

(REVIEW ARTICLE)



## Investigating academic researchers' perceptions of a recommender system for mentor-to-mentee matching

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### Abstract

The importance of mentoring among researchers cannot be overemphasized, and to this effect, several recommender systems have been presented in the literature to find experts for collaborations. However, matching researchers as mentors to their respective mentees has not been looked into. Earlier works suggest that expert-finding recommender systems primarily use metadata from experts' publications for making recommendations. Meanwhile, when matching for mentorship, more emphasis should be placed on the areas and major areas of both the mentors and mentees as intended in our proposed system. It is observed that many authors co-author in some areas in which they are not major, which may not certify them as experts in such areas. This research attempts to investigate the views of researchers about mentoring and also to determine the perceptions of the researchers on the need to develop a recommender system that can match researchers for mentorship. The study was conducted in two universities in south-western Nigeria, namely; Federal University of Technology, Akure, and Federal University, Oye-Ekiti. Data were collected with the aid of structured questionnaires using both online and paper surveys. The collected data were analyzed using frequency tables and charts. The results show that 99% strongly agreed and 1% agreed that mentorship is essential among researchers in academia. 98% strongly agreed and 2% agreed that there is need for tools that can help users get personalized items in all areas of life. 56% strongly agreed, 42% agreed, and 2% were indifferent that building a recommender system for matching researchers for mentorship is important. As can be seen from the results, the majority of the respondents acknowledged the importance of mentorship among academic researchers and the need to develop a recommender system to match these researchers for mentorship.

**Keywords:** Mentorship; Recommender System; Researchers; Perceptions

### 1. Introduction

The incidence of collaboration among researchers continues to grow over time. This is happening due to reasons such as the complexity of the investigated problems, as well as the high cost of the experimental equipment [1]. Other reasons include easier access to funding, aspirations for greater prestige resulting from collaboration with renowned research groups, and opportunities for higher productivity [1] [24]. When a diverse group of researchers comes together, it becomes very possible to create solutions and achieve goals that would have been impossible otherwise. Research collaboration helps to open new lines of communication and allows the participants to learn about issues from multiple perspectives, which eventually assists in solving even complex problems in novel ways [2]. Information sharing among collaborators usually results in the discovery of new breakthroughs.

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The concept of mentoring is not new. In fact, the concept is as old as the history of mankind. Mentorship is a kind of guidance rendered to a less experienced person (mentee) by a more seasoned individual (mentor). Mentorship is an essential phase in a scientist's development that usually has long-term impact on the person's career [3]. Mentorship can occur formally through a postgraduate degree supervisor-student (advisor-advisee) relationship or informally through collaborations [3]. It is widely believed that scientific knowledge, practices, and skills are transferred from one generation of scientists to the next through mentoring relationships [3] [4]. The task of mentoring can be a rewarding experience for both parties involved (that is, the mentor and the mentee). It offers numerous benefits such as developing leadership and communication skills, enhancing professional networking opportunities, creating lasting impacts, as well as gaining satisfaction from helping others reach their goals [5].

Several recommendation algorithms have been developed to recommend personalized items. These recommendation algorithms are employed to run recommender systems, which have been used to suggest various items such as movies [6], places of interest [7], music [8] [9], and even people [10] [11] [12]. A recommender system is a software tool and strategy for suggesting items (products, services, or people) that might be useful to a user [13].

The two basic recommendation techniques, namely collaborative filtering (CF) and content-based methods, have been applied by authors in literature, with the collaborative filtering approach being the most successful and widely used till date. The CF approach works by building a database of preferences for items by users. It then matches users with relevant interests and preferences by computing similarities between their profiles to make recommendations. Users receive recommendations for items that people with similar interests, tastes, and preferences have previously liked. With the assistance of CF algorithms, collaborative recommender systems recognize users with the same preferences (such as rating patterns and similar profiles) as the active user and propose items (such as music, movies, and articles) that the similar users have rated highly (and the active user has not encountered).

In the content-based recommender system, suggestions are made by matching a user's preferences with item content. Items that are similar to those the user had in the past are highly recommended. Recommendations are made without necessarily relying on information provided by other users, but solely on the items' contents and users' profiles. In this filtering approach, only very similar items to previous items preferred by the user are suggested to the active user. This brings about a problem called overspecialization. Overspecialization is a situation where certain relevant items cannot be recommended because they have not been seen or evaluated by the active user before, making recommendation impossible [14].

In a hybrid approach, these techniques are combined to effectively predict users' preferences. This combines techniques X and Y, aiming to use X's strengths to improve Y's weaknesses, or vice versa. Multiple filtering algorithms are combined in this way to exploit their strengths while simultaneously balancing out their weaknesses [15]. In practice, it is often impossible to find a single model that is suited to certain dataset as the strength of one model are employed to improve the weakness of the other one. Using hybrid recommendation models usually enhances recommendation accuracy.

The need for an advisor is imperative for everyone at one time or another, with whom one can share his/her problems and whose views one can seek when in a difficult situation [5]. However, sometimes it could be difficult to find experts in one's field of study, even on some online social networking platforms, as there is a need to read a larger number of profiles of researchers before deciding on whom to choose; in such situations, a recommender system could be useful to get appropriate recommendations that may suit one's demands from a large number of experts. Therefore, this research is one of steps taken towards investigating the development of a recommender system that possibly matches mentors to mentees. The study was conducted in two universities in south-western Nigeria, namely; Federal University of Technology, Akure and Federal University, Oye- Ekiti. Data were collected with the aid of structured questionnaires using both online and paper surveys. The collected data were analyzed using frequency tables and charts. The study is expected to establish the need for our proposed system and also to gather information needed for its development from the prospective users.

### 1.1. Research Questions

The following are the research questions:

- What is the significance of mentorship for researchers in academia?
- What are the perspectives of academic researchers on mentorship?
- What types of data are necessary for matching researchers for mentorship in academia?
- What is the importance of using a recommender system to match researchers for mentorship in academic collaborations?

## 2. Literature review

In literature, many authors have presented and analyzed mentorship among researchers. Some of which are presented as follows: Authors in [4] analyzed academic success using a large-scale genealogical network of scientists. The authors concluded that scientists that have many mentees to pass on their knowledge can be considered academically more successful than the ones with less from the perspective of genealogy. In [16], the authors presented a survey that studied the experiences of junior academicians in health sciences who participated in a mentorship programme in Tanzania. The mentorship programme enhanced the skills and experiences of the mentees as evidenced by the quality of their research outputs and their dissemination of research findings. Another authors in [17] studied the factors that bring about successful mentorship among academicians. Their findings show that the researchers that were more successful are those who have trained under mentors with disparate expertise and bring the expertise into their own work. The work proposed by [18] presented the outcome of an evaluation of the mentoring and scientific collaborations taken place through the National Institute of Mental Health (NIMH) which was supported by Implementation Research Institute (IRI). Their results have shown the importance of mentoring in both implementation science and team science.

Recommender system can be helpful in revealing more criteria (such as employing profile and publication data) for establishing mentor/mentee relationship. Several expert finding recommender systems have been presented in literature to suggest experts in various domains. The authors in [12] presented a recommender system that assist users to find experts in online scientific communities. The authors employed dataset that include information such as user's publications and publication venues to suggest an expert in a particular area of study to the active user. In [19], the authors presented an expert finding recommender system using temporal and topical profiles. The authors employed parliamentary documents to suggest political experts. However, authors have not really looked into the aspect of matching researchers (experts and novice) for mentorship. Yet, the adoption of recommender system continues to grow among various categories of people to get personalized items (such as YouTube to find videos and Netflix to get movies).

Presently, its applications have expanded beyond the commercial to include scholarly activities. Apart from using recommender systems to find experts, the scholars have also employed recommender system to perform several tasks. In [20], a recommender system that finds appropriate publication venues was presented. The authors in [21] developed a content-based recommender that suggests articles corresponding to datasets. Reusability of datasets was made possible with their system. In [22], the authors presented a scholarly recommender system (RS) that assist researchers to easily and quickly find relevant publications. In [23], the authors presented a model that solves the problem of personalized paper recommendation. The authors in [11] developed a recommender system that finds expert on given list of topics. All of the aforementioned scholarly recommender systems, as well as many others presented in the literature, could be of assistance to scholars in various ways. Also, as mentorship is another crucial activity among scholars, we have proposed a recommender system to match researchers for mentorship.

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## 3. Research methods

The study was conducted at two universities in south-western Nigeria, namely the Federal University of Technology, Akure, and Federal University, Oye-Ekiti. These universities were selected because they are engaged in research activities. The population for the study comprised a random sample of academic staff and postgraduate students, as they are the potential users of the proposed recommender system. Data collection was carried out using both online and paper surveys. The link to the online survey was sent via email to respondents. Data collection took place between October 2023 and February 2024. In late January 2024, a low turnout was observed for the online survey, prompting the use of paper questionnaires. After four months, a total of 256 questionnaires were received. The collected data was cleaned before analysis. During the data cleaning process, 4 respondents were excluded due to missing data, leaving 252 questionnaires for analysis.

The questionnaire was divided into four sections. The first section gathered demographic information about the respondents, including their current status and gender. The second section inquired about the respondents' experience as mentors or mentees. The third section focused on the respondents' views on mentoring. The final section aimed to understand the respondents' perceptions of the need for a recommender system to match researchers for mentorship. The first two sections contained binary choice questions (Yes or No), while the third and fourth sections used a five-point Likert scale (Strongly Agree, Agree, Indifferent, Disagree, and Strongly Disagree) to collect responses from the respondents. Perception data are usually analyzed using both descriptive and inferential statistical methods, so we have adopted the same approach in this work. Frequency tables and charts were employed to analyse and present the data.

#### 4. Results and discussion

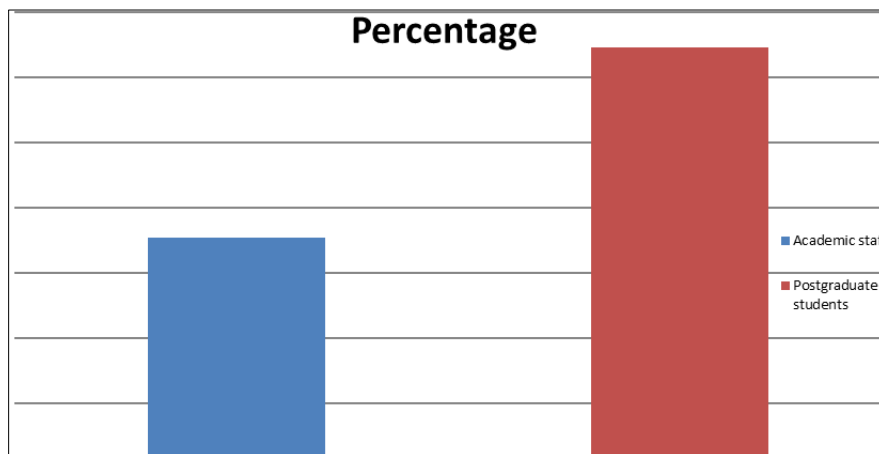
This section presents the results of the data analysis. Table 1 presents the results of the demographics of respondents. The result of respondents' previous mentoring relationships is presented in Table 2. Table 3 presents the respondents' views about mentorship, while Table 4 is the results of the perceptions of respondents on the development of a recommender system for matching researchers for mentorship.

##### 4.1. Demographics of Respondents

The academic staff of university constitutes Professor, Associate Professor, Reader, Senior Lecturer, Lecturer I, Lecturer II, Assistant Lecturer and Graduate Assistant while postgraduates comprises of PhD student and Master' Student. Table 1 presents the frequency and percentage of demographics of respondents (first section of the questionnaire).

**Table 1** Frequency and percentage of demographics of respondents

Variables	Frequency	Percentage
<b>Status</b>		
Professor	8	3.2
Associate Professor	-	-
Reader	5	2
Senior Lecturer	12	4.8
Lecturer I	10	4
Lecturer II	40	16
Assistant Lecturer	12	4.7
Graduate Assistant	2	0.7
PhD Student	86	34
Master's Student	77	30.6
<b>Gender</b>		
Male	111	44
Female	141	56



**Figure 1** Percentage of respondents based on status

The academic staff of the two universities constituted 35.4% of the population while 64.6% are postgraduate students (Figure 1). This implies that majority of the respondents were postgraduate students, this is good as the proposed system will be highly useful to these upcoming researchers. The male respondents amounted to 44% of the population while 56 % are female (Figure 2). Both gender participated well in this survey which shows that both gender understand the importance of mentorship.

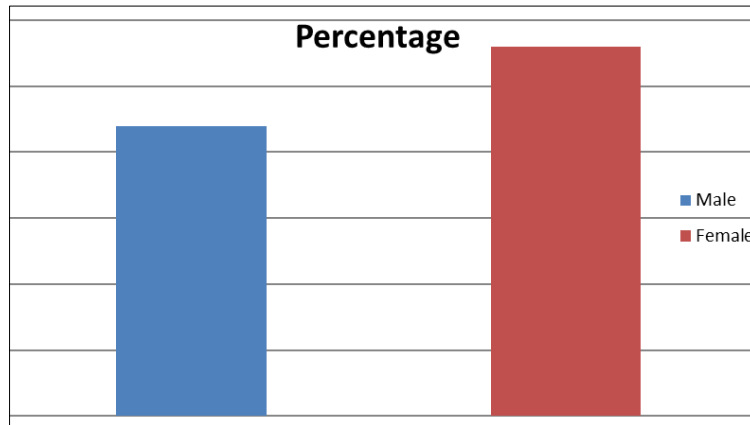


Figure 2 Percentage of respondents based on gender

#### 4.2. Respondent Previous Mentoring Relationship

Table 2 presents the frequency and percentage of responses of respondents’ previous mentoring relationship (second section of the questionnaire).

Table 2 Frequency and percentage of responses of respondents’ previous mentoring relationship

Question	Frequency	Percentage
Have you been a mentor?		
Yes	190	75
No	62	25
Have you been mentored by someone else?		
Yes	250	99.2
No	2	0.8
Have you been involved in informal mentoring?		
Yes	249	98.8
No	3	1.2

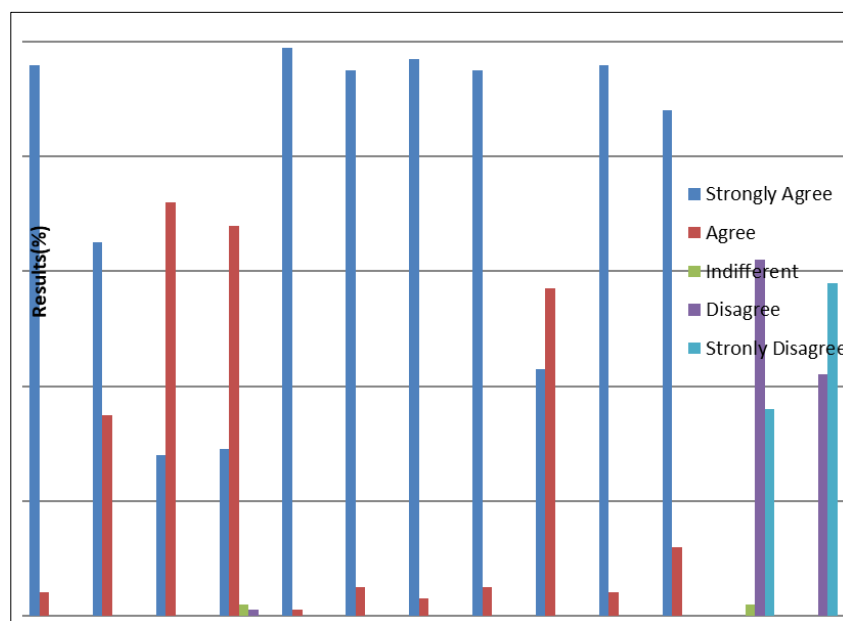
Responses show that 75% of the population have been mentors at one time or the other, this may not necessarily be in the area of academics while remaining 25% of the respondent responses show that they have never been mentors. 99.2% of the population agreed that they have once been mentored by someone else while only 0.8% of the respondent responses show they have not been mentored before. 98.8% of the population agreed they have been involved in informal mentoring before while 1.2% disagreed. These results show that majority of the respondents have participated in mentorship before and know its importance to the career of researchers in academic.

#### 4.3. Respondent view about Mentorship

The result of the responses of the 252 respondents as regards their views about mentorship (third section of the questionnaire) is presented in Table 3. Figure 3 shows the views of respondents about mentorship (in percentage).

**Table 3** Respondents' views about Mentorship

S/N	Question	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1	I love connecting with others for collaboration	242	10	-	-	-
2	I am good at building relationship with those who know more than I do	164	88	-	-	-
3	I spend a lot of time developing connections with others.	71	181	-	-	-
4	I have established a large network of colleagues and associates who I can call on for support when I really need to get things done.	73	171	5	3	-
5	Mentorship is essential among researchers in academic.	249	3	-	-	-
6	Successful mentoring results into ability to influence other and build alliance.	239	13	-	-	-
7	Successful mentoring leads to better self-awareness of strengths and weaknesses.	244	8	-	-	-
8	Gaining good mentoring improves one's ability to work with others.	108	144	-	-	-
9	Better understanding of others' needs and motives can be achieved through mentoring.	108	144	-	-	-
10	A good mentor gives directions to mentee on possible solution to difficult issues.	242	10	-	-	-
11	For an ideal mentoring relationship it is important for both mentor and mentee to have similar research interests	222	30	-	-	-
12	Only the mentees gain from mentoring relationship	-	-	5	156	91
13	Mentorship rarely benefits the mentors	-	-	-	106	146



**Figure 3** Responses of respondents about Mentorship (in percentage)

96% of the respondents strongly agreed that they love to connect for collaboration, while 4% agreed on this. 65% strongly agreed that they are good at building relationships with those who know more than they do, while the remaining 35% agreed. 28% strongly agreed that they spend a lot of time developing connections with others, and 72% agreed. 29% strongly agreed, 68% agreed, 2% were indifferent, and 1% disagreed that they have established a large network of colleagues and associates whom they can call on for support when they really need to get things done.

99% strongly agreed and 1% agreed that mentorship is essential among researchers in academia. 95% strongly agreed and 5% agreed that successful mentoring results in the ability to influence others and build alliances. 97% strongly agreed and 3% agreed that successful mentoring leads to better self-awareness of strengths and weaknesses. 43% strongly agreed and 57% agreed that gaining good mentoring improves one's ability to work with others. 43% strongly agreed and the remaining 57% agreed that a better understanding of others' needs and motives can be achieved through mentoring.

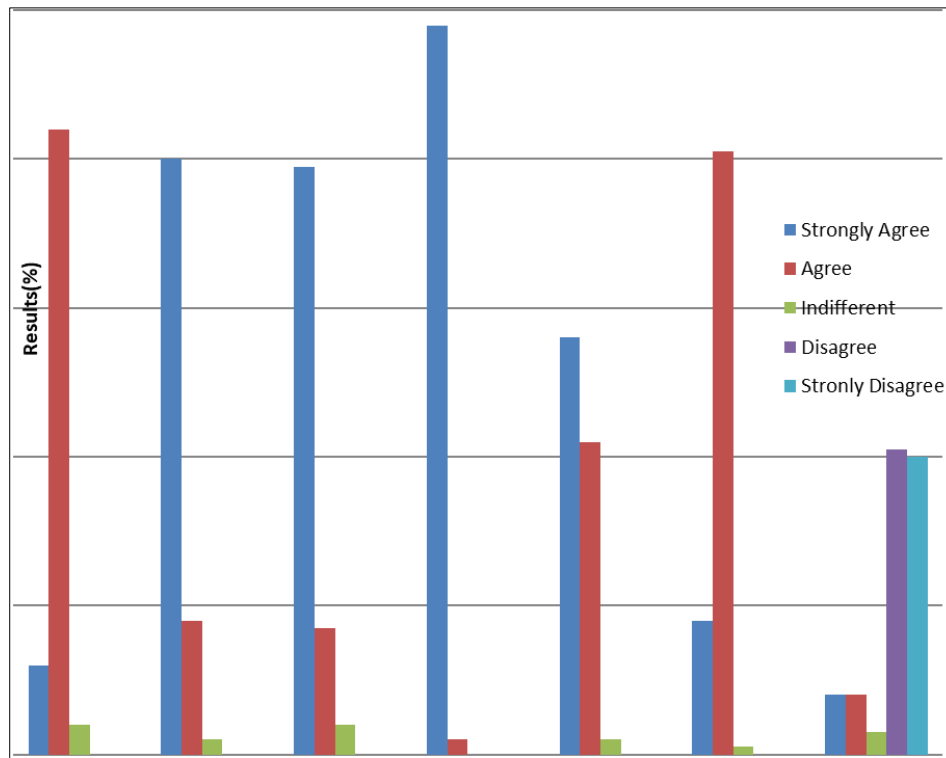
96% strongly agreed and only 4% agreed that a good mentor gives directions to the mentee on possible solutions to difficult issues. 88% strongly agreed and 12% agreed that it is important for both the mentor and the mentee to have similar research interests. 2% were indifferent, 62% disagreed, and 36% strongly disagreed that only the mentees gain from the mentoring relationship. 42% disagreed and 58% strongly disagreed that mentorship rarely benefits the mentors.

#### 4.4. Perceptions of Respondents on development of Recommender system for Mentorship

Table 4 shows the responses of respondents' perceptions on development of Recommender system for Mentorship (fourth section of the questionnaire). Figure 4 shows the perceptions of respondents on Recommender system (in percentage).

**Table 4** Respondents' Perceptions on development of Recommender system for Mentorship

S/N	Question	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1	Recommender system is a powerful tool that provides users with items (such as products, services or people) that might be useful to them.	30	212	10	-	-
2	I am aware that systems such as Youtube, Researchgate, Amazon and Netflix are recommender systems.	202	45	5	-	-
3	Recommender system reduces the effort of user in getting personalized items.	199	43	10	-	-
4	In the recent times, there is problem of information overload (situation in which a user is bombarded with a lot of information) on the internet. So there is need for tools that can help users to get personalized items in all areas of life.	247	5	-	-	-
5	Building a recommender that can match researchers for mentoring relationship is important, taking cognizance of importance of mentoring academic research career.	141	106	5	-	-
6	Recommender system has the power to retrieve profile and publication data of researchers to match them for mentor/mentee relationship.	45	204	3	-	-
7	Recommender systems are usually difficult to use.	20	20	8	103	101



**Figure 4** The perceptions of respondents on Recommender systems (in percentage)

12% strongly agreed, 84% agreed, and 4% are indifferent that recommender systems are a powerful tool that provides users with items that might be useful to them. 80% strongly agreed, 18% agreed, and 2% are indifferent about their awareness that systems such as YouTube, ResearchGate, Amazon, and Netflix are recommender systems. 79% strongly agreed, 17% agreed, and 4% are indifferent that recommender systems reduce the effort of users in getting personalized items. 98% strongly agreed and 2% agreed that there is a need for tools that can help users to get personalized items in all areas of life. 56% strongly agreed, 42% agreed, and 2% are indifferent that building recommender systems for matching researchers for mentorship is important. 18% strongly agreed, 81% agreed, and 1% are indifferent that recommender systems have the power to retrieve profile and publication data of researchers to match them for mentor/mentee relationships. 8% strongly agreed, 8% agreed, 3% are indifferent, while 41% and 40% disagreed and strongly disagreed, respectively, that recommender systems are usually difficult to use.

## 5. Conclusion

The importance of mentorship among researchers cannot be overemphasized as the relationship usually benefits both the advisors and the mentees. Mentorship is an essential phase in a scientist's development that usually has long-term impact on the person's career. This study is therefore investigating the perceptions of academic researchers and their postgraduate students on the development of a recommender system for mentor-to-mentee matching for mentoring and collaborations. The research used two universities as case studies, namely, Federal University of Technology, Akure and Federal University, Oye-Ekiti.

The work employed a questionnaire to gather responses from respondents. 99% strongly agreed and 1% agreed that mentorship is essential among researchers in academia. 98% strongly agreed and 2% agreed that there is a need for tools that can help users to receive personalized recommendations in all areas of life. 56% strongly agreed, 42% agreed, and 2% were indifferent regarding the importance of building a recommender system for matching researchers for mentorship. From the results of the analysis, the majority of the respondents acknowledged the importance of mentorship among academic researchers and the need to develop a recommender system to match these researchers for mentorship.

Finally, this research focused mainly on investigating the perceptions of academic researchers regarding a recommender system for matching mentors to mentees. It is understood that mentorship is essential in everyone's life.



Therefore, further studies can explore the perceptions of other categories of people on recommender systems that can match these individuals for mentoring relationships, as well as determine the type of data needed for matching.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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