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Article

Exploring social media marketing in higher education on academic social network sites: A Hungarian case study analysis

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Abstract: The evolution of the internet has led to the emergence of social media (SM) platforms, offering dynamic environments for user interaction and content creation. Social media, characterized by user-generated content, has become integral to electronic communication, fostering higher engagement and interaction. This study aims to explore the utilization of SM marketing, particularly in Higher Education Institutions (HEIs), focusing on Széchenyi István University's academic social network sites (SNS) as a case study to enhance student engagement and satisfaction. The primary objective of this study is to review recent academic literature on SM marketing, especially for HEI marketing, and investigate the potential of the University's SNS platforms as a case study in increasing student engagement. First a systematic literature review was conducted using Scopus and Science Direct databases to analyze recent research in academic SM. Then the article examined the University's website and SNS platforms using the Facepager program to collect and analyze posts' content. The findings from the literature review and observation indicate the growing importance of SM in higher education marketing. The university's use of various SM strategies, such as visual storytelling, multimedia content, blogs, and user-generated content, contributes to increased student engagement of the university's values.

Keywords: social media marketing; higher education institutions; academic social network sites; student engagement; web 3.0; user-generated content

1. Introduction

The term 'Web 2.0,' introduced by O'Reilly Media in 2004, led to the rise of social media (SM). Unlike the passive Web 1.0, Web 2.0 enables dynamic interaction between users (Chandran, 2016; Schroeder, 2014). Web 3.0, the next evolution, focuses on decentralization, openness, and AI-enhanced user value, potentially transforming social networking sites (SNS) (Sridhara and Raghunandana, 2019).

SM can be considered a style of electronic or online communication where the shared content is manipulated or created by the users. User-Generated Content (UGC) can cause higher engagement (Hamm et al., 2013). Examples of common SM channels/platforms include blogs, SNSs such as Facebook, Instagram, and LinkedIn; microblogs such as X/Twitter; 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 SM marketing, especially for in Higher Education Institutions (HEI) marketing. It also aims to investigate the potential of the University's academic SNS with the goal of increasing student engagement and ultimately student satisfaction. The university are using 5 SM platforms which includes Facebook,

Instagram, X/Twitter, LinkedIn and TikTok.

2. Materials and methods

Universities today increasingly use websites and social media (SM) platforms to engage with students and share important information. This study explores how universities leverage these tools, with a focus on Széchenyi István University's online efforts as a case study to reach both Hungarian and international students. To address this, a systematic literature review was applied.

The research questions the study seeks to answer are:

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

RQ2.: How does the University use its website and SM platforms to reach Hungarian and international students?

To address Research Question 1 (RQ1), the research conducted a systematic literature review within the framework of the PRISMA guidelines. This method was chosen to provide a comprehensive, structured, and up-to-date overview of the existing academic research in the field of social media in general and in higher institutions. The PRISMA framework ensures a transparent and replicable review process, which is essential for synthesizing evidence from a large body of literature. The review focused on recent studies to ensure that the findings reflect current trends and methodologies in the field. For the literature search, the Scopus and Science Direct databases were selected due to their comprehensive coverage of peer-reviewed articles in the areas of higher education marketing, and social media. The search included a combination of relevant keywords and filters to capture studies published in the last 10 years, ensuring a focus on contemporary research. After selecting the relevant articles, data such as methodology, and key findings were extracted and organized using Excel for further analysis and synthesis. The results were categorized into themes and trends that emerged across the literature.

For Research Question 2 (RQ2), the research analyzed the website and social networking sites (SNSs) of the University to assess their social media presence and user engagement. The analysis was conducted using Facepager Version 4.5.3, a software tool that enables the extraction of social media data from various platforms. This tool was used to collect data on the content of the university's social media posts, as well as the number of comments and reactions each post received. The data was then exported into CSV files, which were further processed and analyzed using Microsoft Excel for initial data organization and cleaning. To gain deeper insights into patterns and correlations within the data, Python programming was employed. Python's versatility, particularly with libraries such as Pandas and Matplotlib, allowed for more advanced data analysis, such as identifying trends in engagement and visualizing the relationship between post content and audience reactions. This multi-step approach provided a comprehensive analysis of the university's social media effectiveness and user interaction patterns.

SM platforms are important for HEIs since they can effectively convey the university's mission and core values to students and staff members. Universities use a variety of SM strategies, using images, blogs, and polls as gamification tools to

engage students (Al-Daihani and Abrahams 2018; Eisinger et al., 2014). Visual storytelling creates an immersive experience that fosters active participation. Blogs facilitate in-depth communication and encourage insightful discussions, and UGC provides subconsciously satisfaction for the user (Kuo et al., 2016; Damico and Krutka, 2018). 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.

According a survey results by Statista, Facebook emerged as the most popular social media platform in Hungary, with 85% of respondents accessing it daily. YouTube followed closely with 50%, and Instagram ranked third with a daily usage rate of 29% (Statista, 2023). These findings highlight the University's strategic alignment with current SM trends, as it is prominently featured among the top 10 most used platforms identified in the study.

3. Results and discussion

The article conducted a systematic literature review research approach using the PEO (Population, Exposure, Outcome) framework, thereby ensuring a structured examination of social media data across various platforms (Mammun et al., 2021). Discussion analytics were applied to each platform individually, thus allowing for a nuanced understanding of user interactions, correlations, and topic engagement. This multi-layered analysis provides a more profound insight into audience behaviours, as well as highlighting platform-specific variations in how content was received and discussed. The benefits of this approach included enhanced accuracy in identifying key themes, improved relevance in recommendations for future content strategies, and a comprehensive view of social media's impact on the target population. Ultimately, this methodical process enriched the study's validity and provided actionable insights applicable across diverse social media channels.

3.1. 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. It 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 (Briner and Denyer, 2012; Denyer and Tranfield, 2009).

3.1.1. 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 (Hamel et al., 2020; Reyen et al., 2017).

During keyword identification, the research study also took into account the most common synonyms and alternatives for HEI SM Marketing. Based on this approach the following keywords were identified and used in the research (**Table 1**).

The PEO (Population, Exposure, Outcome) framework is used to categorize the keywords into three main groups 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	SM	Website	Engagement
University Student	Marketing	Facebook	Retention
University	Communication	Instagram	Interaction
Higher Education		X/Twitter	Satisfaction
		TikTok	Effectiveness
		LinkedIn	

Population is the category in which the research question is focused, which is in this case the HEI 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. During the preparation of the SLR, the following inclusion and exclusion criteria were formulated:

a) The articles have to be related to Social Sciences/Psychology/ Business/Computer Science fields.
b) The articles have to be freely accessible.
c) The articles have to be written in English.
d) The articles have to be published between 2012 and 2023.
e) The articles which are present in both databases have to be eliminated to avoid duplication.
f) The articles have to be related to the research question (RQ1.).

3.1.2. 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.

402 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 October 2023. After the articles were chosen based on the four criteria, there were 357 papers left. 249 papers were chosen from the ScienceDirect database, and 108 papers were chosen from the Scopus Database. 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	

In general, the number of the publication in HEI SM Marketing is low in the examined period of time which indicates a 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 (Duque, 2016).

3.1.3. Narrative summary of the results

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, X/Twitter, LinkedIn, and TikTok.

HEI websites must be accessible to attract and convert prospective students while providing current students with essential information and news. However, unclear standards often result in poor user experiences (Manzoor et al., 2019). University websites serve internal- and external users. Their needs vary: students seek admissions and scholarship information, faculty need event schedules, and external users look for collaborations or institutional achievements (Çerri, 2014).

Facebook offers an exceptional opportunity for marketing experts to promote businesses due to its high page views (Wang, 2019). Ertugan (2017) studied university students, active Facebook users, exposed to diverse ads often misaligned with their lifestyles. Soares et al. (2020) found that higher post interactivity in HEI contexts negatively correlates with the number of likes received.

Instagram is an image-based platform where users share life experiences through photos. Social interaction is a key motivation for its use (Geurin-Eagleman and Burch, 2016). It allows users to manage impressions through high-quality images, which are more impactful than text (Marwick, 2015). Rosa-Castillo et al. (2022) used gamification on Instagram in a course, with 71.7% of students reporting enhanced learning, highlighting its educational potential.

X/Twitter, a micro-blogging platform, enables short posts and peer communication, enhancing idea expression, social skills, and collaborative learning (Chen and Chen, 2012; Gao et al., 2012). Prestridge (2013) found that X/Twitter supports first-year students by fostering connectivity and resourcefulness, despite

challenges like task management and tweet length limits.

Studies show LinkedIn is the most effective platform for employers and job seekers. Del Cerro (2017) found it was preferred by 94% of recruiters, followed by Facebook and X/Twitter. López-Carril et al. (2020) highlighted LinkedIn's potential for blended/online learning, allowing students to develop content and professional profiles. López-Carril (2022) found that students, despite video tutorials and private group collaboration, were mostly inactive on LinkedIn, indicating a lack of familiarity with professional SM use.

TikTok, a leading platform for short-form mobile videos, was the most downloaded app in 2020 (Nakafuji, 2021). It allows users to create videos up to 10 minutes long and features diverse content like advice, challenges, and humor (Alley and Hanshew, 2022). An analysis of U.S. academic libraries on TikTok found that 61.4% of their content focused on "humanization/fun," emphasizing engagement and entertainment (Alley and Hanshew, 2022).

The review found that only 24 articles on HEIs' SM strategies met the selection criteria, highlighting a research gap. This is significant given the evolving digital world and the need for different engagement strategies on various platforms.

In conclusion, this discussion highlights the strategic role of social media platforms and university websites in enhancing the marketing effectiveness of HEIs and their attractiveness to prospective students. Despite the distinct advantages offered by each platform, a significant research gap remains in understanding how these channels can be optimised specifically for HEI marketing. Current studies offer limited insight into the nuanced ways in which content type, posting frequency and interactive features influence student engagement and retention outcomes. Expanding research in this area is critical for HEIs seeking to use digital channels to increase visibility, attract a larger and more diverse student body, and improve student engagement. Ultimately, more targeted research can help HEIs refine their digital strategies to ensure that social media and online presence are effectively aligned with student expectations and institutional goals.

This research paper examines the digital presence of Széchenyi István University on various SM platforms as a case study. The second research question (RQ2) investigates the website and SM 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.

3.2. University websites

The university is located in Győr (Hungary), founded in 1968 as the College of Transport and Telecommunications, expanded its programs significantly after 1986, adding economics, health, social education, law, and music. It gained university status in 2002 and now offers diverse undergraduate, master's, and doctoral programs across 9 faculties and 5 doctoral schools, emphasizing regional competitiveness through innovation and research integration. More than 12,000 students' study at some program in full-time, correspondence or distance learning mode in Hungarian or 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. 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).

The University's domain (sze.hu) investigation was conducted using specialised tools, in particular the DomainTools, which is designed to facilitate enquiries about 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.

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". In 2002, the institution changed status from a college to a university; therefore, the domain name was changed to "sze". 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) redirects to uni.sze.hu.

The domain sze.hu was also analysed by Semrush. 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 from other countries. The university has not spent any money on online advertising and its' organic traffic has been 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 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, enrolment and Freshers' Week (Schedule of Academic Year 2023/24). Students seek information about these events and other programmes on one of the websites of the sze.hu domain during these months.

The official website of the university, uni.sze.hu, and its subpages were reviewed. It offers Hungarian, English, and Chinese language options with a multi-page layout. However, navigation bars vary across languages, and some Hungarian pages lack English/Chinese translations, notably on faculty subpages. Hungarian content is accessible at uni.sze.hu, while English and Chinese versions are found at admission.sze.hu, switchable via a flag icon at the top right. Mobile versions of all sites were reviewed for usability. Common issues include excessive white space, reducing information visibility. The Hungarian mobile site lacks a direct language switch, challenging foreign users seeking English/Chinese content; therefore, adding a language switch button on the Hungarian site is recommended.

3.3. Facebook analytics

In this section, the article conducts primary research on the social media platforms of the examined university. Analytics and results from Facebook, Instagram, X (formerly Twitter), LinkedIn, and TikTok have been analyzed. The extracted data provides valuable insights into user behaviour and engagement, which can help the university strategically plan its social media activities to better inform

and engage current students and increase applications from prospective students.

The 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. In Facebook groups students help each other with academic questions. Not every faculty and department have page on the examined platform making the university image a bit inconsistent.

In this research, the main official Facebook page was analysed since it reaches the most college students. The page has approximately 27.000 likes and 28,000 followers in October 2023. Facebook data was collected using Facepager software that can fetch publicly available data from SMPs based on APIs (Application Programming Interface) and web scraping (Jünger and Keyling, 2019). Analysis was performed by the Python programming language.

3.3.1. Descriptive statistics

In the examined period, 514 posts were published. On average, posts were made in the second 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 other reactions. 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 ranged widely, indicating varying levels of user interaction across different posts.

3.3.2. Post text statistics

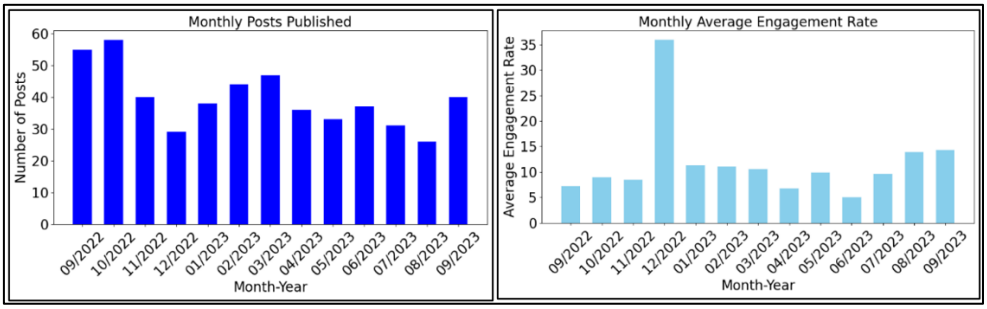
A code was written which shows the 20 most frequent words occur in the posts in the examined one year period. Hungarian words dominate the content, indicating a strong focus on the local students. Words like "az", "és" are frequently used, reflecting the university's emphasis on its Hungarian identity. The presence of words like "https", "hu", and "www" suggests a high number of references and links shared in the posts, indicating a focus on providing external resources. The word "uni" also appears, likely referencing the university itself. English word "the" is present, possibly indicating some content aimed at international students.

3.3.3. Monthly and daily engagement

As it can be seen on the **Figure 1a,b**, the monthly posts and the average monthly engagement of students on the Facebook page (09/2022–09/2023). It was analyzed by Python.

It 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. It corresponds 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. This pattern suggests a correlation between the university's engagement and the academic calendar, highlighting the influence of the semester structure on its SM activity.



(a) **(b)**

Figure 1. (a) Monthly posting frequency on facebook; **(b)** Monthly engagement rate on facebook.

The highest number of posts published was on Tuesday (93), followed by Wednesday (90) and Thursday (92). The lowest number of posts was on Sunday (39), followed by Saturday (46) and Monday (77). 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).

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. The heatmap shows the potential correlation of all the column's data with other variables (**Figure 2**).

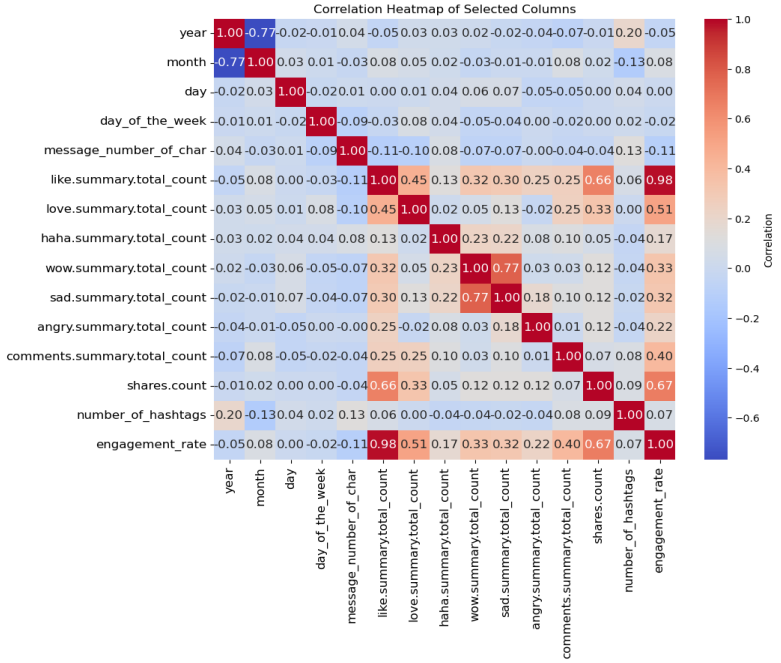


Figure 2. Facebook correlation matrix.

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.

3.3.5. Regression

Based on the correlation results, one of the relevant most and least correlated variables were also used to measure regression (see **Figure 3**).

The linear regression analysis summarizes the relationship between post length (x) and engagement rate (y) on the university's main official Facebook page. The regression equation is:

$$y = -0.01x + 15.30 \quad (1)$$

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.

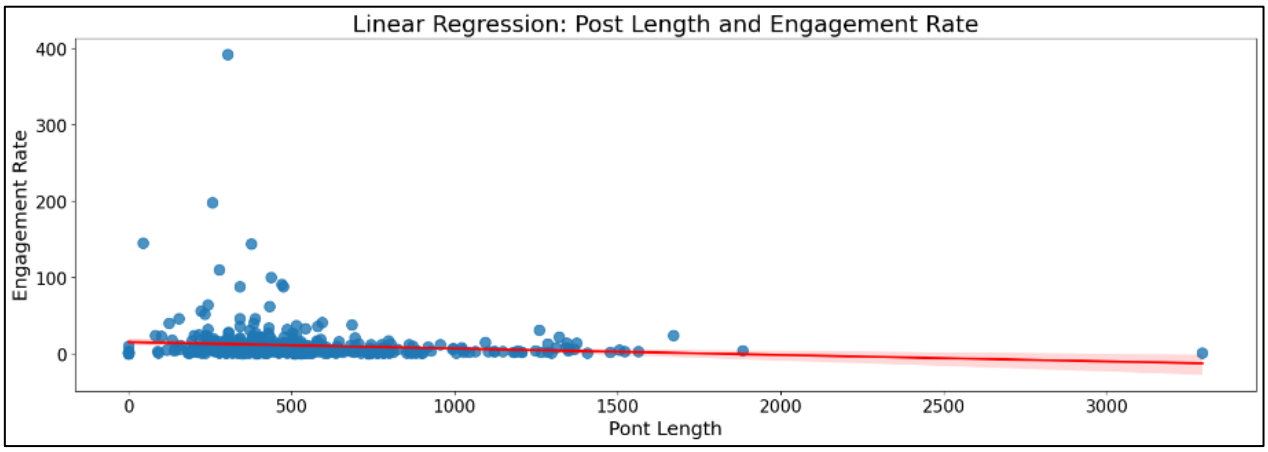


Figure 3. Linear regression: Post length and engagement rate.

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

The uUniversity has several official Instagram accounts 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 account, which is maintained by the Student Union, and the university has an account for internationals, which is used by the Student Committee of Foreign Affairs.

For this article, the main official Instagram account was analysed since it reaches the most college students. The account has 7387 followers in 1 November 2023. The data were collected from the Instagram page using a python library called Instaloader. The data collection period was from 01/09/2022, to 31/09/2023.

3.4.1. Descriptive statistics

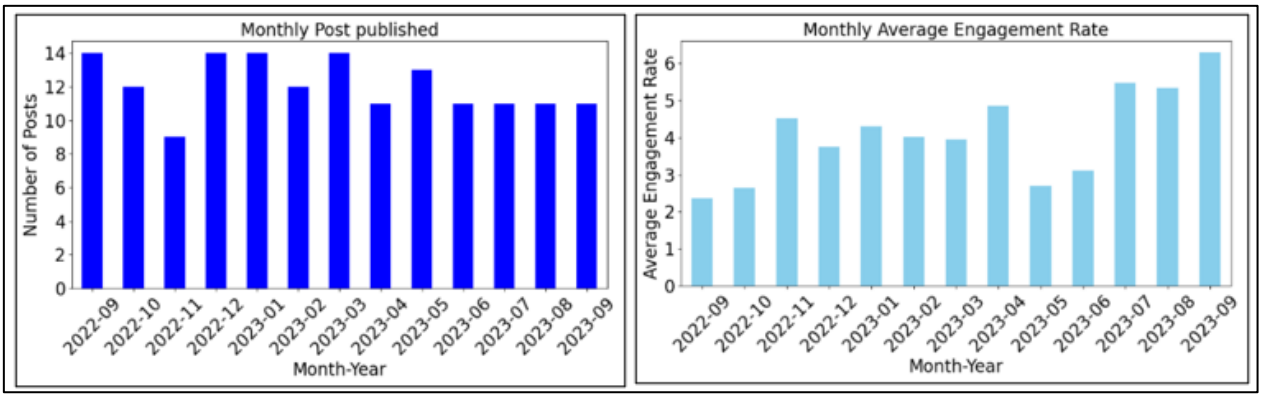
In the one-year period 157 posts were published. On a monthly basis, the mean month of 6.57 suggests a steady flow of content throughout the year, while the mean day of 16.24 highlights a consistent posting schedule within each month. In terms of content characteristics, the mean message length of 530.58 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.

3.4.2. Post text statistics

The analysis of word frequency 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" and Hungarian equivalents such as "az" and "és", 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', emphasising the local and institutional context of the posts. Furthermore, the presence of "unisze" and "széchenyiegyetem" underlines the university's efforts to brand itself on SM platforms. The frequent appearance of personal pronouns such as "you" suggests an interactive approach, possibly engaging directly with the audience.

3.4.3. Monthly and daily engagement

Figure 4a,b highlights the significance of analysing 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 9-14 posts. This consistent posting strategy reflects a structured approach to content dissemination, ensuring regular engagement with the audience.



(a) **(b)**

Figure 4. (a) Monthly posting frequency on instagram; **(b)** Monthly engagement rate on instagram.

The most engaged month was September 2023 with 11 posts. These posts were mainly about Freshers' Week and some other university events. Posts were published most frequently on Wednesday (33), followed closely by Monday (27). In contrast, Sunday recorded the lowest posting frequency with (13). This disparity in posting frequency provides an initial insight into the university's content dissemination strategy. 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.

3.4.4. Correlation

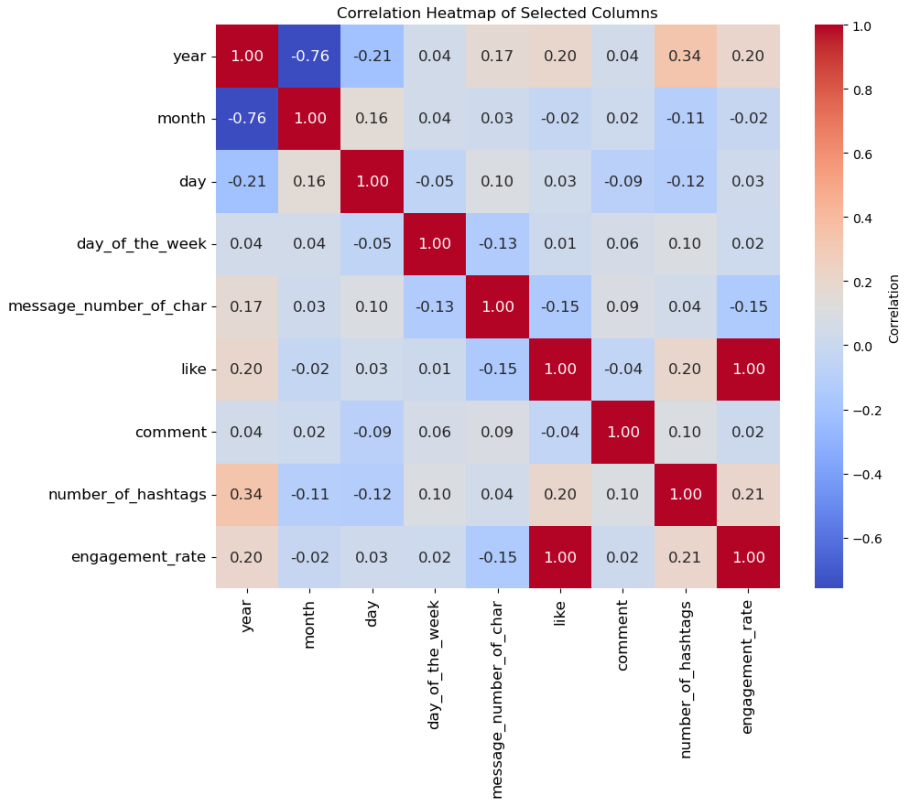


Figure 5. Instagram correlation matrix.

The heatmap was applied for the Instagram data (**Figure 5**). 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, suggesting that concise and impactful content resonated well with audiences.

3.4.5. Regression

Regression between the post length and engagement rate was not measured because of extremely high MSE which would be 6.9 indicates the average squared difference between the actual engagement rates and the engagement 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. Other variables have not examined regression-wise since these one of the most relevant and correlated variables.

Figure 6 shows a positive correlation between the number of hashtags and engagement rate, peaking at 8–9 hashtags. This suggests a moderate number of hashtags maximizes engagement on social media platforms. However, using more than 9 hashtags leads to a decline in engagement, possibly due to perceived spamming or diluted content focus, highlighting the risks of excessive hashtag use.

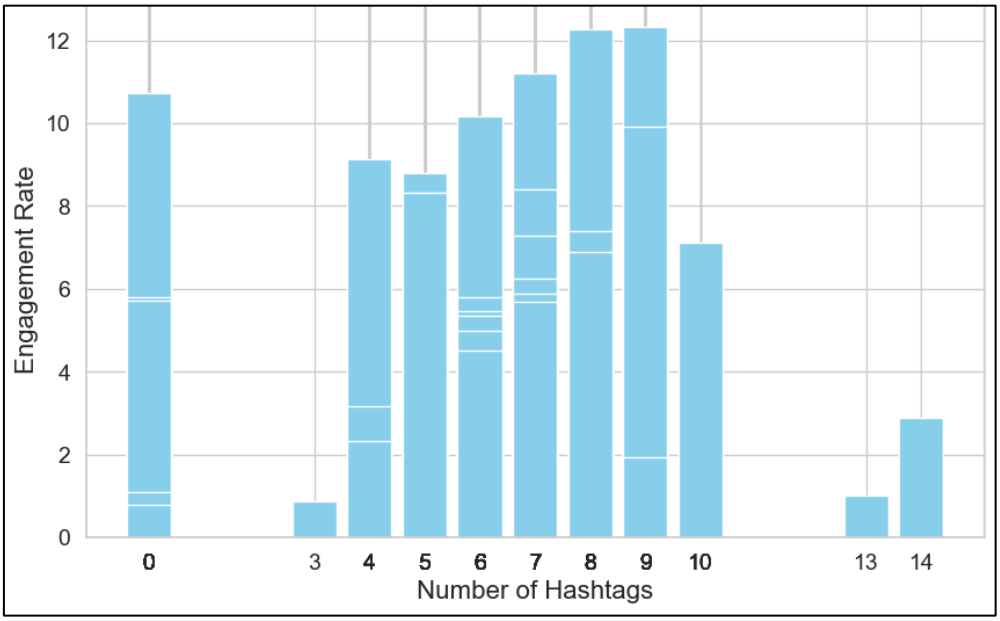


Figure 6. Engagement rate and number of hashtags.

3.5. X/Twitter analytics

The university utilizes its X/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 (X/Twitter 2023). During the examined period, the page could not be analyzed without API commands.

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, 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 X/Twitter 's guidelines.

The university's X/Twitter page only has 132 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.

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 X/Twitter (LinkedIn, 2023). The University's LinkedIn page witnessed steady growth, reaching 9000 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 9232 past students engaging with the university's LinkedIn content in November.

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. 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

The 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 SM sites. It might be worthwhile to create more TikTok accounts, as a lot of views can be gained in a short period of time. The main TikTok account 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.

3.7.1. Descriptive statistics

34 video posts were published between 09/2022–09/2023. 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, 1163.15 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. This comprehensive analysis provides valuable insights into the dynamics of the university's TikTok account.

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 7**). 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. 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 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 demonstrate the university's ability to capitalise on popular TikTok trends.

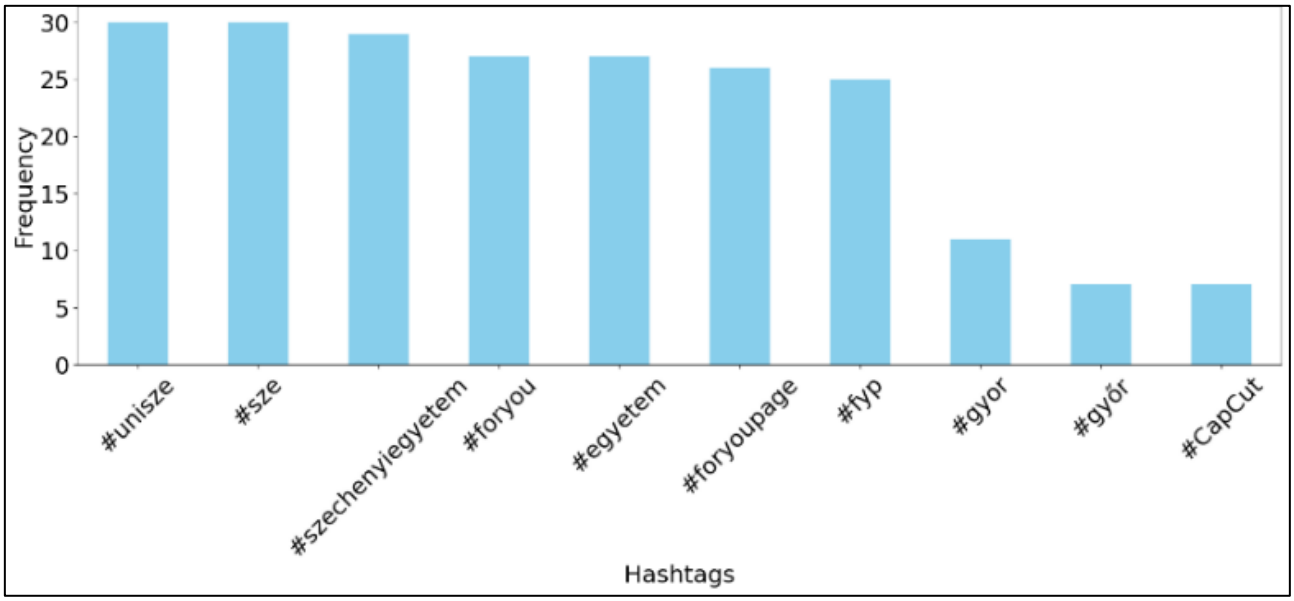


Figure 7. Top 10 most frequent hashtags in messages (posts).

The analysis of the university's TikTok topics frequency reveals several important findings (**Figure 8**). Total of 34 videos were published during this period. It was found that the videos were distributed across five 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. "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. The inclusion of 'Famous artist' section contains 3 videos.

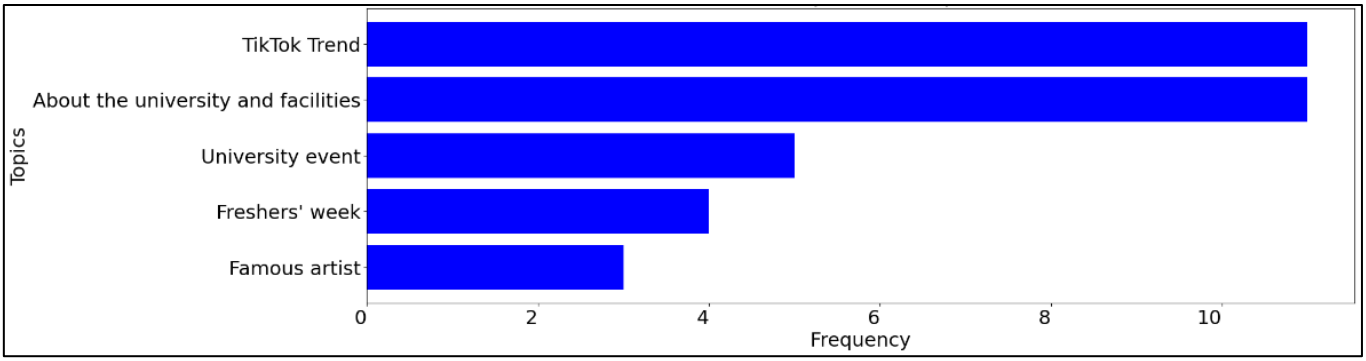
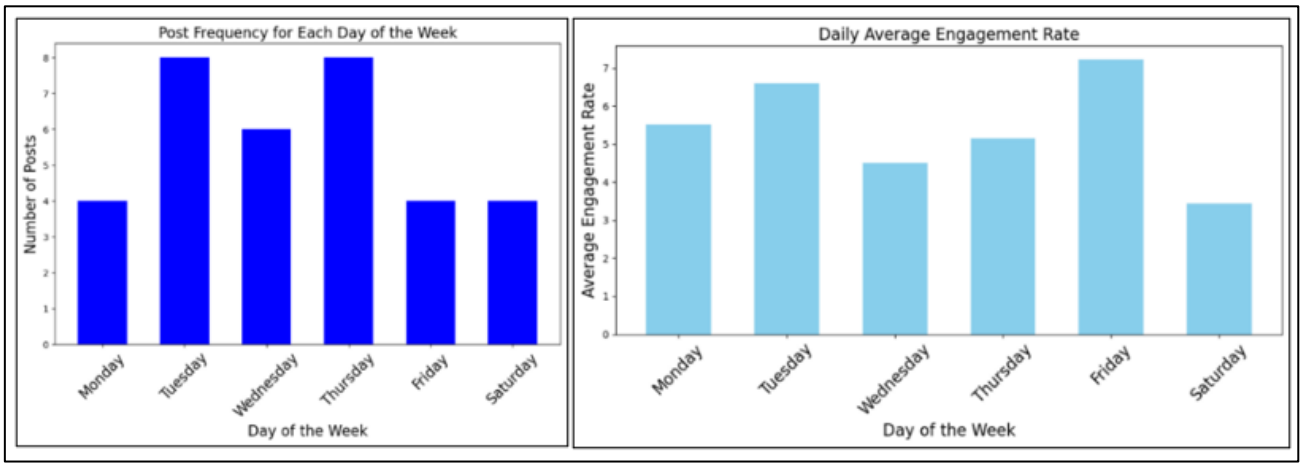


Figure 8. Topics frequency.

3.7.3. Daily engagement

Due to the few numbers of published post only the frequency of each day of the week (a) and engagement was measured (b) (**Figure 9a,b**). The engagement data for each day of the week illustrates the mean frequency of engagement, ranging from 1 (Monday) to 6 (Saturday), with varying levels of user interaction. Notably, Saturday has the highest engagement frequency (7.21), indicating a peak in user activity, while Wednesday has the lowest engagement frequency (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 and Thursdays have the highest posting frequency, with 8 posts each, while Saturdays and Tuesdays have the lowest posting activity, with 4 posts each.



(a) **(b)**

Figure 9. (a) Monthly posting frequency on TikTok; **(b)** Monthly engagement rate on TikTok.

3.7.4. Correlation

Analysing the matrix, several interesting patterns emerge (**Figure 10**). "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 and engagement rate have negative correlations with several other attributes, implying that shorter messages and lower engagement rates are linked to certain video characteristics.

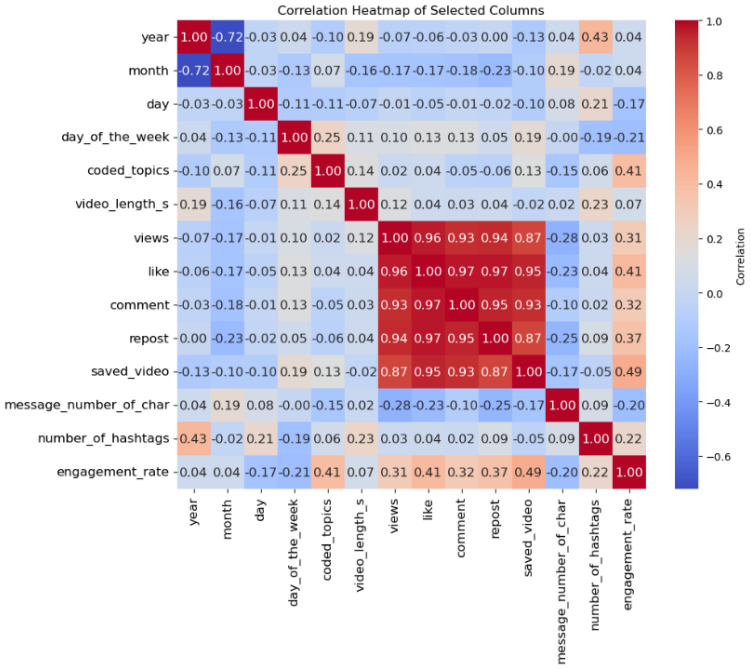


Figure 10. TikTok correlation matrix.

3.7.5. Regression

This relationship between the post length and the reposts is clarified by the regression (**Figure 11**), 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. It implies that content on TikTok may become more viral if it is shorter. 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:

$$y = -1.11\,x + 318.31 \tag{2}$$

This equation offers a quantitative basis for comprehending the dynamics of user involvement on the university's TikTok platform.

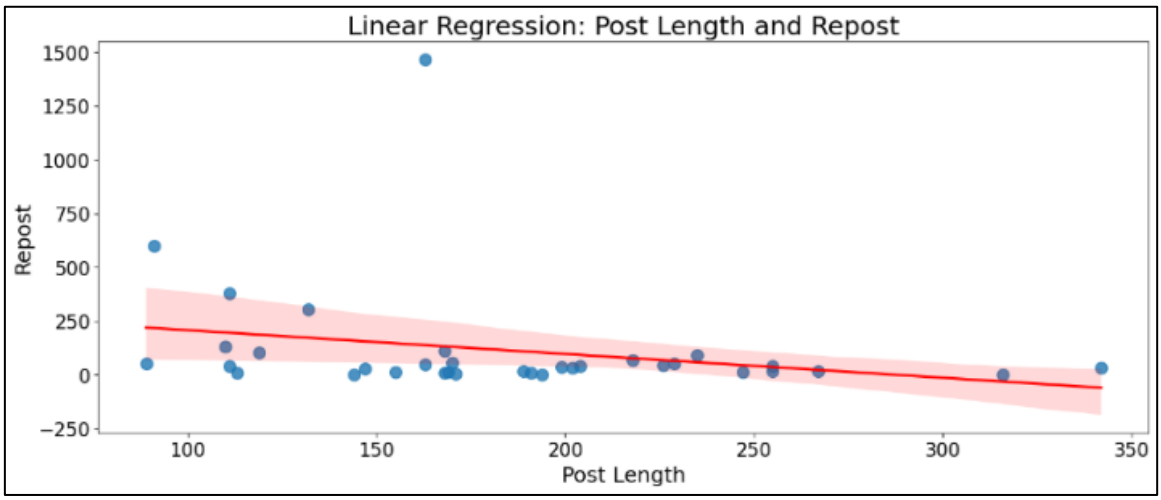


Figure 11. Linear regression: post length and repost.

4. Discussion

In this part, the findings have been summarised and some recommendations and conclusions was added for the website and each of the platforms. The study of The University's digital presence revealed key insights and recommendations for enhancing website functionality and SM engagement.

The primary limitation of this study is that the sample was gathered from only one institution, resulting in sample homogeneity and limited representativeness. Additionally, the data collected reflects a specific time period. In the rapidly evolving field of digital marketing, it is crucial to monitor user behavior continuously to keep pace with changing trends and to refine social media strategies effectively. Conducting similar studies in other countries would be highly beneficial to address this research gap, allowing for a clearer understanding of user satisfaction and engagement through greater sample heterogeneity. Despite these limitations, this article is valuable in raising awareness of the need for further research in this field and highlights key findings from a Hungarian institution. These insights could assist regional universities in enhancing their social media content strategies to increase student engagement.

In conclusion, the investigation of the university's domain was carried out using DomainTools and Semrush. 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. The analysis suggested areas for improvement, specifically enhancing mobile responsiveness and adding a language button to the main Hungarian site on mobile devices.

To maintain a consistent university image, each department and faculty should have a Facebook page, and each course a Facebook group. As the university internationalizes, all posts should be translated into English for foreign students. Post activity peaks on Tuesdays, Wednesdays, and Thursdays, making them ideal for key announcements and events. Although fewer posts appear on Sundays, engagement is higher, so posting important updates then can be beneficial. Lastly, concise posts, strategic hashtags, and encouraging likes, shares, and comments are recommended to boost engagement.

The university's Instagram promotes its brand, values, and achievements through photos and videos of programs, research, student life, and events. Engaging followers with questions, stories, and hashtags, it aligns with the motto, "It is good to study at Széchenyi!". Research shows mid-week posts boost engagement. Consistent posting, strategic hashtags, concise messaging, and active interaction are key to building a vibrant online community.

The university's X/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 X/Twitter presence. By increasing audience engagement, promoting the page, and using hashtags, the university could significantly enhance its online presence.

In November 2023, the university successfully leveraged its LinkedIn platform to engage a global audience of approximately 9000 followers and a growing alumni network. 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.

The analysis of TikTok engagement at the university revealed distinct weekly user activity patterns and strong correlations between views, likes, comments, and reposts. The research identified cyclical trends and showed that specific hashtags and video characteristics influence engagement rates.

Focus areas include mobile responsiveness, multilingual support, and strategic posting schedules to optimize audience interaction. To create a more impactful digital marketing strategy, the next step of the research will be to conduct a survey assessing student satisfaction with different social media platforms. This survey will be analyzed using cluster and factor analysis, which will allow for grouping students based on shared preferences and identifying underlying patterns in their social media engagement. These analytical techniques are especially effective in revealing the key factors that influence university students' social media usage, providing targeted insights to help the institution craft more appealing and relevant content strategies.

5. Conclusion

This study aimed to assess the digital presence of the university across various platforms and provide actionable insights for improving engagement and functionality. To achieve this, a combination of methods was employed, including a systematic literature review (SLR) to explore current research trends in social media and digital marketing, as well as detailed analyses of the university's website and social media platforms. The research questions (RQ1 and RQ2) guided the investigation into both the academic background of digital marketing strategies and the university's current online performance.

Through the systematic literature review, key trends and methodologies in the field of social media marketing were identified, providing a foundation for the analysis of the university's digital presence. The website and social media platforms, including Facebook, Instagram, X (Twitter), LinkedIn, and TikTok, were carefully examined using various tools, such as Facepager and Python programming, to analyze engagement metrics and content performance.

The findings revealed several strengths in the university's online presence, such as significant web traffic driven by effective keyword use and active engagement on social media platforms. However, areas for improvement were also identified, including mobile responsiveness, multilingual support, and optimized posting schedules to increase user interaction. The study emphasized the importance of consistent, strategic content creation, particularly on platforms like Instagram and LinkedIn, and recommended further efforts to grow the university's Twitter presence.

Despite the valuable insights gathered, the study has limitations, notably the focus on a single institution, which limits the generalizability of the findings. The data also reflects a specific time frame, which may not capture the full scope of trends in the rapidly evolving digital marketing landscape. To address these gaps, future research could include institutions from other countries, providing a broader and more diverse sample to better understand global user satisfaction and engagement patterns.

In conclusion, while this research provides important recommendations for enhancing the university's digital marketing strategy, it also highlights the need for continued exploration in this field. Further studies, particularly those focused on student satisfaction and engagement across multiple institutions, would contribute to a more comprehensive understanding of how universities can effectively utilize social media to engage their target audiences and enhance their online presence.

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Data availability statement: The data presented in this study are available on request from the corresponding author.

Conflict of interest: The authors declare no conflict of interest.

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