Original Research

How Do Parsijoo, Parseek and Google Respond to the Students' Course-related Queries?

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Abstract

This study aimed to identify the quality of web pages retrieved by Parsijoo and Parseek Persian search engines and Google to respond to students' course-related queries. This study was conducted using evaluations from a researcher-made checklist. The first population included Persian and Google search engines selected from Persian, Parsijoo, and Parseek search engines. The second population included the keywords of the section for collecting data from the fourth, fifth, and sixth-grade elementary school science textbooks, from which 12 keywords were selected by simple random sampling. The third population included web pages retrieved for each keyword by search engines. From the first ten results retrieved in each keyword search, relevant pages were selected as the sample. The results revealed that the quality of the web pages retrieved by all three search engines, i.e., Parsijoo, Parseek, and Google, was above average. However, there was a significant difference between the engines regarding the number of relevant results. This is the first study investigating the quality of web pages retrieved by search engines to respond to students' course-related queries. The study results can help the designers and developers of Persian search engines improve their performance in retrieving high-quality pages and gaining a proper place among Iranian users.

Introduction

The Internet and the Web have become indispensable for all human beings today. So, the Internet is becoming an essential and comprehensive source of information for all people, including children. According to the February 2018 report by the United Nations Children's Fund (UNICEF, 2018), one in three Internet users in the world is a child, and daily, more than

175,000 new children connect to the Internet for the first time and use information released on the Internet. In Iran in 2017, almost one in eight Internet users was a child (6-15 years) (Statistical Centre of Iran, 2019). Also, according to the 2021 census in the UK, approximately 9 out of 10 children (89%) in the UK and Wales are online every day or use the Internet for a variety of activities, the most common of which is watching movies, messaging, and studying or do homework (Office for National Statistics of UK, 2021). Children at school or home use computers and the Internet for this purpose. Teachers or parents do not constantly monitor their presence on the Internet, and 60% of children generally search the Internet alone (Gossen, 2016). They need to use tools such as search engines to search for information on the Internet optimally.

Search engines are only to retrieve information on the Internet and have no control over the content of the pages they index in their database (Machill, Neuberger & Schindler, 2003). For this reason, there is no guarantee for the accuracy of the information retrieved by search engines; moreover, search engines retrieve a lot of contradictory and misleading information, and the quality of the information provided varies more or less (Ramachandran, Paulraj, Joseph and Ramaraj, 2009). According to a report published by UNICEF in September 2019, 'fake information' on the Internet was introduced as one of the most serious emerging global threats for children. Notably, children and students use numerous websites on the internet to complete their projects and tasks.

On the other hand, some studies show that children are not successful in recognizing certain issues related to the quality of information (including updates, author credibility, etc.) (Macedo-Rouet et al., 2019). Hence, it is necessary to evaluate the quality of pages retrieved by information retrieval systems such as search engines to measure their success in retrieving high-quality pages for children.

Today, the most popular search engine in the world is Google (Lewandowski & Schultheiß, 2023), but in many countries, for various reasons, including maintaining independence from the Google search engine, have launched a native search engine, a successful example of which is the Baidu search engine in China, Yandex in Russia, and Naver in South Korea (Bakhshipour, 2021). In Iran, several Persian search engines have been launched, but despite the popularity of Google, there are various reasons for using Persian and native search engines. The most important reason is the special features of the Persian language (such as attached or detached writing, difference in phonetics, variety of plural signs, variety of transliterations, distance between letters of a word, etc.). Persian language, due to its special features and the same time does no standard writing style, for electronic settings face difficulties and challenges that greatly affect the effectiveness of information retrieval (Sotudeh & Honarjooyan, 2013). Also, various studies have shown that search engines such as Google ignore the specific structure and features of non-English languages and do not perform well in searching in non-English languages (AlSobh, Al Oroud, Al-Kabi & AlSmadi, 2010; Namk & Bitirim, 2015). Therefore, Persian search engines can provide more desired results for Persian speakers due to the complexity and specific features of the Persian language. Since children are less familiar with the complexity of Persian language and the correct writing style than adults, using Persian search engines can help children retrieve the information they need and be useful.

Persian search engines are beginning their development and have a long way to go to reach strong competitors such as Google. These engines should provide the highest-quality results for searches of Iranian users, including children. One of the main and important factors of a search

engine's success is providing high-quality results that allow the user to select good and appropriate web pages, make the user confident in the information provided, and satisfy him/her (Taylor, 2013).

Furthermore, Google is a Western search engine that Iranian users may find inaccessible for a variety of reasons, such as US sanctions against Iran or filtering. A prime example is when Google was inaccessible to Iranian users in 2019 (between November 16 and November 24). Additionally, Google has wholly blocked Iranian users from accessing certain of its commercial and non-commercial services (Sharifi, 2021). Thus, it is not sufficient to rely solely on Google and ignore Persian and native search engines.

It should be noted that in several studies, the performance of native search engines compared to Google has been evaluated (e.g., Luyt, Goh & Lee, 2009; Morvarid, Behzadi & Radad, 2016; Zeynali Tazehkandi & Nowkarizi, 2020; Khaki Farrokhad, 2021). One of the reasons for this comparison is that for evaluating search engines at the beginning of development, a powerful and advanced search engine such as Google can be used as an index to measure the performance of search engines. Search engine evaluation is vital in improving the performance and quality of results retrieved using these tools (Bouramoul, Kholladi & Doan, 2011). Six criteria, including content, validity, updates, links, graphics, and performance, must be considered in evaluating the quality of web pages. Accordingly, this study aimed to evaluate the retrieved web pages in response to students' course-related queries using Persian search engines (Parsijoo and Parseek) and Google search engines using the above six criteria. The study also aimed to rate the six criteria for evaluating the quality of webpages retrieved by search engines and those that retrieved the most relevant results.

Hence, by evaluating the quality of web pages retrieved by Persian search engines and Google to respond students' course-related queries while introducing Persian search engines, it was attempted to help students and their parents select the most appropriate and quality search engine and help teachers and librarians becoming familiar with the proper search engine for students to introduce it to students for use in homework and information retrieval. On the other hand, the study results can help designers and developers of Persian search engines improve their performance in retrieving high-quality pages. The course-related queries in this study are based on the questions of the data collection section of the fourth, fifth, and sixth grade science textbooks in Iran, from which keywords and search terms were extracted and then searched in search engines. Children in this study are children aged 10-12 years who are fourth, fifth, and sixth grade elementary students.

Research Questions

RQ1. What is the quality of the web pages retrieved by Parsijoo, Parseek, and Google search engines to respond to students' course-related queries? (This question consists of 6 sub-questions)

   RQ 1.1. What is the quality of web pages retrieved by search engines in terms of content, validity, updates, links, graphics, and performance?

RQ2. Which Parsijoo, Parseek, and Google search engines retrieve the highest quality web pages to respond to students' course-related queries?

RQ3. What is the order of priority of the six quality criteria for web pages retrieved by the search engines to respond students' course-related queries?

Literature Review
Evaluation of Persian Native Search Engines

Several studies have been conducted on Persian search engines. For example, Erfanmanesh and Didegah (2010) evaluated the performance of 16 Persian search engines based on the criteria obtained from the Alexa database by correspondence analysis. The study showed that most Persian search engines performed poorly and needed improvement. The study results of Parseek, Parsijoo, Ghatreh, Google, and Yahoo search engines for retrieving web pages by Golzardi, Meghdadi and Qaderzadeh (2013) showed that Google and Yahoo performed better than Persian search engines. Parseek, Jamasp, Rismoon, Kavoshgar, and Googler were evaluated similarly. Regarding recall, Googler and Kavoshgar performed the best in terms of precision. In addition, Kavoshgar was introduced as the most efficient Persian search engine for retrieving relevant results (Rajabi & Norouzi, 2015). In another study, Nowkarizi and Zeynali Tazehkandi (2017) concluded that the relative overlap of Parseek compared to Parsijoo and the relative overlap of Parsijoo compared to Yooz was 26% on average. Also, regarding covering the indexable web, first, there was the Parseek search engine, followed by Parsijoo, Yooz, and Rismoon search engines.

Using a different approach to compare the two criteria of recall and comprehensiveness, Nowkarizi and Zeynali Tazehkandi (2019) calculated these two criteria in Parsijoo, Yooz, and Rismoon. For this purpose, they asked students to search for simulated tasks based on 32 Persian *subject headings* in these search engines and copy the URLs of relevant websites in the search form. The comprehensiveness criterion showed the difference in search engine retrieval performance more accurately. In the continuation of this study, comparing the performance of Parsijoo, Yooz, and Rismoon with Google in retrieving Persian documents showed that in terms of effectiveness, Google was in the first place and then Parsijoo, Yooz and Rismoon (Zeynali Tazehkandi & Nowkarizi, 2020). In another evaluation study, Parsijoo and Parseek were far behind Google regarding subject coverage (Khaki Farrokhad, 2021).

Several other national studies have been conducted that have evaluated Persian search engines using different methods, i.e., surveys or qualitative approaches. Observance of user interface components of Parsijoo, Rismoon, and Jasjoo in a survey showed that Google Farsi observing 70 criteria was in the first place, and then Rismoon and Parsijoo were in the second and third places, respectively (Aghaee, Ghaebi & Kamran, 2015). In another survey, more than 75% of students were unfamiliar with national search engines, and in general, students' acceptance of international search engines, especially Google, was much higher than national search engines (Ghavidel, Niazmand & Khaleghi, 2018). Taheri Khoinrood (2018) used a qualitative approach to identify the strengths and weaknesses of Parsijoo through interviews with eighth-grade female students in a school in Tabriz. But the only other study that is similar to the present research is a study by Morvarid et al. (2016) investigating the quality of web pages in the Islam field retrieved by Persian search engines Yooz and Parsijoo and non-Persian search engines Yahoo and Google using a researcher-made checklist. The results showed no significant difference between Persian and non-Persian engines regarding the quality of retrieved web pages.

Evaluation of Foreign Native Search Engines

Various researchers have also considered studies evaluating native search engines in other countries. Demirci, Kismir and Bitirim (2007) evaluated the performance of 5 international and Turkish search engines regarding information retrieval based on accuracy and normalized recall criteria. For this purpose, they searched 12 queries in each engine and investigated the first twenty results retrieved for each query. Google had the highest precision and normalized recall ratios and retrieved more relevant Turkish documents than other international search engines. The poor performance of the Filipino search engine Yehi was also reported against Google by Luyt et al. (2009). One of the most critical drawbacks was retrieving many business sites, dead, and advertising links. In another study, 50 Arabic-speaking users rated the top 10 results retrieved by search engines used by Arabic speakers, including Araby, Ayna, Google, MSN, and Yahoo, for 50 queries. Google performed better than other engines for information retrieval (Tawileh, Mandl & Griesbaum, 2010). Using the Delphi method and the Analytic Hierarchy Process (AHP), Zhu, Du, Meng, Wu and Sun (2011) evaluated 6 Chinese search engines. According to the results, Google had the best performance among Chinese search engines, and Baidu was in second place with a small difference. A study of Yandex and Google search engines in Russia showed that the algorithm used in Yandex was more suitable for searching and retrieving local information, while Google retrieved better results for descriptive and commercial searches. In addition, regarding precision and response time, Yandex performed better than Google and provided better-quality results for Russian-language searches (Paananen, 2012). In a study by Zhang, Fei and Le (2013) showed that Google performed better than Google China in terms of effectiveness in information retrieval. Also, Baidu performed worse than the other two search engines.

According to the literature review, Persian and non-Persian native search engines have been investigated using various criteria. The quality of web pages retrieved by search engines is crucial for children's learning outcomes. However, previous research has not examined the comparative performance of Persian and Google search engines in retrieving high quality web pages for students' course-related queries. This study aims to address this research gap.

Materials and Methods

Research Design

Searching for keywords in search engines and evaluating web pages were done in one month, from November to December 2021.

Selection of Search Engines

The statistical population of this study consists of three groups. The first population included Persian general search engines and Google search engines. First, a list of Persian search engines was prepared by reviewing studies conducted on Persian search engines, documents, and websites that introduced these search engines. Many of these engines were not available for reasons such as filtering, non-retrieval of search results, domain sales, and blind links, and among them, only Parsijo, Parseek, Rismoon, and Zarebin engines were available. Upon further studies, it was found that the Rismoon search engine had an inferior performance regarding the relevance of the retrieved results, and in most cases, the pages were completely irrelevant and repetitive.

For this reason, this search engine was excluded from this study. Also, Zarebin's results

were quite similar to Google's. Because there are a restricted number of public and accessible Persian search engines, no sampling of search engines was conducted, and only the two Persian search engines, Parsijoo, Parseek, and Google, were selected as the research population.

The second population consisted of the keywords and phrases that were selected to be searched by the selected search engines. To select the subject area of keywords and phrases, an interview with some students and three elementary school teachers revealed that, on the one hand, most of the course-related research assigned to the students was related to the science course, and, on the other hand, according to the teachers, they were usually assigned to students in the second cycle of elementary school (fourth, fifth, and sixth grades), who are believed to be more able to use the Internet and collect information. The keywords and phrases were selected based on the science books for grades four, five, and six.A section in the science textbook called "data collection" asks students to collect information about a topic and present it to the class. The science books for grades four, five, and six contain 12, 11, and 16 sections on information collection, respectively. Hence, of the keywords of the "data collection" section of the science textbook of all three grades, four were randomly selected for the search (a total of 12 keywords).

The third population included web pages retrieved by search engines. According to Paananen (2012), the top 10 results retrieved by search engines are significant to most users. Hence, in this study, among the retrieved results, after excluding and ignoring the dead links and repeated results, the first 10 retrieved pages that directly provided the relevant information in the form of an article and for free were selected as the sample.

Data Collection Tool

Data were collected using a researcher-made checklist. This checklist is based on website quality evaluation tool (WQET) (McInerney & Bird, 2005) and reviewing web page evaluation checklists such as Web Quality Evaluation Method (WQEM) (Olsina, Godoy, Lafuente & Rossi, 1999), *WebQual (*Loiacono, Watson & Goodhue, 2002), criteria of the American Library Association for selection of websites for kids and teens (ALA, 1997), etc. Finally, the checklist consisted of 6 criteria and 41 items: content (10 items), credibility (10 items), updates (3 items), links (6 items), graphics (8 items) and performance (4 items). The items were mainly designed on a 5-point Likert scale and some on a Yes / No scale.

Reliability and Validity

The researcher-made checklist was validated by sending a compiled list to six Knowledge and Information Science experts. The list was revised based on their feedback. To confirm the reliability of the checklist, three people, including two evaluators and an elementary school teacher, completed the checklist for 5% of the retrieved web pages. After the data was obtained by entering software SPSS version 22, the inter-category correlation was calculated, indicating the checklist's very high reliability ($\alpha=0.954$).

Normality of the Distribution of Variables

Q-Q plot was used to confirm the normality of the distribution of variables. Given that in the plot for each web page evaluation criteria, the data on or near the goodness of fit line were considered normal.

Evaluation and Scoring Web Pages

After confirming the validity and reliability of the checklist, each of the first 10 relevant web pages (about each keyword) retrieved by search engines was evaluated accordingly, and the score of each page was calculated according to the items of each criterion. Each page was scored in such a way that in the case of items with a Likert scale, a score from 1 to 5 and in the case of items on Yes / No scale, 1 (for a no answer) and 5 (for a yes answer) were assigned (Exception: In the second item of the content criterion which was related to biasedness, a reverse scoring method was used, so that the answer "Yes" was assigned point 1 and the answer "No" was assigned point 5.)

Then, the average score obtained for web pages, given that the distribution of variables was normal, was compared with a sample with an average of 3 by the parametric one-sample t-test (for RQ1 and sub-questions 1 to 6). Also, the average scores of pages retrieved by each search engine according to 6 quality criteria (41 items) were compared with a one-way analysis of variance (RQ2). The ranking of the six quality criteria for web pages obtained from the search engines was examined using the Friedman test (RQ3).

Results

Descriptive Statistics of Performed Searches and Retrieved and Evaluated Results

As shown in Table 1, of the first 120 results retrieved by each search engine, the highest number of relevant pages to the searched keywords was related to Google (87.5%) and then Parseek (83.33%). However, the Parsijoo search engine was very different from Google and Parseek, as approximately half of the top 10 results retrieved by Parsijoo included irrelevant pages, repeated pages, or dead links.

Table 1
Performed searches and retrieved and evaluated results

Search engine	Number of keywords searched	Number of results reviewed for each search	Total number of reviewed results	Number (percentage) of relevant and evaluated results
Parsijoo	12	10	120	62 (51.66%)
Parseek	12	10	120	100 (83.33%)
Google	12	10	120	120 (87.5%)

Total quality of web pages retrieved by search engines (according to all six quality criteria)

The total quality of web pages included six criteria (i.e., content, credibility, updates, links, graphics, and performance) and 41 items. Therefore, to determine the total quality of web pages, the score of each web page was calculated according to 41 items. Given the data distribution's normality, the parametric one-sample t-test based on the mean limit of 3 was used to answer this question. According to the test results ($p < 0.05$, positive mean difference), it can be said that the quality of retrieved web pages, given all six quality criteria, was higher than average for all three search engines Parsijoo, Parseek, and Google (Table 2 and Figure 1).

Table 2
The total quality of web pages retrieved by search engines

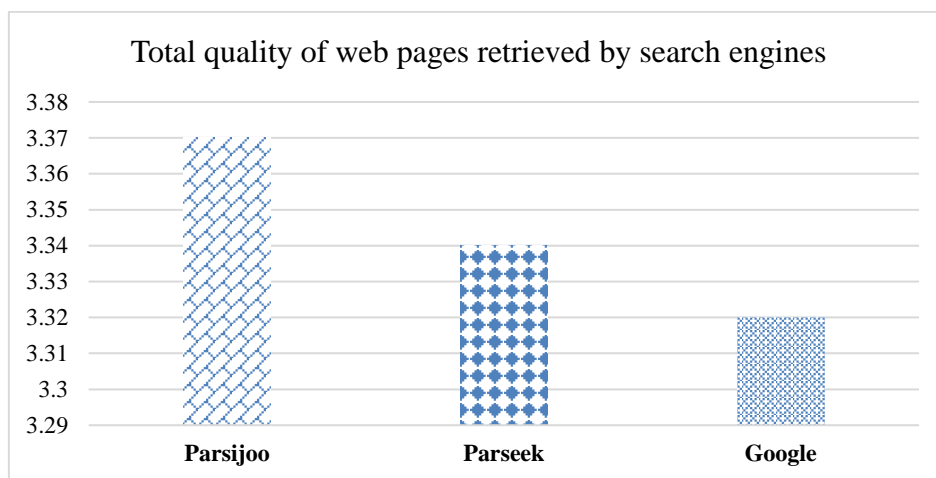| Search engine	No. of web pages	Mean	Standard deviation	Mean difference	t	p	Inference
Parsijoo	62	3.37	0.34	0.37	8.59	0.000	Sig.
Parseek	100	3.34	0.32	0.34	10.46	0.000	Sig.
Google	105	3.32	0.36	0.32	9.19	0.000	Sig.

Figure 1: The total quality of web pages retrieved by search engines

Quality of web pages retrieved by search engines in terms of content

The average score of web pages was calculated according to the ten items in terms of content and then compared with an average of 3 by t-test. According to the test results, it can be said that the content quality of web pages retrieved by all three search engines was above the average (p<0.05, positive mean difference) (Table 3).

Table 3
Quality of web pages retrieved by search engines in terms of content

Search engine	No. of web pages	Mean	Standard deviation	Mean difference	t	p	Inference
Parsijoo	62	3.87	0.55	0.87	12.49	0.000	Sig.
Parseek	100	3.90	0.54	0.90	16.60	0.000	Sig.
Google	105	3.95	0.59	0.95	16.35	0.000	Sig.

Quality of web pages retrieved by search engines in terms of validity

The results of comparing the average scores of web pages according to the 10 items in terms of validity with an average of 3 is presented in Table 4. It indicates that the quality of web pages retrieved by all three search engines was higher than the average ($p<0.05$, positive mean difference).

Table 4
Quality of web pages retrieved by search engines in terms of validity

Search engine	No. of web pages	Mean	Standard deviation	Mean difference	t	p	Inference
Parsijoo	62	3.39	0.63	0.39	4.85	0.000	Sig.
Parseek	100	3.42	0.57	0.42	7.35	0.000	Sig.
Google	105	3.28	0.66	0.28	4.40	0.000	Sig.

Quality of web pages retrieved by search engines in terms of updates

The researchers used three items in this criterion to determine the quality of web page updates, and they evaluated the web pages based on these items (Table 5). The test results indicate that the quality of web pages retrieved by all three search engines was below average ($p<0.05$, negative mean difference).

Table 5
Quality of web pages retrieved by search engines in terms of updates

Search engine	No. of web pages	Mean	Standard deviation	Mean difference	t	p	Inference
Parsijoo	62	2.22	0.63	-0.77	-9.64	0.000	Sig.
Parseek	100	2.23	0.90	-0.76	-8.40	0.000	Sig.
Google	105	2.18	0.96	-0.81	-8.59	0.000	Sig.

The quality of web pages retrieved by search engines in terms of links

The results of evaluating web pages according to the six items in terms of links are presented in Table 6. The link quality of web pages retrieved by all three search engines was above the average ($p<0.0$, positive mean difference).

Table 6
Quality of web pages retrieved by search engines in terms of links

Search engine	No. of web pages	Mean	Standard deviation	Mean difference	t	p	Inference
Parsijoo	62	4.32	0.52	1.32	19.93	0.000	Sig.
Parseek	100	4.20	0.51	1.20	23.47	0.000	Sig.
Google	105	4.16	0.54	1.16	22.05	0.000	Sig.

Quality of web pages retrieved by search engines in terms of graphics

The results of evaluating the web pages according to the eight items in terms of graphics in Table 7 indicate that the quality of pages retrieved by all three search engines was below the average ($p<0.05$, negative mean difference).

Table 7
Quality of web pages retrieved by search engines in terms of graphic

Search engine	No. of web pages	Mean	Standard deviation	Mean difference	t	p	Inference
Parsijoo	62	2.70	0.72	-0.29	-3.23	0.002	Sig.
Parseek	100	2.60	0.70	-0.39	-5.61	0.000	Sig.
Google	105	2.72	0.68	-0.27	-4.07	0.000	Sig.

Quality of web pages retrieved by search engines in terms of performance

The performance criterion consisted of 4 items based on which web pages were evaluated. The test results in Table 8 indicate that the quality of the retrieved web pages was above the average in this respect ($p<0.00$, positive mean difference).

Table 8
Quality of web pages retrieved by search engines in terms of performance

Search engine	No. of web pages	Mean	Standard deviation	Mean difference	t	p	Inference
Parsijoo	62	3.70	0.68	0.70	8.19	0.000	Sig.
Parseek	100	3.68	0.69	0.68	9.90	0.000	Sig.
Google	105	3.64	0.64	0.64	10.23	0.000	Sig.

Determination of the search engine that retrieves the highest quality web pages to respond students' course-related **queries**

The researchers calculated the average scores of the pages retrieved by each search engine according to 6 quality criteria (41 items) to determine the search engine that retrieves the highest quality pages to respond students' course-related queries. Then, the scores were compared by one-way analysis of variance. According to the test results, it can be said that Parsijoo, Parseek, and Google were not significantly different regarding the retrieved pages' quality in responding to students' **course-related** queries (Table 9).

Table 9
Difference in quality of web pages retrieved by search engines

Search engine	No. of web pages	Mean	Sum of squares	df	Mean squares	f	p	Inference
Parsijoo	62	3.37						
Parseek	100	3.34	0.08	2	0.04	0.34	0.711	No sig.
Google	105	3.32						

Ranking of the six quality criteria of web pages retrieved by the search engines

Friedman test was used to determine the priority of six web page quality criteria in each search engine. This test determines priorities based on average rankings. Since the significance level of this test was less than 0.05 for all three search engines, the equality of priorities is rejected. The criterion links were ranked higher in all three search engines than the other criteria. After that, the content, performance, credibility, graphics, and updates criteria were in the second to sixth priorities, respectively (Table 10 and Figure 2).

Table 10
Difference in the priority of six web page quality criteria in each search engine

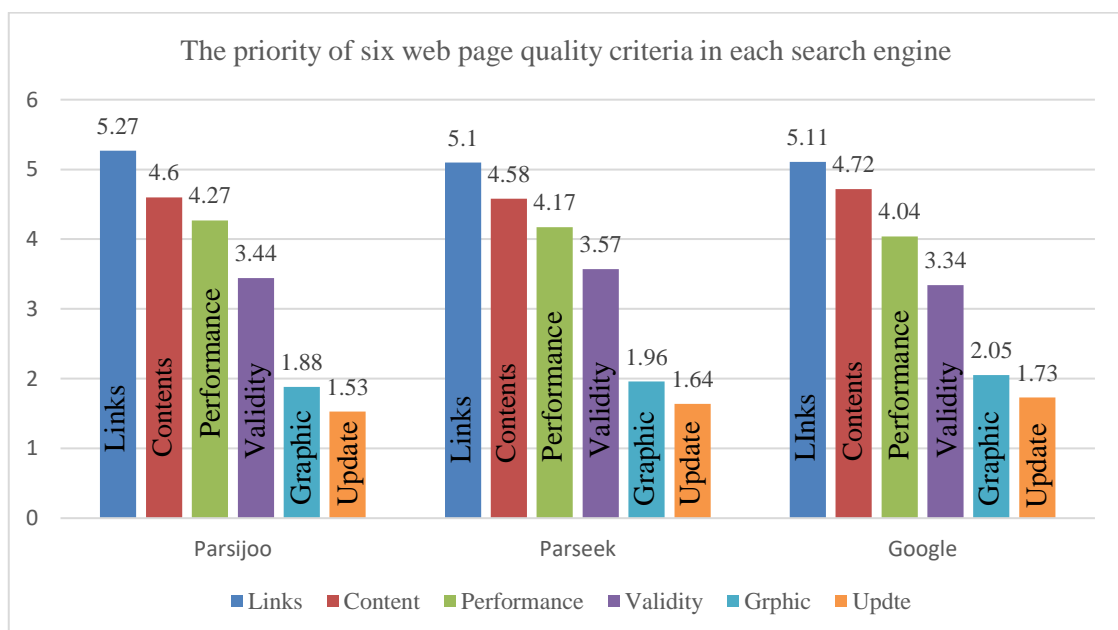| Search engine	Criteria	Mean rank	Priority	df	p-value
Parsijoo	Content	4.60	2	5	204.097
	Validity	3.44	4		
	Update	1.53	6		
	Links	5.27	1		
	Graphic	1.88	5		
	Performance	4.27	3		
Parseek	Content	4.58	2	5	288.167
	Validity	3.57	4		
	Update	1.64	6		
	Links	5.10	1		
	Graphic	1.96	5		
	Performance	4.17	3		
Google	Content	4.72	2	5	291.702
	Validity	3.34	4		
	Update	1.73	6		
	Links	5.11	1		
	Graphic	2.05	5		
	Performance	4.04	3		

Figure 2: The priority of six web page quality criteria in each search engine

Discussion

As mentioned earlier, the quality of web pages retrieved by Persian and Google search engines to respond students' course-related queries has not been evaluated based on all criteria of web page quality, i.e., content, credibility, updates, links, graphics, and performance. The study results showed that Parsijoo, Parseek, and Google differed regarding the number of relevant results among the first ten retrieved. So, the Google search engine had better performance in retrieving relevant results than Persian search engines, which is consistent with the results of several studies (Zeynali Tazehkandi & Nowkarizi, 2021; Khaki Farrokhad, 2021; Golzardi et al., 2013). After Google, Parseek was in second place, but Parsijoo was very different from the other two search engines and its performance in retrieving relevant results was poor. In addition, the study results of Parsijoo showed that in addition to retrieving irrelevant results, many results were also dead links and were unavailable for reasons such as error messages, page not loading, message of page not found, etc. Parsijoo's poor performance may be due to the search engine's novelty and lack of experience compared to Google and Parseek. Consistent with this result, one of the most significant drawbacks of the Filipino search engine Yehi compared to Google was the retrieval of many commercial sites, dead links, and advertisements (Luyt et al., 2009).

Given the importance of the quality of web pages retrieved by search engines, various studies have investigated the feasibility and development of quality-based search engines. For example, Mandl (2006) proposed an approach to develop a quality-based search engine that considered different qualitative components for page rank. These components include the colors used in the page and text, language features (such as the number of unique and stop words, etc.), external links, graphic elements relative to the file size, etc.

An essential finding of this study is that the overall quality of the pages retrieved by Parsijoo, Parseek, and Google to respond students' course-related queries was higher than average, which is consistent with the study results of Morvarid et al. (2016) and inconsistent with the study results of Luyt et al. (2009). In a study by Luyt et al. (2009), the quality of pages retrieved by Yehi and Google search engines was evaluated as below average. This result was also inconsistent with Zeynali Tazehkandi and Nowkarizi (2020) study results because they reported average Parsijoo performance and Google's above-average performance. The difference in the study results of Persian search engines may be due to differences in evaluation criteria because they considered the criteria of precision, recall, and cumulative gain to evaluate the performance of search engines. Also, another reason could be the difference in the timing of the two studies. Because search engines are constantly improving their algorithms, a similar search in a search engine may have different results at different times.

According to the results of the present study on the relatively good quality of web pages retrieved by search engines, it may be concluded that Persian and Google search engines in their ranking algorithms, have paid equal attention to the quality of web pages. However, according to the results of several national studies that have reported the effectiveness of Google significantly more than Persian engines, this result of the present study shows that the performance of Persian search engines has improved over time. But a crucial point that should be noted is that the number of relevant pages identified and evaluated among the first ten retrieved results in each search engine significantly differed between the search engines studied. This means that among the 120 results retrieved and reviewed for each engine, the number of

relevant and evaluable results was 105 for Google, 100 for Parseek, and 62 for Parsijoo. Therefore, it can be said that although the quality of retrieved web pages by Persian and Google search engines was similar and higher than the average, in terms of the number of relevant results, a significant difference was between the first 10 results, indicating better performance of Google and then Parseek. However, Parsijoo was significantly different from Google and Parseek.

The content quality of the web pages retrieved by Parsijoo, Parseek, and Google search engines to respond students' course-related queries was above average. This finding is consistent with Shahrabi Farahani, Shekofteh, Kazerani and Emami (2018) and Nouri Afkand, Matlabi and Alipour Hafezi (2013). The probable reason for this finding may be that the quality of page content is one of the criteria search engines consider in ranking web pages, and all three search engines surveyed paid equal attention to this criterion. In this regard, Serrano-Cinca and Muñoz-Soro (2018) believe that the first and most important principle for search engine optimization (SEO) is the quality of web page content.

The quality of the web pages retrieved by Parsijoo, Parseek, and Google was above average in terms of validity. This result is inconsistent with the study results of Morvarid et al. (2016). Their study evaluated the validity of pages retrieved by Persian and non-Persian search engines in Islam field as below average. This difference may be due to differences in the timing of these studies and the studied subject. A study by Khaki Farrokhad (2021) showed that the three search engines, Parsijoo, Parseek, and Google, significantly differed in the subject coverage of different categories. In general, the reason for the relatively good quality of retrieved web pages in terms of validity can be that web page validity is considered in search engine indexing and ranking algorithms. So, Parsijoo, Parseek, and Google consider the validity of the web pages in their algorithms. As Google stated, to offer a page to users in search results, the authoritativeness or trustworthiness of the pages is considered (Baranchikov, Svirina, Grinchenko and Sumenkov, 2018).

Another finding was that the quality of the web pages retrieved by Parsijoo, Parseek and Google was evaluated as below average regarding updates. This finding aligns with Morvarid et al. (2016) and Bagherinasab (2011). Updating web pages is not a new issue; up-to-date content is vital in search engine ranking results (Ali and Khusro, 2021). Search engines such as Google claim that they care about information updates. For example, search engines, including Google, use the Query Deserved Freshness (QDF) factor to rank the results of some queries (Wilson, 2019). However, search engine robots crawl web pages at various intervals, and search engines do not have a perfect solution for an up-to-date index (Lewandowski, 2008). Thus, the low update quality of web pages retrieved by Parsijoo, Parseek, and Google may be due to this fact. Also, search engines acknowledge that they are click-based and pay attention to pages the user clicks on and visits (Zhang, Xie, Mao, Liu, Zhang & Ma, 2021). Therefore, another reason could be that updated web pages may not have been visited by users and, hence, have not been considered by search engines.

Regarding links, the quality of web pages retrieved by Parsijoo, Parseek, and Google was higher than average, which is inconsistent with the study results of Morvarid et al. (2016). This difference may be due to the difference in the subject and timing of the two studies. According to the study results, it seems that Parsijoo, Parseek, and Google have paid attention to internal and external links on web pages for ranking results. Mandl (2006) believed that link analysis is an approach that automatically evaluates a web page quality, and some search engines include

link analysis in their ranking algorithms. Internal links affect visits to all pages of the website and their indexing and ranking by search engines (Jalal, 2019).

On the other hand, external links can significantly improve site traffic and page rank. In addition, most of the retrieved pages had links to their social media pages. Search engine algorithms pay attention to social signals and the effect of content producers on social networks to evaluate the value of a website. Therefore, building links to web page accounts on social networks will increase web page traffic and quality backlinks, increasing the web page's credibility on search engines (Ziakis, Vlachopoulou, Kyrkoudis & Karagkiozidou, 2019). Therefore, one of the reasons for the relatively good quality of web page links can be the existence of such links.

The quality of web pages retrieved by Parsijoo, Parseek, and Google was below average regarding graphics. This finding partially confirms Salehi's (2015) finding. Various graphic elements of a web page affect the user experience of the web page. Using the proper graphic elements will make an enjoyable user experience and keep the bounce rate of a web page low (Lopriore, 2022), which affects page ranking by search engines (Sellamuthu, Ranjithkumar, Kavitha & Gowtham, 2022; Ziakis et al., 2019).

The quality performance of the web pages retrieved by Parsijoo, Parseek, and Google was above average. This finding is consistent with the findings of Nouri Afkand et al. (2013), while it is not consistent with those of Farhadpour and Khalaf Abadi (2014) in which they evaluated the quality of Iranian children's and teenagers' websites from several perspectives, including performance. Their results revealed that the performance of the estimated websites was lower than the average. This variation in the findings may be due to the difference in the population and time of conducting the research.

Web page loading speed and sitemap were among the performance quality items in this study. A review of literature related to SEO and search engine results ranking by Ziakis et al. (2019) showed that a web page loading time and the presence of sitemaps are essential factors that significantly affect ranking a search engine result. Search engines, including Google, consider page loading time in their ranking algorithm (Lambrecht & Peter, 2022). On the other hand, a slow loading speed (maybe more than two seconds) makes browsing the website difficult (Gregurec & Grd, 2012). Further, if a web page takes more than three seconds to load, 53% of visitors will leave the page (Yakovliev & Filonenko, 2019).

Sitemap (of performance criterion items) helps search engines in the process of crawling and identifying pages on a website. Therefore, sitemap design is effective in indexing the pages of a website by search engines (Gregurec & Grd, 2012). In addition, Google Webmaster SEO guidelines suggest that in addition to a map containing website links, providing a map or index of the website that is readable to users is effective in indexing and ranking the website by Google. Therefore, according to the above, it can be concluded that Persian and Google search engines have paid attention to performance when ranking Persian web pages.

Another objective of this study was to determine the search engine that retrieves the highest quality web pages to respond students' course-related queries. But, the results showed that the search engines Parsijoo, Parseek, and Google were not significantly different in this regard. According to the results, these search engines consider similar quality criteria for selecting web pages for indexing in their database. This result is consistent with the study results of Morvarid et al. (2016) but inconsistent with the study results of Demirci et al., 2007; Luyt et al., 2009; Tawileh et al., 2010; Zhu et al., 2011; Zhang et al., 2013. In these studies, native search engines

were compared to Google and other international search engines in various aspects. The results of these studies showed that Google performed better than other global and native search engines. But, in a study by Paananen (2012), the native Yandex search engine performed better than Google in terms of precision, response time, and quality of retrieved Russian-language results.

The last objective of this study was to identify the priority of the six quality criteria of web pages retrieved by search engines. The results showed that the priorities were not equal. In all three search engines, links were higher than the other criteria; content, performance, credibility, graphics, and updates were the second to sixth priorities, respectively. The highest ranking among quality criteria by links indicates that search engines are paying attention to the link analysis approach for indexing and ranking web pages. Hence, internal and external links between the pages of a website and other websites can help websites not only to have all their pages indexed by search engines but also rank better among search engine results.

Updates, which were ranked last, were not good on most of the retrieved pages. According to the study results, Persian and Google search engines do not perform well in this regard and cannot retrieve the updated pages to respond to students' course-related queries. As mentioned earlier, this may be due to the interval between web page crawls by search engine crawlers or the fact that users did not click new web pages.

Conclusion

This study evaluated the quality of pages retrieved by Parsijoo, Parseek, and Google to respond to students' course-related queries. The study results showed that the quality of the retrieved pages was relatively good, but this quality is still far from the desired level, and Persian and Google search engines should review their algorithms for indexing web pages and providing better quality pages to meet users' needs. On the other hand, no significant difference was observed between Parsijoo, Parseek, and Google regarding the quality of pages retrieved to respond to students' course-related queries, and Persian search engines perform relatively well and are similar to Google. However, the critical point is that a significant difference is between Google and Persian search engines, especially Parsijoo, regarding the number of relevant results among the first 10. While selecting a search engine, in addition to the quality of the pages, retrieving the relevant results is very important and is an important factor in satisfying users (Ali and Khusro, 2021). The large number of irrelevant, repeated, and blind links that waste user's time can cause users' frustration towards Persian search engines and negatively affect their mentality towards using them. Hence, the designers of Persian search engines, especially Parsijoo, should do their best to develop the technology and fix the problems and shortcomings of these search engines. Thus, we can hope for the widespread use of these search engines and create popularity among Iranian users.

Also, in all three search engines studied, the quality of the retrieved pages was desirable in terms of links and content and above average in terms of credibility and performance. However, the quality of the web pages was lower than average regarding updates and graphics. In addition, ranking the six web page quality criteria showed that in all three search engines studied, the search engines considered links and content of the pages more than other criteria.

In general, it can be concluded that Parseek and Parsijoo have improved to some extent over time, but they still should refine their policies and algorithms for indexing and ranking web pages. Moreover, they should constantly update their databases to minimize the retrieval

of irrelevant, blind, and repeated pages, retrieve high-quality pages in response to the users' needs, and find their place by gaining the trust of Iranian users. Of course, given the novelty of these engines, the development and improvement of the effectiveness of these engines, which can improve the position of these engines and the capability to compete with the powerful Google search engine, requires financial and legal support and technical infrastructure of government and related organizations. Also, given the protection plan for cyberspace users' rights proposed in the Islamic Consultative Parliament of Iran and its implementation, which requires local tools in the web and cyberspace, full support of the government and relevant organizations to develop and promote these tools is an extraordinary necessity. According to the findings, the following recommendations are suggested to the Iranian search engine designers and developers, related organizations, and policymakers to improve the quality of Persian search engines:

- Persian search engines should retrieve more relevant results by modifying their algorithms and policies to index and rank web pages and hiring specialized human resources for these processes. So that they can meet the needs of Iranian users and gain the necessary popularity.

- It is necessary to review the algorithms and policies of Persian search engines' indexing and ranking, especially the criteria for updates and graphics, to retrieve quality results in all web page quality criteria. This will lead to users' attention and trust in using these native tools.

- It is suggested that special attention be paid to updating the database of these search engines and greatly reducing the interval between web pages reviewed by their crawlers so that they can retrieve more up-to-date pages to meet users' needs.

- The officials and designers of Persian search engines should pay attention to the results of research conducted on these engines and use them to improve their performance and resolve existing defects to strengthen and enhance the performance of Persian search engines. The government and related organizations are also advised to pay special attention to the provision of infrastructure and technical requirements, legal and financial support for developing these tools, and support research projects to identify problems and resolve defects of these engines. So that they can take an effective step in implementing the protection plan of users' rights in cyberspace.

Future research

This study presents several recommendations for further and future research. First, it is suggested that the quality of webpages retrieved from Persian search engines and Google in other fields and subject areas be evaluated based on the six criteria used in this research, and the results should be compared with the current research. Second, it is suggested that a similar study be conducted after a time interval to monitor any developments in the quality of webpages retrieved from Persian and Google search engines. Third, it is recommended that a similar investigation be carried out on other active native Iranian search engines, as they were inactive at the time of this research. Fourth, it is also suggested that the impact of retrieving the number of irrelevant or blind pages retrieved by search engines on students' reception and willingness to choose a specific search engine as a web search tool be investigated.

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