.sze.hu/post/evi-egymillio-forint-tamogat-as-mar-lehet-palyazni-a-szechenyi-istvan-egyetem-golya-osztondijara #SZE #Ösztöndíj	NaN	2023-09-19
531084003	data	51:24.2	Facebook/<page-id>/posts	298	👉 RUN-EU has grants for you to take part in the Students Week 2023! 🇵🇹 Are you interested in exploring opportunities to shape a better, more harmonious digital interregional environment for generations to come? 📩 APPLY BY 1 OCTOBER FOR A WEEK IN PORTUGAL! +INFO: bit.ly/SAP_Digital_Challenge23	NaN	2023-09-9
517730741	data	51:24.2	Facebook/<page-id>/posts	291	👉 RUN-EU has grants for you to take part in the Students Week 2023! 🇵🇹 Do you want to explore cooperation solutions to foster a brighter future for Europe and its diverse, interconnected communities? 📩 APPLY BY 1 OCTOBER FOR A WEEK IN PORTUGAL! +INFO: bit.ly/SAP_Cooperation_Challenge23	NaN	2023-09-9

```
In [233]: 1 import pandas as pd
2
3 szefacebook['created_time'] = pd.to_datetime(szefacebook['created_time'])
4
5 szefacebook['day_of_the_week'] = szefacebook['created_time'].dt.dayofweek + 1 #1-7 index
6 szefacebook['day'] = szefacebook['created_time'].dt.day
7 szefacebook['month'] = szefacebook['created_time'].dt.month
8 szefacebook['year'] = szefacebook['created_time'].dt.year
```

```
In [183]: 1 selected_columns = ['year', 'month', 'day', 'day_of_the_week', 'message_number_of_char', 'like.summary.total_count', 'love.summary.total_count', 'haha.summary.total_count']
2 summary_stats = szefacebook[selected_columns].describe()
3 summary_stats
```

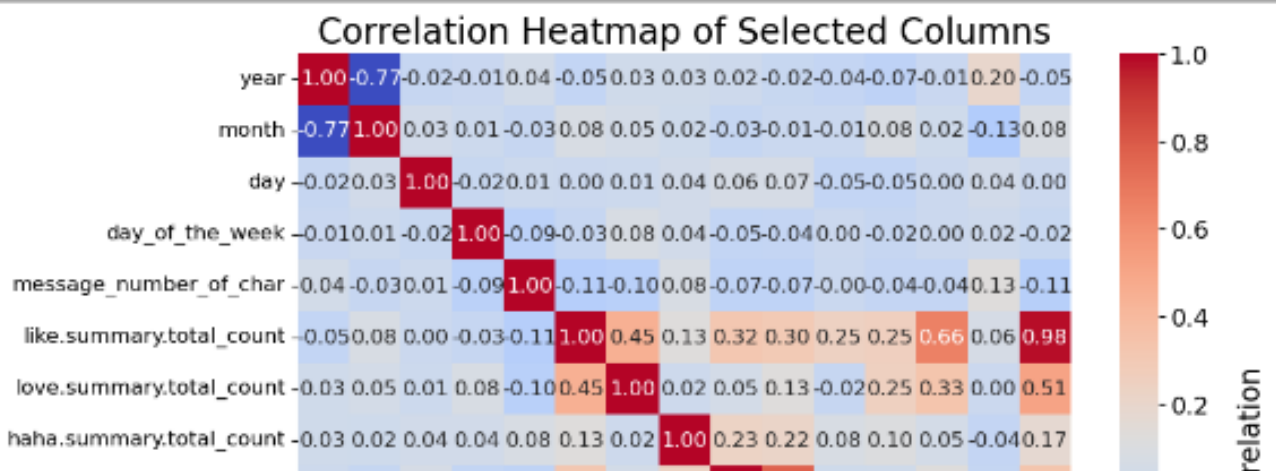
```
Out[183]:
```

	year	month	day	day_of_the_week	message_number_of_char	like.summary.total_count	love.summary.total_count	haha.summary.total_count
count	514.000000	514.000000	514.000000	514.000000	514.000000	514.000000	514.000000	514.000000
mean	2022.645914	6.704280	15.908560	3.570039	500.708171	47.389105	3.114786	0.000000
std	0.478701	3.408809	8.569712	1.805330	314.258880	104.924777	7.599916	4.000000
min	2022.000000	1.000000	1.000000	1.000000	0.000000	0.000000	0.000000	0.000000
25%	2022.000000	3.250000	9.000000	2.000000	327.250000	12.000000	0.000000	0.000000
50%	2023.000000	7.000000	16.000000	3.000000	431.500000	25.500000	1.000000	0.000000
75%	2023.000000	9.000000	23.000000	5.000000	576.750000	51.000000	3.000000	0.000000
max	2023.000000	12.000000	31.000000	7.000000	3294.000000	1896.000000	86.000000	101.000000

```

In [234]: 1 import pandas as pd
          2 import seaborn as sns
          3 import matplotlib.pyplot as plt
          4
          5 subset_df = szefacebook[selected_columns]
          6 correlation_matrix = subset_df.corr()
          7
          8 annot_font_size = 12
          9 axis_font_size = 12
         10
         11 plt.figure(figsize=(10, 8))
         12 sns.heatmap(data=correlation_matrix, annot=True, fmt=".2f", cmap='coolwarm', square=True,
         13           annot_kws={"size": annot_font_size}, cbar_kws={"label": 'Correlation'},
         14           xticklabels=correlation_matrix.columns, yticklabels=correlation_matrix.columns)
         15 plt.xticks(fontsize=axis_font_size)
         16 plt.yticks(fontsize=axis_font_size)
         17
         18 plt.title('Correlation Heatmap of Selected Columns')
         19 plt.show()

```



```

In [1]: 1 #correlation_matrix

```

```

In [258]: 1 from collections import Counter
          2 import re
          3
          4
          5 # Function to preprocess text and extract words
          6 def extract_words(text):
          7     words = re.findall(r'\b\w+\b', str(text).lower())
          8     return words
          9
         10 all_words = szefacebook["message"].apply(extract_words).sum()
         11
         12 word_counts = Counter(all_words)
         13
         14 most_common_words = word_counts.most_common(20)
         15
         16 word_statistics = pd.DataFrame(most_common_words, columns=["Word", "Frequency"])
         17
         18 word_statistics = word_statistics.sort_values(by="Frequency", ascending=False)
         19 word_statistics

```

```

Out[258]:
   Word  Frequency
0    a          2339
1   az           723
2   és           660
3  széchenyi     539
4   istván     476
5   egyetem     463

```

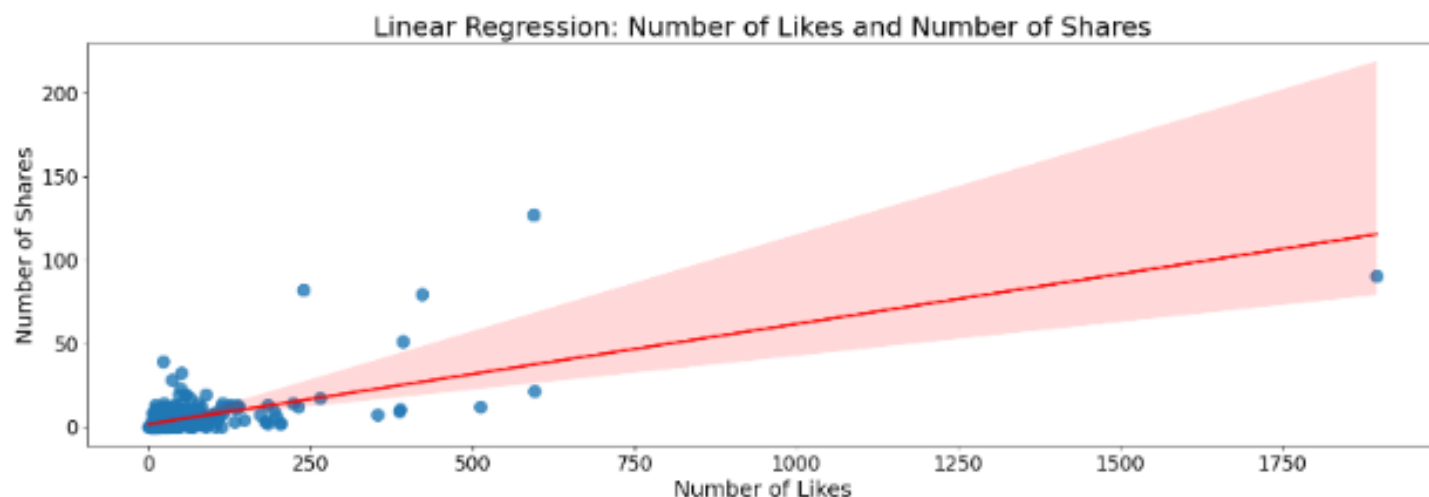


```

In [247]: 1 from sklearn.linear_model import LinearRegression
2 # Set font sizes
3 matplotlib.rcParams.update({'font.size': 16, 'axes.labelsize': 16, 'axes.titlesize': 20, 'xtick.labelsize': 14, 'ytick.labelsize': 14})
4
5 x = szefacebook['like.summary.total_count'].values.reshape(-1, 1)
6 y = szefacebook['shares.count']
7
8 model = LinearRegression()
9
10 # Fit the model to the data
11 model.fit(x, y)
12
13 # Make predictions using the trained model
14 predictions = model.predict(x)
15
16 # Calculate mean squared error
17 mse = mean_squared_error(y, predictions)
18
19 # Print coefficients, intercept, and mean squared error
20 print("Coefficients:", model.coef_[0])
21 print("Intercept:", model.intercept_)
22 print("Mean Squared Error:", mse)
23 print("Regression Equation: y = {:.2f}x + {:.2f}".format(model.coef_[0], model.intercept_))
24
25 # Create a scatter plot with regression line using seaborn
26 plt.figure(figsize=(20, 6))
27 sns.regplot(x='like.summary.total_count', y='shares.count', data=szefacebook, scatter_kws={'s': 100}, line_kws={'color': 'red'})
28 plt.xlabel('Number of Likes', fontsize=18)
29 plt.ylabel('Number of Shares', fontsize=18)
30 plt.title('Linear Regression: Number of Likes and Number of Shares', fontsize=22)
31
32 # Set the font size of axis numbers
33 plt.xticks(fontsize=16)
34 plt.yticks(fontsize=16)
35
36 plt.show()

```

Coefficients: 0.0599748599951538
 Intercept: 1.455184284786844
 Mean Squared Error: 51.33596233890934
 Regression Equation: $y = 0.06x + 1.46$



```

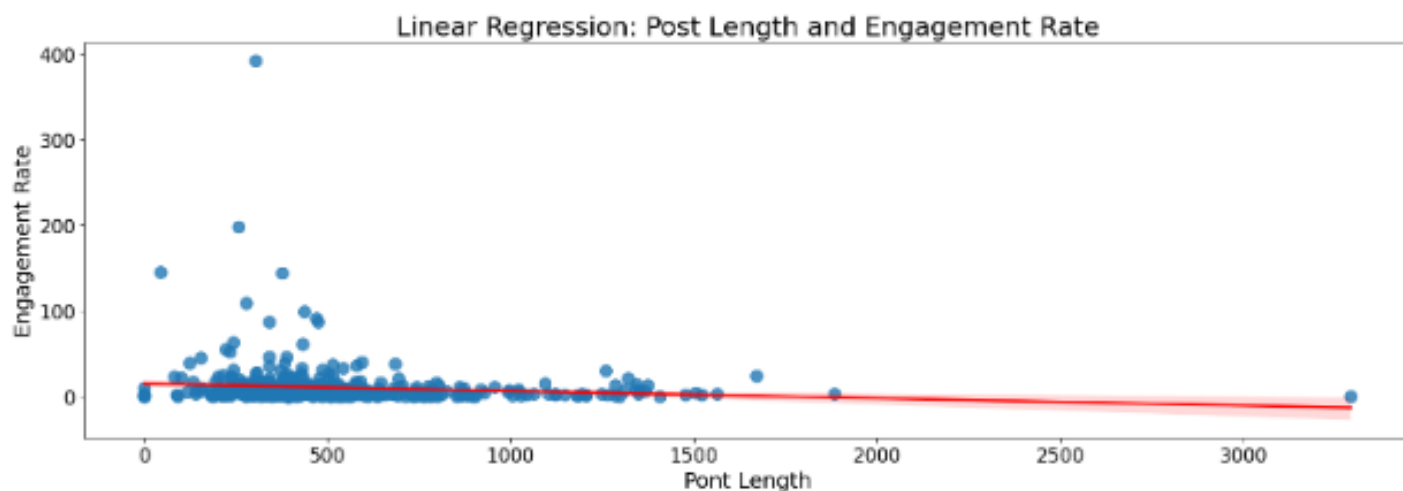
In [246]: 1 # Set font sizes
2 matplotlib.rcParams.update({'font.size': 16, 'axes.labelsize': 16, 'axes.titlesize': 20, 'xtick.labelsize': 14, 'ytick.labelsize': 14})
3
4 x = szefacebook['message_number_of_char'].values.reshape(-1, 1)
5 y = szefacebook['engagement_rate']
6
7 # Create a Linear regression model
8 model = LinearRegression()
9
10 # Fit the model to the data
11 model.fit(x, y)
12
13 # Make predictions using the trained model
14 predictions = model.predict(x)
15
16 # Calculate mean squared error
17 mse = mean_squared_error(y, predictions)
18
19 # Print coefficients, intercept, and mean squared error
20 print("Coefficients:", model.coef_[0])
21 print("Intercept:", model.intercept_)
22 print("Mean Squared Error:", mse)
23 print("Regression Equation: y = {:.2f}x + {:.2f}".format(model.coef_[0], model.intercept_))
24
25 # Create a scatter plot with regression line using seaborn
26 plt.figure(figsize=(20, 6))
27 sns.regplot(x='message_number_of_char', y='engagement_rate', data=szefacebook, scatter_kws={'s': 100}, line_kws={'color': 'red'})
28 plt.xlabel('Post Length', fontsize=18)
29 plt.ylabel('Engagement Rate', fontsize=18)
30 plt.title('Linear Regression: Post Length and Engagement Rate', fontsize=22)
31
32 # Set the font size of axis numbers
33 plt.xticks(fontsize=16)
34 plt.yticks(fontsize=16)
35
36 plt.show()

```

```

Coefficients: -0.008445884550668805
Intercept: 15.30210171936445
Mean Squared Error: 570.5432791463983
Regression Equation: y = -0.01x + 15.30

```



```

In [ ]: 1 correlation_comments = szefacebook['like.summary.total_count'].corr(szefacebook['comments.summary.total_count'])
2 print("Correlation between likes and comments:", correlation_comments)

```

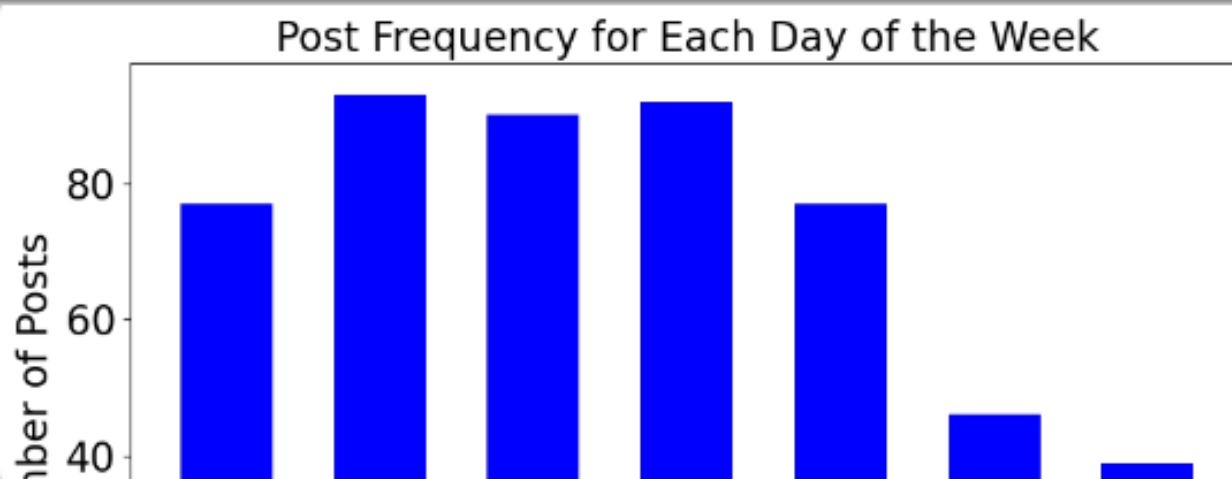
```
In [252]: 1 # Extract day of the week (1=Monday, 2=Tuesday, ..., 7=Sunday)
2 szefacebook['day_of_week'] = szefacebook['created_time'].dt.dayofweek + 1
3
4 # Calculate post frequency for each day of the week
5 post_frequency = szefacebook['day_of_week'].value_counts().sort_index()
6
7 # Print post frequency for each day of the week (assuming 1=Monday, 2=Tuesday, ..., 7=Sunday)
8 print("Post Frequency for Each Day of the Week:")
9 print(post_frequency)
```

Post Frequency for Each Day of the Week:

```
1 77
2 93
3 98
4 92
5 77
6 46
7 39
```

Name: day_of_week, dtype: int64

```
In [253]: 1 # Extract day of the week (0=Monday, 1=Tuesday, ..., 6=Sunday)
2 szefacebook['day_of_week'] = szefacebook['created_time'].dt.dayofweek
3
4 # Count the number of posts for each day of the week
5 post_frequency = szefacebook['day_of_week'].value_counts().sort_index()
6
7 # Define day names for labeling the x-axis
8 day_names = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sunday']
9
10 # Plotting the bar chart
11 plt.figure(figsize=(10, 6))
12 plt.bar(day_names, post_frequency, color='blue', width = 0.6)
13 plt.xlabel('Day of the Week', fontsize = 20)
14 plt.ylabel('Number of Posts', fontsize = 20)
15 plt.title('Post Frequency for Each Day of the Week', fontsize = 20)
16 plt.xticks(rotation=45, fontsize = 20) # Rotate x-axis labels for better visibility
17 plt.yticks(fontsize=20)
18 plt.show()
19
```



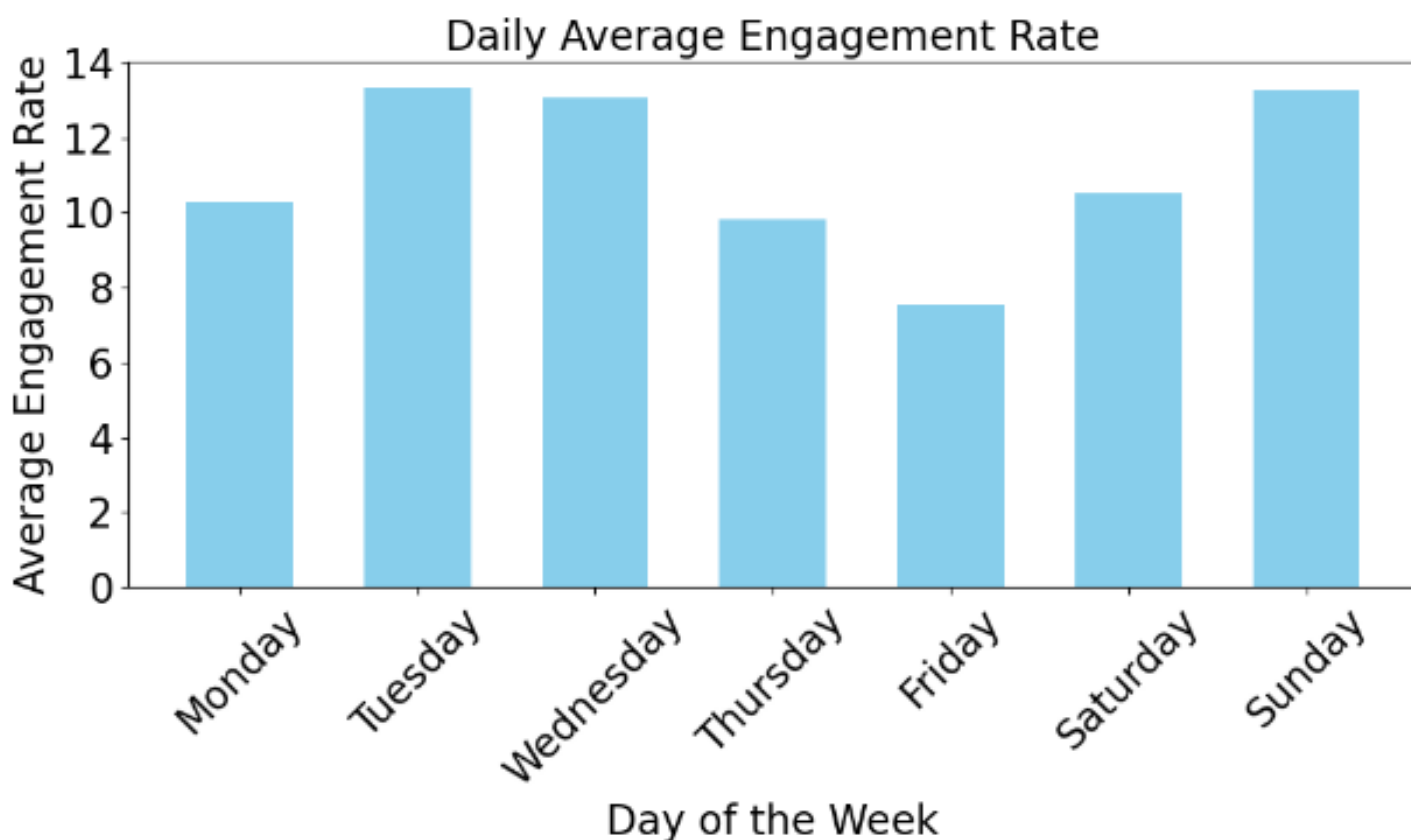
```
In [256]: 1 post_frequency
```

```
Out[256]: 0 77
1 93
2 98
3 92
4 77
5 46
6 39
Name: day_of_week, dtype: int64
```

```
In [255]: 1 # Convert lists to pandas Series
2 post_frequency_series = pd.Series(post_frequency)
3 daily_avg_engagement_series = pd.Series(daily_avg_engagement)
4
5 # Calculate correlation using pandas Series
6 correlation_post_frequency_engagement_rate = post_frequency_series.corr(daily_avg_engagement_series)
7 print("Correlation between Daily Post Frequency and Daily Average Engagement Rate:", correlation_post_frequency_engagement_r
```

Correlation between Daily Post Frequency and Daily Average Engagement Rate: 0.64234579913024

```
In [209]: 1 # Calculate daily average engagement using groupby and mean()
2 daily_avg_engagement = szezfacebook.groupby('day_of_the_week')['engagement_rate'].mean()
3
4 # Plotting the bar chart with days of the week as x-axis labels
5 plt.figure(figsize=(10, 6))
6 plt.bar(day_names, daily_avg_engagement, color='skyblue', width=0.6)
7 plt.xlabel('Day of the Week', fontsize=20)
8 plt.ylabel('Average Engagement Rate', fontsize=20)
9 plt.title('Daily Average Engagement Rate', fontsize=20)
10 plt.xticks(rotation=45, fontsize=20)
11 plt.yticks(fontsize=20) # Set Y-axis numbers font size to 20
12 plt.tight_layout()
13 plt.show()
14
```



In [2]:

```
1 #daily_avg_engagement
```

In [213]:

```
1 # Filter December posts
2 december_posts = szefacebook[szefacebook['created_time'].dt.month == 12]
3
4 # Get frequency of topics
5 topics_frequency = december_posts['topics'].value_counts().reset_index()
6 topics_frequency.columns = ['topics', 'frequency']
7
8 # Now, topics_frequency DataFrame contains topics and their frequency in December
9 topics_frequency
```

Out[213]:

	topics	frequency
0	Success of organisations, students, teachers, enhancing the image of the university	10
1	Opportunities and news for students	9
2	University-related news for general audience	5
3	University-related information for secondary school students	5

In [214]:

```
1 # Filter and group by 'topics' and 'created_time' month, then calculate mean engagement_rate
2 grouped_data = december_posts[december_posts['created_time'].dt.month == 12].groupby(['topics', december_posts['created_time'].dt.month)
3
4 # Rename the columns for clarity
5 grouped_data.columns = ['topics', 'created_month', 'mean_engagement_rate']
6
7 # Sort the DataFrame by mean 'engagement_rate' in descending order
8 grouped_data = grouped_data.sort_values(by='mean_engagement_rate', ascending=False).reset_index(drop=True)
9
10 # Drop the 'created_month' column if you don't want it in the final DataFrame
11 grouped_data = grouped_data.drop(columns=['created_month'])
12
13 grouped_data
```

Out[214]:

	topics	mean_engagement_rate
0	University-related information for secondary school students	71.712062
1	Opportunities and news for students	54.128837
2	University-related news for general audience	15.525292
3	Success of organisations, students, teachers, enhancing the image of the university	11.908615

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