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The evolution of SEO strategies: from keywords to user experience in private universities of Jordan

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ABSTRACT

This research investigated the factors that influence the search engine rankings of local private universities in Jordan, taking into account the mediating effect of user engagement. We used stratified random sampling to distribute a structured questionnaire to 1,000 respondents, including students, faculty, and administrative staff from five local Jordanian universities. A total of 791 valid responses were received and analyzed using partial least squares structural equation modeling (PLS-SEM). The results showed that factors such as content quality, technical search engine optimization (SEO), backlink quality, and mobile friendliness all had a significant and positive impact on search engine rankings. User engagement mediates these relationships. These findings emphasize the importance of a comprehensive SEO approach for private universities in Jordan to achieve sustainable improvements in search engine ranking. This research provides several implications and suggestions for future research.

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1. Introduction

The Search Engine Optimization (SEO) concept has witnessed substantial transformations since its beginning, from simple and easy keyword-based techniques to more complicated strategies directed toward user experience (UX) centrality. Initially, SEO applications mainly focused on the density of keywords and backlinks to enhance search engine rankings (Al-Ananbeh et al., 2012; Saeed et al., 2024). Nevertheless, advancements in search engine algorithms, particularly Google's, have significantly shifted toward prioritizing users' perspective factors such as content quality, website usability, and mobile-friendliness. To determine the web page's authority and relevancy, search engines such as Google profoundly depend on the density of keywords and the number of inbound links (Berman & Katona, 2013). Manipulation of search rankings by Webmasters by generating many low-quality backlinks or stuffing pages with keywords that no longer exist. However, such practices lead to a weak user experience, with numerous search results flooded by low-quality or unrelated content (Bataineh et al., 2024; Enge et al., 2015). This scene began to change dramatically with unlimited algorithm updates, such as Hummingbird, Panda, and Penguin, which were designed to improve content quality, penalize spammy websites or any inappropriate backlinks, and reward the best user-friendly websites. The growing updates have created a noticeable shift in SEO strategies, emphasizing the importance of content quality, functionality, and overall user satisfaction.

With the evolution of search engines, user expectations have also increased. Users are extremely demanding mobile-friendly websites that offer engaging and valuable content. Dean (2020) indicated that webpage speed, usability, and metrics related to user engagement such as dwell time and bounce rate have become serious issues in search rankings. Consequently, modern SEO strategies have developed a

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more holistic approach that integrates high-quality content, technical optimization, and a simple user experience. Similarly, navigating websites through mobile devices has further affected SEO practices. With an increasing search via mobiles more than desktop searches, search engines have adopted (mobile-first indexing), such as Google, where compatible mobile versions of a website become the key source for ranking (Chaffey & Ellis-Chadwick, 2019). The remarkable progress in artificial intelligence (AI) technologies and their integration with machine learning have played a vital role in search algorithms (Bataineh & Qasim, 2023). AI tools, such as Google's RankBrain, assist search engines in understanding and analyzing user intentions and delivering more valid search results (Berman & Katona, 2013). This transformation indicates the importance of mobile optimization and the crucial role of responsive design in achieving improved search visibility, which can help universities look for high-tech-savvy students (Poturak et al., 2022). Generating personalized and interactive content and easy navigation is considered a strong signal for search engines about a website's value (Al-Ananbeh et al., 2012; Pansari & Kumar, 2017).

For private Jordanian universities, efficient SEO strategies are critical for surviving in a competitive educational landscape, attracting potential students, and providing valuable and updated information to current students and faculty. Furthermore, organic traffic was obtained from the university's website without paying additional fees for search engines (Kritzinger & Weideman, 2013). By adopting and implementing modern SEO strategies that put user experience as a top priority, these institutions can improve their online presence (Chen et al., 2011; Panchal et al., 2021). Accordingly, this research investigates the key elements of this transition within private Jordanian universities by exploring the impact of content quality, technical SEO, backlink quality, and mobile-friendliness on search engine rankings. This research attempts to provide real insights into the future of SEO and digital marketing for private Jordanian universities.

2. Literature review and theoretical framework

This research thoroughly investigates various SEO strategies and how they have evolved over time, focusing on four key factors: content quality, technical SEO, backlink quality, and mobile-friendliness. These variables were examined based on their collective impact on the dependent variable of search engine rankings, considering the mediating role of user engagement. This research has been applied to private universities in Jordan. The choice of the private university sector in Jordan was due to the country's severely competitive environment, availability of resources, and focus on internationalization and innovation (Poturak et al., 2022). With (18) private universities operating in Jordan, these institutions heavily invest in digital marketing to attract new students, professional staff, and faculty members. Their flexibility, wide range of programs, collaborations, and focus on managing reputation make them fertile grounds for analyzing advanced SEO strategies. All these factors can provide valuable insights into SEO's role in marketing higher education institutions (Bhandari & Bansal, 2018; Chen et al., 2011; Panchal et al., 2021). Thus, this research aims to illuminate how these strategies enhance online visibility and encourage user engagement within the context of private universities in Jordan.

Developing and designing unique website content, user-friendly navigation, and interactive elements can prompt users to spend more time browsing the websites of private universities in Jordan, indicating the relevance and importance of the site to search engines. Technical SEO can play a vital role in influencing the search engine rankings of private universities in Jordan. Factors such as website speed, mobile optimization and compatibility, and structured data are required to achieve success in SEO (Bataineh et al., 2023). Private universities in Jordan depend on search engine rankings to improve their online visibility and competitiveness in the rival sector. Achieving a better position in search engine results in pages, SERP can result in more website visitors, increased awareness, and, ultimately, higher student enrollment rates.

According to Zhang and Cabage (2017), backlink quality is a strategic tool in search engine ranking. Private universities in Jordan can improve their search engine rankings by obtaining a solid backlink profile from reputable educational sources. Receiving links from reputable educational institutions, accreditation bodies, and industry associations helps universities enhance their online credibility and visibility, improving their rankings on SERP (Poturak et al., 2022). Ensuring that the university website is

optimized for desktop and mobile devices, is quick to download, and follows structured data to markup best practices can lead to high search engine rankings. Additionally, user engagement metrics are considered prominent signals of website relevance and quality, which impact search engine ranking algorithms.

2.1. Content quality

The quality level of website content plays a key role in SEO by directly impacting both user engagement and search engine rankings. High-quality content is defined by its relevance, originality, depth, and ability to address users' preferences and interests. Enge et al. (2015) stated that search engines provide higher search rankings for innovative content that offers valuable and credible information to users. In the context of private Jordanian universities, creating highly engaging and informative content about academic programs, campus life, and research support can attract prospective students and improve website rankings. Recent research has indicated that rich content that matches users' preferences and includes semantic depth tends to rank higher in SERP (Järvinen et al., 2012, Baye et al., 2016). Accordingly, private Jordanian universities can improve their online visibility and search rankings by concentrating on delivering valuable content that meets the requirements and expectations of prospective students (Giomelakis & Veglis, 2015b). Thus, we propose the following hypothesis:

H1: Content quality has an impact on user engagement toward better search engine rankings.

2.2. Technical SEO

Technical SEO involves improving a website's technical elements, such as website speed, mobile optimization, and structured data, to enhance its visibility and ranking on search engines. Websites that load quickly, are optimized for mobile devices, have clean code, and use proper schema markups have a greater chance of ranking higher in the SERP. Dean (2020) emphasized the importance of technical SEO for user experience, which directly impacts search engine rankings. A website with strong technical capabilities ensures that users have a smooth experience, leading to lower bounce rates and longer dwell times (Giomelakis & Veglis, 2015a; Lewandowski et al., 2021). Private universities in Jordan can improve website performance by investing in technical SEO, making it easier for users to access and navigate relevant information and resulting in increased engagement and rankings (Dramilio et al., 2020; Shahzad et al., 2018). Recent studies have highlighted the importance of technical SEO in improving the overall user experience and their strong relationship with search engine performance (Anttila, 2021). Thus, we propose the following hypothesis:

H2: Technical is an impact on user engagement toward better search engine rankings.

2.3. Backlink quality

The quality of backlinks is a cornerstone of SEO strategies, especially for private universities in Jordan seeking to strengthen their online presence and impact. In the era of digital technology, a strong online presence is crucial (Shahzad et al., 2018). Well-selected backlinks leading to a university website can significantly impact its credibility and search engine rankings. Zhang and Cabage (2017) highlighted the implications of high-quality backlinks as a key feature in search engine algorithms to achieve high rankings. Acquiring multiple backlinks from recognized sources in the education sector, such as government institutions, accredited academic journals, and reputable educational organizations, can indicate to search engines the reliability and authority of private universities in Jordan. For private universities in Jordan, obtaining backlinks from local educational associations, Jordanian accreditation bodies, and other local and international universities can improve the importance of these links.

By focusing efforts on obtaining backlinks from highly authorized domains, such as esteemed educational platforms, peer-reviewed journals, and related government institutions, private universities in

Jordan can strengthen the value of SEO backlinks and improve their visibility in SERP (Giomelakis & Veglis, 2015a). Thus, we propose the following hypothesis:

H3: Backlinks have an impact on user engagement toward better search engine rankings.

2.4. Mobile-friendliness

Owing to the growing popularity of mobile devices for browsing the Internet, being mobile-friendly has become an imperative aspect of SEO. According to Chaffey and Ellis-Chadwick (2019), search engines, such as Google, now prioritize a website's mobile versions for ranking as part of its move to mobile-first indexing. Websites that are not mobile-friendly face the potential for reduced user interaction and decreased search rankings. Enge et al. (2015) emphasized the importance of incorporating mobile optimization and responsive design into current SEO strategies. Websites that are compatible with smartphone devices offer a solid user experience base, resulting in high engagement and lower bounce rates. Current research continues to validate the influence of mobile optimization on user experience and SEO results (Schubert, 2016; Shahzad et al., 2018). By ensuring that websites are compatible with mobile devices, private universities in Jordan can improve accessibility for potential students who increasingly rely on mobile devices for Internet browsing (Dramilio et al., 2020). Thus, we propose the following hypothesis:

H4: Mobile-friendliness has an impact on user engagement toward better search engine rankings.

2.5. User engagement

User engagement is vital for connecting SEO strategies and search engine rankings. Users who are dynamically involved in a website search are more motivated and interested in devoting much time to it, browsing its content, and making frequent visits, indicating to search engines that the website offers useful information (Al-Solaiman et al., 2020). Pansari and Kumar (2017) stated that enhancing user engagement can increase search engine rankings by reducing bounce rates and boosting dwell times. More user interactions may result in better search rankings, drawing in a larger pool of potential customers (Bataineh, 2022; Masrek et al., 2018). Focusing on engaging websites can enhance the impact of SEO strategies on private Jordanian universities. They can enhance user engagement by creating attractive content, optimizing technical elements, creating high-quality backlinks to ensure mobile compatibility, and utilizing artificial intelligence (AI). The relationship between user engagement and search engine rankings is inherently complex and may not be strictly unidirectional. This research posits that higher user engagement enhances search engine rankings by signaling relevance and quality to search engines. Thus, we propose the following hypothesis:

H5: User engagement has a direct significant impact on search engine rankings.

H6: The impact of content quality (H6-1), technical SEO (H6-2), backlink quality (H6-3), and mobile friendliness (H6-4) on search engine rankings can be mediated by user engagement.

Based on a thorough literature review, the researchers developed the following conceptual framework to demonstrate the relationships between research variables. This framework can provide practical insights into advanced SEO strategies in an academic context (see Figure 1).

3. Research methodology

This research employs a quantitative approach using a cross-sectional survey design. This design was chosen for its ability to gather standardized data from a large sample size, facilitating statistical analysis and generalization of results (Sekaran & Bougie, 2016). It is particularly suitable for examining the impact of search engine ranking factors in private universities, as it allows for the collection of data at a single point in time across multiple institutions.

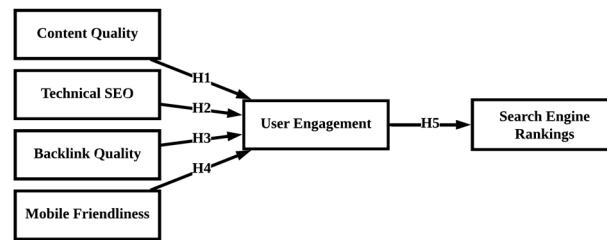


Figure 1. Conceptual framework (developed by authors).

3.1. Population and sampling

The population for this research consists of students, faculty members, and administrative staff from private universities in Jordan, who are the most frequent visitors to university websites. According to the Ministry of Higher Education in Jordan (Ministry of Higher Education & Scientific Research, 2024), there are 18 private universities operating in Jordan. A stratified random sampling technique was employed to ensure representation across different geographic areas and university types. The country was divided into five geographic strata, and from each stratum, one university was selected: Jadara University, Zarqa University, Applied Science Private University, Al-Ahliyya Amman University, and Al-Zaytoonah University of Jordan. This selection ensures coverage of diverse institutional characteristics and regional variations. Due to limitations in time, budget, and accessibility, convenience sampling was used within each selected university. While this approach may introduce some bias, efforts were made to include participants from various departments and roles to enhance representativeness. The sample size was determined based on Taherdoost's (2017) recommendation for large populations, aiming for a 95% confidence level and a 5% margin of error. Consequently, a target sample of ,1000 respondents was set with a minimum of (384) retrieved valid samples.

3.2. Survey instrument

The survey instrument was designed to comprehensively assess various aspects of search engine optimization (SEO) and its impact on university website rankings. The questionnaire was structured into several key sections, beginning with demographic information to capture the respondents' background. Following this, six main constructs were measured: Content Quality, Technical SEO, Backlink Quality, Mobile Friendliness, User Engagement, and Search Engine Rankings. Each of these constructs was evaluated using a set of five items, carefully selected to thoroughly assess each aspect.

To ensure consistency and ease of response, all items were measured using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). This standardized approach allowed for uniform data collection across all constructs. Recognizing the linguistic diversity of the target population, the survey was made available in both English and Arabic. The Arabic version experienced an exact back-translation process to ensure equivalence with the English version, thus maintaining the integrity of the questions across both languages.

The constructs and their respective items were carefully sourced from previous literature in the field of SEO and website quality. Content Quality items were adapted from Hasan (2013), while Technical SEO measures were derived from the works of Baye et al. (2016) and Gupta et al. (2016). Backlink Quality items were based on research by Jain and Dave (2013) and Sharma et al. (2019). Mobile Friendliness was assessed using items from Dramilio et al. (2020), User Engagement measures were adapted from Masrek et al. (2018), and Search Engine Rankings items were sourced from Anttila (2021) and Sharma et al. (2019). This approach of using multiple items for each construct, adapted from reputable sources, ensured both the reliability and validity of the measurements, self-reported measures have been chosen to capture nuanced perceptions of SEO and website quality constructs, as subjective insights complement technical evaluations. Grounded in validated literature, this approach ensures reliability and feasibility. While response bias and subjectivity are limitations, clear survey design and cross-validation with objective data mitigate risks, making this method suitable for understanding

user-centered aspects. Accordingly, the list of items for each construct, providing a detailed view of the questionnaire content is available in (Appendix A).

3.3. Data collection

Data was collected between February and April 2024 using a structured questionnaire. The questionnaire was developed based on relevant literature on SEO strategies and adapted from previous research in related fields. It was initially pilot-tested with a group of 30 participants to ensure clarity and relevance of questions. The survey was distributed through multiple channels; Google Forms links shared on university social media platforms and physical distribution of Quick-Response (QR) codes on campus. To ensure data quality, responses were regularly monitored for completeness and consistency.

According to Table 1, the sample profile shows a relatively balanced gender distribution, with 52.0% female and 48.0% male participants. This aligns with the trend of increasing female representation in higher education in Jordan, as reported by the Ministry of Higher Education and Scientific Research (2024). The university affiliation data indicates that Al-Zaytoonah University of Jordan (27.0%) and Applied Science Private University (23.8%) had the highest response rates, possibly due to the researchers' access to these institutions. Regarding roles, students comprise the majority of the sample (64.2%), followed by faculty members (25.5%) and administrative staff (10.3%), which is representative of typical academic institution demographics. In terms of SEO familiarity, 38.3% of respondents were somewhat familiar with the concept, while 35.5% were very familiar. This distribution could be attributed to varying research interests, disciplines, or job responsibilities among participants. Website access frequency data reveals that 46.6% of respondents access their university website several times a week, with 31.5% accessing it daily. This pattern aligns with the sample composition, as students may not require daily access compared to faculty and administrative staff. The primary purposes for website usage were accessing academic resources (32.2%), reading university news and updates (20.6%), and administrative information (17.8%). These findings reflect the typical needs of students and faculty members, who frequently require academic resources and need to stay informed about university operations and achievements.

Table 1. Sample characteristics.

Characteristics	Category	Frequency	Ratio
Gender	Male	380	48.0%
	Female	411	52.0%
University affiliation	Jadara University	73	9.2%
	Zarqa University	151	19.1%
	Applied Science Private University	188	23.8%
	Al-Ahliyya Amman University	165	20.9%
	Al-Zaytoonah University of Jordan	214	27.0%
Role	Student	508	64.2%
	Faculty member	202	25.5%
	Administrative staff	81	10.3%
Familiarity with (SEO)	Very familiar	281	35.5%
	Somewhat familiar	303	38.3%
	Neutral	88	11.1%
	Somewhat unfamiliar	79	10.0%
	Very unfamiliar	40	5.1%
Website access frequency	Daily	249	31.5%
	Several times a week	369	46.6%
	Once a week	84	10.6%
	A few times a month	56	7.1%
	Rarely	33	4.2%
Website usage	Access academic resources	255	32.2%
	Administrative information	141	17.8%
	Reading university news and updates	163	20.6%
	Following events	87	11.0%
	Check university e-mail	114	14.4%
	Other	31	4.0%
Total		N= 791	100%

3.3.1. Ethical approval statement

In January 2024, the ethical committee in each deanship approved the research proposal, methodology, and questionnaire items after conducting a thorough review. This study received ethical approval from the Faculty of Business Ethics Committee (Reference: 15/1/2023–2024) at Al-Zaytoonah University of Jordan. This research was also verbally approved by the (deanships of scientific research) at all participating universities. The study was conducted following the ethical principles for research with human participants, as highlighted in the National Statement on Ethical Conduct in Human Research.

3.3.2. Human participants statement

All human participants provided informed consent prior to participation in this research in accordance with ethical guidelines for research involving human subjects. The nature and purpose of the research, potential risks and benefits, and participants' rights and responsibilities were explained in detail. To ensure participants' understanding of technical concepts, the survey instrument included clear definitions and examples for all key terms, aligning with the terminology used in the cited literature. Attention checks were incorporated to gauge familiarity, and a pilot study validated the self-reported measures against objective criteria, refining clarity and relevance. Informed consent was obtained in written form from each participant before any data collection procedures were initiated. Participants were assured of confidentiality and anonymity throughout the research process. They were informed that their participation was entirely voluntary and that they had the right to withdraw from the research without any consequences, and all of that was clearly mentioned and documented on the research questionnaire. In line with the principles of respect for persons, beneficence, and justice, the research was designed to minimize risks to participants while maximizing potential benefits to the field of knowledge. Participants were provided contact information for the researchers and the institutional review boards should they have any questions or concerns about the research.

4. Analysis, results, and discussion

This comprehensive research examines the determinants of search engine rankings using partial least squares structural equation modeling (PLS-SEM). PLS-SEM was chosen over Covariance-Based SEM (CB-SEM) due to its suitability for exploratory research and its ability to handle complex models with multiple constructs (Hair et al., 2017). The nature of our research questions, which aimed to explore the relationships between various factors affecting search engine rankings, aligned well with the strengths of PLS-SEM. Additionally, PLS-SEM's flexibility in dealing with non-normal data distributions and smaller sample sizes made it an appropriate choice for our study (Chin & Newsted, 1999). The analysis involves a two-step process: the measurement model examines the precision and consistency of the indicators to confirm internal consistency, convergent validity, and discriminant validity, thus ensuring unbiased measurement of the constructs. By contrast, the structural model assesses the proposed relationships between constructs, evaluating the strength and significance of these relationships, the explained variance (R^2 values), effect sizes, and predictive relevance. This comprehensive analysis enhances result credibility, facilitates replication, and supports result generalizability, ultimately validating both the constructs and their interrelationships (Hair et al., 2022).

4.1. The measurement model

In this stage, we assessed the data quality for the validity and reliability of the constructs of the research. According to (Table 2), all factor loadings (FL) are above (0.70) which is typically considered adequate because they reflect their respective constructs (Hair et al., 2022). Additionally, Average Variance Extracted (AVE) with values above (0.50) indicates that those constructs explain more than half of the constructs' variance, which confirms convergent validity (Sarstedt et al., 2022). Furthermore, the constructs were consistent and accurate after measuring Cronbach's alpha (α) and Composite Reliability (CR) values, which should be above (0.70). These values confirm the reliability and internal consistency (Hair et al., 2020). Additionally, this study calculated Variance Inflation Factors (VIFs) for all predictor variables to address

potential multicollinearity concerns. The VIF values range from 1.666 to 2.654, well below the commonly accepted threshold of 5, confirming the absence of problematic multicollinearity and supporting this study's structural equation model's stability (Hair et al., 2022).

We employed two methods to ensure the discriminant validity of the constructs. First, we assessed it using the Fornell-Larcker criterion. According to Fornell and Larcker (1981), the square root of AVE for each construct should exceed the construct's highest correlation with any other construct. Discriminant validity was assessed, as presented in (Table 3).

Following Henseler et al. (2015), we employed the Heterotrait-Monotrait Ratio (HTMT) matrix, which compares the average correlations between indicators of different constructs to those within the same construct. HTMT values below the threshold of 0.90 indicate adequate discriminant validity. All HTMT values were below the threshold, supporting discriminant validity, as demonstrated in (Table 4).

Based on the previous results, we can assert that the measurement model criteria utilized in this research exhibit reliability and convergent and discriminant validity, signifying its appropriateness. Nonetheless, it is imperative to appraise the quality of the inner model to ensure its robustness and ability to represent the sample population. While traditional fit indices are not typically recommended for PLS-SEM, we cautiously report some model fit indicators for completeness. According to Table 5, the SRMR values of the saturated model (0.047) and estimated model (0.068) are both below the recommended level (0.08). The NFI values for the saturated model (0.863) and estimated model (0.858) are close to but do not reach, the ideal threshold of 0.9. Additional fit indicators include d_ULS (1.013 for saturated, 2.177 for estimated), d_G (0.440 for saturated, 0.464 for estimated), and Chi-square (2071.148 for saturated, 2145.074 for estimated) (Hair et al., 2022).

Table 2. Constructs reliability and validity.

Constructs and items	Item	FL	VIF	CR	(α)	AVE
Content quality (CQ) (Hasan, 2013)	CQ1	0.805	2.073	0.916	0.885	0.686
	CQ2	0.874	2.654			
	CQ3	0.834	2.244			
	CQ4	0.834	2.266			
	CQ5	0.793	1.938			
Technical SEO (TSEO) (Baye et al., 2016; Gupta et al., 2016)	SEO1	0.829	2.126	0.921	0.893	0.701
	SEO2	0.853	2.361			
	SEO3	0.845	2.243			
	SEO4	0.838	2.211			
	SEO5	0.821	2.120			
Backlink quality (BQ) (Jain & Dave, 2013; Sharma et al., 2019)	BQ1	0.812	2.044	0.907	0.872	0.662
	BQ2	0.833	2.161			
	BQ3	0.840	2.205			
	BQ4	0.822	2.068			
	BQ5	0.760	1.666			
Mobile friendliness (MF) (Dramilio et al., 2020)	MF1	0.810	1.971	0.917	0.887	0.689
	MF2	0.853	2.391			
	MF3	0.836	2.180			
	MF4	0.841	2.302			
	MF5	0.810	2.012			
User engagement (UE) (Masrek et al., 2018)	UE1	0.773	1.719	0.895	0.853	0.630
	UE2	0.794	1.815			
	UE3	0.815	1.921			
	UE4	0.794	2.117			
	UE5	0.792	2.103			
Search engine rankings (SER) (Anttila, 2021; Sharma et al., 2019)	SER1	0.851	2.313	0.916	0.886	0.687
	SER2	0.833	2.120			
	SER3	0.825	2.086			
	SER4	0.825	2.101			
	SER5	0.808	2.011			

Table 3. Fornell-Larcker criterion.

Constructs	BQ	CQ	MF	SER	TSEO	UE
BQ	0.814					
CQ	0.573	0.829				
MF	0.529	0.570	0.830			
SER	0.514	0.513	0.495	0.829		
TSEO	0.603	0.563	0.552	0.454	0.837	
UE	0.537	0.556	0.528	0.623	0.543	0.794

Table 4. HTMT Matrix.

Constructs	BQ	CQ	MF	SER	TSEO	UE
BQ						
CQ	0.652					
MF	0.602	0.642				
SER	0.584	0.578	0.557			
TSEO	0.683	0.634	0.620	0.509		
UE	0.623	0.638	0.606	0.713	0.621	

Table 5. Model fit summary.

Indicator	Saturated model	Estimated model
SRMR	0.047	0.068
d_ULS	1.013	2.177
d_G	0.440	0.464
Chi-square	2071.148	2145.074
NFI	0.863	0.858

Table 6. R-squared values and F-squared effect sizes.

Construct	R-squared	Path	f-squared
SER	0.388	UE -> SER	0.635
UE	0.435	CQ -> UE	0.051
Construct	R-squared adjusted	MF -> UE	0.037
SER	0.388	TSEO -> UE	0.036
UE	0.433	BQ -> UE	0.033

The R-squared (R^2) value estimates the model's predictive capabilities by assessing internal latent variables. In this research, the R^2 value was 0.388 for the dependent variable – search engine rankings construct and 0.435 for the mediating construct – user engagement, highlighting the moderate explanatory power of the model. This indicates that the independent variables investigated in this research explain 38.8% of the influence on search engine rankings, affecting SEO strategies seeking better rankings in search engines.

The adjusted R^2 values, which account for the number of predictors in the model, are 0.388 for search engine rankings and 0.433 for user engagement, further supporting the model's explanatory power (Hair et al., 2022). Additionally, we assessed the f^2 effect sizes to determine the impact of each exogenous construct on the endogenous constructs. The f^2 values for the relationships with user engagement are: backlink quality (0.033), content quality (0.051), mobile friendliness (0.037), and technical SEO (0.036), indicating small to medium effects. Notably, user engagement has a large effect (0.635) on search engine rankings. These f^2 effect sizes provide valuable insights into the relative importance of each predictor variable in explaining user engagement and search engine rankings, complementing the information provided by the R^2 values presented in (Table 6).

4.2. The structural model

After verifying the reliability and validity of the model, we proceeded to the second phase of the analysis. In this phase, we test the relationships proposed in the hypotheses. Additionally, we utilized the bootstrapping technique with the recommended default number of subsamples (5,000) to explore the mediating role of user engagement and its impact on the relationships between the research variables and search engine rankings, following Cheah et al. The analysis results shown in (Table 7) reveal a significant positive impact of content quality on user engagement ($\beta=0.231$ | $t=5.062$), supporting hypothesis (H1). Furthermore, user engagement positively impacts the relationship between content quality and search engine rankings ($\beta=0.144$ | $t=4.975$), supporting Hypothesis (H6-1). Technical SEO also has a significant positive impact on user engagement ($\beta=0.196$ | $t=4.037$), which supports hypothesis (H2); also, which is also found to impact the relationship between technical SEO and search engine rankings ($\beta=0.231$ | $t=5.062$), supporting hypothesis (H6-2).

Additionally, backlink quality has a significant positive impact on user engagement ($\beta=0.186$ | $t=4.013$), supporting hypothesis (H3); also, which positively impacts the relationship between backlink quality and search engine rankings ($\beta=0.116$ | $t=3.901$), supporting hypothesis (H6-3). Finally, mobile friendliness has a significant positive impact on user engagement ($\beta=0.189$ | $t=4.334$), supporting hypothesis (H4), and the mediating impact of user engagement was found to impact the relationship between mobile-friendliness and search engine rankings ($\beta=0.118$ | $t=4.292$), supporting hypothesis (H6-4). On the other hand, user engagement has a significant positive impact on search engine rankings ($\beta=0.623$ | $t=26.774$), supporting hypothesis (H5).

These relationships are shown in Table 7, and the measurement and structural models were extracted from the SmartPLS program with all statistics to show the conceptual framework results of this research (Figure 2).

4.3. Discussion

The comprehensive analysis in this research offers valuable and in-depth insights into the various determinants influencing search engine rankings. It specifically focuses on the experiences of university students when they search for university websites using search engines. The findings highlight the significant positive influence of factors, such as content quality, technical search engine optimization, backlink quality, and mobile friendliness, on user engagement as mediating variables. In turn, these factors play a pivotal role in shaping search engine rankings, providing a nuanced understanding of the dynamics at play in this context. The positive link between content quality and user engagement highlights the

Table 7. Direct and indirect hypotheses testing results.

Hypothesis	Path	Coefficients	T values	P values	Result
H1	CQ -> UE	0.231	5.062	0.000	Supported
H2	TSEO -> UE	0.196	4.037	0.000	Supported
H3	BQ -> UE	0.186	4.013	0.000	Supported
H4	MF -> UE	0.189	4.334	0.000	Supported
H5	UE -> SER	0.623	26.774	0.000	Supported
H6-1	CQ -> UE -> SER	0.144	4.975	0.000	Supported
H6-2	TSEO -> UE -> SER	0.122	3.937	0.000	Supported
H6-3	BQ -> UE -> SER	0.116	3.901	0.000	Supported
H6-4	MF -> UE -> SER	0.118	4.292	0.000	Supported

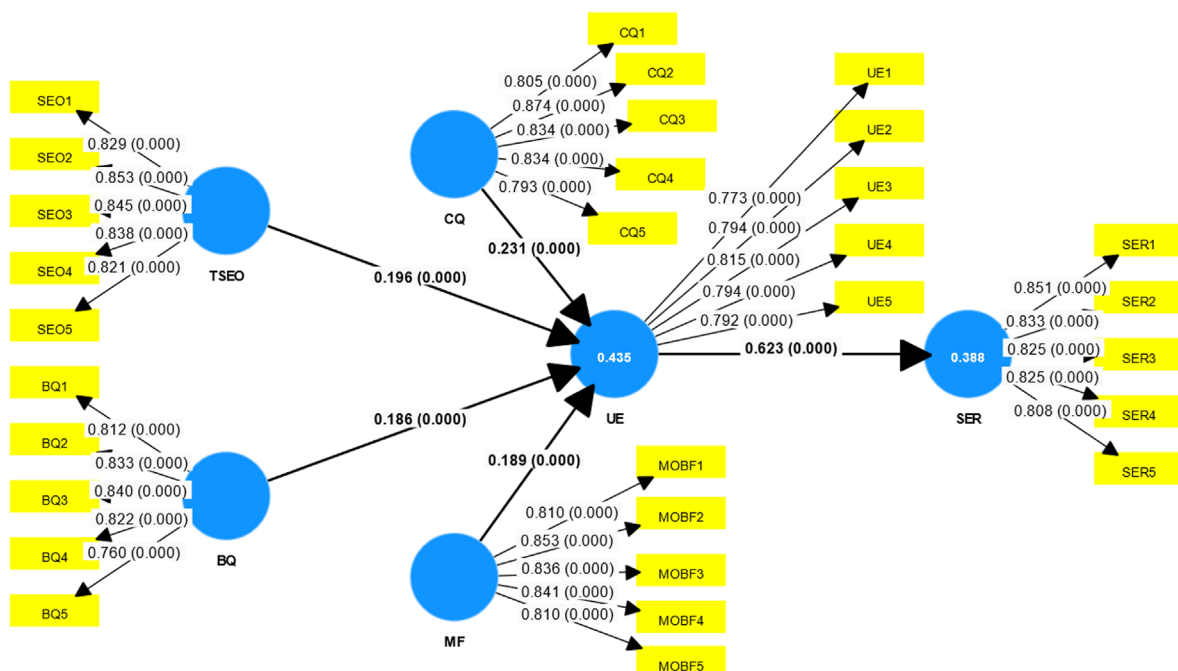


Figure 2. The measurement and structural model.

paramount importance of creating high-quality, informative, and compelling content on university websites. By focusing on producing relevant, valuable, and easily understandable content, university websites can effectively attract and retain students, ultimately leading to improved search engine rankings, consistent with previous research works (Giomelakis & Veglis, 2015b; Lewandowski et al., 2021). This finding is particularly pertinent to university websites given that students constitute the primary audience. These results strongly suggest that university websites should prioritize content quality to enhance user engagement and improve their search engine rankings (Giomelakis & Veglis, 2015b).

The importance of technical search engine optimization cannot be overstated, particularly when it comes to enhancing user engagement on university websites. Optimizing technical aspects such as speed, mobile friendliness, and structured data is crucial for enhancing user experience and improving search engine rankings. University websites must prioritize these technical aspects as students rely heavily on search engines for information about universities. Poor user experience can lead to frustration and reduced engagement (Berman & Katona, 2013; Malaga, 2008). The findings highlight the critical importance of technical search engine optimization for university websites. This is consistent with previous research works, suggesting that by prioritizing technical optimization, universities can effectively improve their overall user experience, leading to increased engagement and enhanced search engine visibility. Considering that students frequently use search engines to gather information about universities, the impact of technical optimization on user engagement cannot be underestimated. Neglecting these technical aspects could potentially lead to user frustration and reduced engagement, ultimately impacting a university's online presence. Therefore, the focus on technical optimization remains crucial for universities seeking to deliver an optimal user experience and maintain a competitive edge in the digital landscape.

This research uncovers compelling insights into the interplay between backlink quality and user engagement. This underscores the critical importance of cultivating robust and pertinent backlink profiles for university websites. Significantly, this research posits that securing high-caliber backlinks from respected and pertinent sources can augment university websites' online visibility and reliability (Shahzad et al., 2018). Consequently, this enhancement has the potential to bolster user engagement and elevate search engine rankings. The implications of these findings carry considerable weight for academia, as they underscore the pivotal role played by a robust backlink profile in augmenting the online standing and presence of universities. This, in turn, has emerged as a crucial determinant in attracting prospective students. This research draws from Moogan (2011) to support its conclusions. Overall, the implications of this research are profound for universities seeking to strengthen their digital footprints and attract a larger student body. By attending to the cultivation and upkeep of high-caliber backlinks, universities can potentially bolster their digital standing and extend their outreach, thereby influencing their competitive edge within the sphere of higher education.

Moreover, the significance of mobile-friendliness in user engagement cannot be overlooked. The positive relationship between mobile-friendliness and user engagement underscores the increasing importance of optimizing university websites for mobile devices. This result supports the works of (Chaffey & Ellis-Chadwick, 2019; Enge et al., 2015). As the number of individuals accessing the Internet via mobile devices continues to rise, universities must tailor their online presence to provide seamless and user-friendly experiences on mobile interfaces. By prioritizing mobile-friendliness, universities can enrich user engagement and bolster their visibility and ranking on the SERP. This implication holds particular relevance for academic institutions given that students frequently rely on mobile devices to access vital university-related information (Giomelakis & Veglis, 2015a; Statista, 2022). Embracing mobile optimization strategies is thus instrumental in strengthening the digital presence of universities and facilitating enhanced user experience.

Finally, the research highlights the mediating role of User Engagement, demonstrating a significant and positive mediation effect on the relationship between the independent variables (content quality, technical search engine optimization, backlink quality, and mobile friendliness) and search engine rankings. While our findings suggest a positive relationship between user engagement and search engine rankings, alternative causal pathways must be considered. For instance, higher rankings may result in increased engagement as more users are directed to the site via search results. This underscores the criticality of prioritizing user experience for university websites, which supports

the work of Anderson & Kabbaj. Emphasizing high-quality content creation, technical optimization, robust backlink acquisition, and mobile adaptability can elevate user engagement and enhance search engine rankings. This discovery has substantial implications for universities as it underscores the potential of positive user experiences in fostering heightened student satisfaction and loyalty (Berman & Katona, 2013; Giomelakis & Veglis, 2015b). Overall, the findings of this research emphasize the vital role of content quality, technical search engine optimization, backlink quality, and mobile-friendliness in influencing search engine rankings for university websites. These factors affect rankings through the mediating effect of user engagement. It is crucial for university websites to prioritize these elements to enhance their online visibility, attract and retain students, and improve their search engine rankings. These discoveries add to the expanding body of knowledge on search engine optimization and offer practical implications for university websites that aim to enhance their online presence and performance.

5. Conclusions, implications, and future work

The results of this research emphasize the important role of content quality, technical search engine optimization, backlink quality, and mobile-friendliness in influencing search engine rankings for university websites. This influence occurred through the mediating effect of user engagement. Content quality is crucial for university websites to effectively communicate their unique value propositions to prospective students, faculty members, and other stakeholders. Compelling and educational content can enhance the user experience, leading to continued website visits and returning visitors, which can then improve search engine rankings. Technical SEO, including aspects such as website loading time, correct use of meta-tags, and structured data, ensures that university websites can be easily accessed and listed by search engines. Adhering to technical SEO guidelines can help universities enhance their visibility in search engine result pages, resulting in higher organic traffic. The quality of backlinks, which demonstrates the relevance and authority of external websites linked to university sites, is also a critical factor in the performance and success of SEOs. Effective backlinks not only validate the content but also signal to search engines the website's expertise in its field, leading to higher search rankings. Additionally, given the increasing use of mobile devices, university websites must be optimized for mobile compatibility. Innovative and adaptable layouts for smartphones can improve the user experience across different devices and comply with search engine algorithms that prioritize mobile-friendly websites in their rankings. Therefore, university websites should prioritize these factors to enhance online visibility, attract and retain students, and achieve higher search engine rankings. These findings contribute to the growing body of research on search engine optimization and provide practical implications for university websites that aim to enhance their online presence and performance.

5.1. Theoretical and practical implications

This research adds to the expanding body of knowledge on search engine optimization and its impact on search engine rankings. The results of this research confirm the significant role of user engagement in the relationship between website characteristics and search engine rankings. Moreover, it emphasizes the importance of understanding the specific context of university websites and the preferences of university students as target audiences. From a theoretical perspective, this research contributes to the growing body of research on search engine optimization and factors influencing rankings. These findings extend the existing literature by empirically validating the mediating role of user engagement in the relationship between website characteristics and search engine rankings. This research also underscores the importance of considering the unique context of university websites and the specific needs and preferences of university students as target audiences.

The practical implications of this research are important for university administrators, marketing professionals, and web developers managing university websites. The findings indicate the need for universities to prioritize creating high-quality, informative, and engaging content, optimizing the technical aspects of their websites, cultivating a strong and relevant backlink profile, and ensuring mobile

friendliness to enhance user engagement and boost search engine rankings. Implementing these strategies can help universities attract more prospective students, enhance online visibility, and strengthen their competitive positions in higher education.

5.2. Limitations and future research

Although this research provides valuable insights, it is not without limitations. The sample was limited to university students, and future research could explore the perspectives of other stakeholders such as faculty, staff, and prospective students. Additionally, the research focused on a specific set of independent variables. The research relied on self-reported measures for all variables, which introduces the potential for common method bias (CMB). While procedural and statistical remedies were implemented to mitigate this risk, the potential impact of CMB on the relationships between constructs is acknowledged as a limitation. Future research might explore integrating data from multiple sources, such as objective website analytics, to mitigate the limitations of self-reported measures. This approach would enhance the robustness of findings and provide a more comprehensive understanding of the studied constructs. Moreover, adopting longitudinal or experimental approaches by other researchers might lead to a better understanding of the directionality of the relationship between user engagement and search engine rankings. These methods would allow for a more nuanced examination of bidirectional effects and provide stronger evidence for causal inferences. Future research could investigate the influence of other factors, such as social media presence, user-generated content, and personalization, on user engagement and search engine rankings. Furthermore, longitudinal studies could provide a more comprehensive understanding of the dynamic nature of search engine optimization and the long-term impact of the identified determinants. Cross-cultural comparisons can also shed light on the potential influence of cultural and regional differences on the relationships examined in this research. Overall, this research offers a solid foundation for understanding the critical factors that influence search engine rankings for university websites and highlights the importance of prioritizing user engagement as a key driver of online success. The findings and implications presented in this research can guide universities in their efforts to enhance their online presence and effectively reach and engage their target audiences.

Authors' contributions

Conceptualization, project supervision and administration: AB and DQ; Methodology and resources: MI and IA; software: DQ; validation: AB and IA; formal analysis: DQ and IA; investigation: AM; data curation and writing—original draft preparation: AB; writing—review and editing: AM, DQ, MI, and IA; visualization: AB, DQ, and MI.

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Data availability statement

The data are available on a reasonable request from the corresponding author. All authors agree to be accountable for all aspects of this research.

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Appendix A. The items used in this study questionnaire

Content Quality (CQ) (Hasan, 2013)

The content on most of Jordanian universities' websites I visit is relevant.

The content on Jordanian universities' websites I visit is original.

Detailed and in-depth content keeps me engaged with Jordanian universities' websites.

I find the content on most Jordanian universities' websites to be informative.

The websites of Jordanian universities I visit frequently update their content.

Technical SEO (Baye et al., 2016; Gupta et al., 2016)

Websites of Jordanian universities I visit usually load quickly.

I rarely encounter broken links or errors on the university's website when I visit.

A well-structured university's website impacts my decision to stay on it.

The websites of Jordanian universities I visit have clear and easy navigation.

The websites of Jordanian universities I visit are optimized for search engines.

Backlink Quality (Jain & Dave, 2013; Sharma et al., 2019)

I trust Jordanian private universities' websites that are linked to other reputable websites.

Backlinks from authoritative sources enhance the credibility of my university's website.

Backlinks significantly influence my trust in the content of my university's website.

The number of backlinks to universities' websites influences my perception of its quality.

I am more likely to visit a universities' website if it is frequently referenced by other websites.

Mobile Friendliness (Dramilio et al., 2020)

I often access Jordanian universities' websites via mobile devices.

Mobile-friendly website design of Jordanian universities is important for my experience.

I tend to leave Jordanian universities' websites that are not mobile-friendly.

Jordanian university websites I visit are usually well-optimized for mobile devices.

A good mobile experience makes me more likely to revisit my university's website.

User Engagement (Masrek et al., 2018)

I frequently interact with content provided by Jordanian universities' websites.

I spend a significant amount of time on Jordanian university websites I find engaging.

I am likely to return to a Jordanian university website that I found engaging on my first visit.

I often recommend engaging Jordanian universities' websites to others.

User-friendly features enhance my engagement with a Jordanian university website.

Search Engine Rankings (Anttila, 2021; Sharma et al., 2019)

I usually visit Jordanian universities' websites that appear on the first page of SERP.

Higher rankings of the university's website in SERP makes me perceive it as more credible.

I am against visiting a lower a lower-ranked Jordanian universities' website.

I trust Jordanian universities' websites more if they have high search engine rankings.

Search engine rankings influence my perception of a Jordanian university's website's authority.