Digital Mentoring System Using Recommendation Techniques: A Review Study

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Abstract:

This paper This conceptual paper centered within the framework and directions of digital transformation in the field of university mentoring, and presented many methodologies, tools, practices and previous studies, as our main objective has been achieved that we have come to the conclusion that there is a need for a comprehensive and effective smart system for university mentoring, linked to skills, tendencies, market trends, and the compass that Future knowledge is heading towards it, as through our benchmark that we have made, we can confirm now that the existence of an application and a smart platform for academic and vocational guidance is very necessary not only for Al-Zaytoonah University, but for universities and the educational and academic system as a whole, because there is a great importance in ensuring the quality of Universities inputs and the quality of their outputs to the vocational market.

Where this paper came as a link between the theoretical framework of our project, which we are currently working on at Al-Zaytoonah University of Jordan, and the next practical framework, which will be designed according to a technical and educational map with an entrepreneurial and innovative

dimensions, through realistic simulation and applied modeling and Techniques.

Keywords: Mentorship, digital transformation, Labor market, Smart application.

INTRODUCTION

Most universities around the world, and particularly in the Arab world, face significant challenges in assigning students to the majors that match their interests and correspond to the labor market needs.

It is evident that each individual student has his own points of strength and weaknesses. Such points of strength would play vital role in his future career if discovered accurately and invested accordingly. Having an education system for group of students has its benefits in terms of time and cost, but it ignores such individual abilities, and it is difficult or even impossible to have a human advisor for each individual student despite its importance. Thanks to the recent developments in the field of artificial intelligence and data science, this objective is no longer impossible, and with the advent of state-of-the-art learning methods, the opportunity to detect and extract student hidden abilities and aptitudes is becoming more and more possible. To be more specific, the presence of an intelligent interactive digital mentoring model for students about to register in universities or in the first stages of their study (first or second semester) is critical in empowering the students and directing them in the right directions.

The main aim of this study is to create an intelligent, modern, digital, effective, and integrated academic mentorship model to improve the major selection process and therefore to increase the likelihood to study the right major, get the right job, improve the creativity and the innovativeness of students, and improve the student's quality of life.

Through this conceptual paper, we shed light on the most significant challenges confronting the mentoring of the major selection process as well as the possible advantages that students can obtain by using an intelligent digital model for this objective.

Furthermore, we demonstrate the expected impact of this digital model on the mentoring and the major selection process by making it more accurate, of higher quality, closely linked to the

labor market and trends, and fit better to the academic and personality characteristics of the student. Therefore, the decision to choose a university major needs to be based on internal factors that belong to the relevant student such as his abilities, desires, inclinations, future practical goals, and other internal factors.

Research Problem

This research addresses a problem that is very important to Jordanian universities in general as academic mentoring for students is a national priority due to its direct link to the labor market, market trends, and higher education. The institutions of higher education bear a great responsibility in working to raise the efficiency of the graduates and arming them with the tools of science, knowledge, skill and experience (Al-momani,2020).

In addition, and based on a questionnaire distributed by the authors, there is a high percentage of students studying the wrong major, and therefore will be facing big challenges in finding a suitable job. Moreover, they will be most likely lacking success, creativity, and innovation. The transition from traditional major mentoring to an intelligent mentoring is proposed to be based on artificial intelligence and psychometric questions that will determine the student's tendencies, capabilities, abilities, and aspects of his/her future specialization choices.

Research Gap

Selecting the major that conforms with the student abilities has been one of the most vital decisions any person would make. Yet, the selection process has been done based on non-scientific factors in most cases. Such factors include, but not limited to, the student temporary preference, parents' desires, and peer's opinions. Such factors may not lead to student success in that selected major, as they are not based on scientific study that reflects the student hidden aptitudes. Although this topic is of a great importance to each student as it would shape its future, there is a lack of studies in this field. There is a scarcity of literature that is related to the smart and digital mentoring as most of the reviewed studies dealt with university mentoring in its traditional way. Even those studies that tackled the aspect of using technology in the mentoring process were limited.

The main aim of this study is to create an integrated smart digital model for the mentoring process. Such model is proposed to begin with the mentoring journey and is expected to end with the process of selecting the right collage major related to the student's

tendencies, abilities, and skills. As the world continues to move toward greater use of fourth industrial revolution applications, as these applications have entered all areas of life, the most important of which are education applications that use artificial intelligence and try to find creative solutions for education to achieve quick wins in this regard (Al-Shafei, 2022).

For the mentor process in Arab universities, the researchers did not find an integrated and holistic digital model that works like our model. This is due to the fact that our model is proposed to be built on a solid scientific and cognitive foundations, and it is to be designed in a manner similar to the methodologies for designing psychometric tests used by the world's largest consulting firms (McKinsey, Boston).

This model has the great potent to be the best strategy for selecting a market-demanded specialization that is also consistent with the student's skills, abilities, capabilities, and labor market needs, to improve the student's job satisfaction and strengthen their entrepreneurial orientation.

Research Methodology

This paper is a theoretical component and the first step in an integrated research project at Al-Zaytoonah University of Jordan, where it will describe the theoretical framework for designing the digital model for mentoring at the university by presenting the aspects associated with this proposed model. To begin, individuals with expertise in academic, professional, psychological, social, educational, and other disciplines directly related to assessing students' tendencies, abilities, and desires must be involved. They will be asked to answer questions with multiple choices (Multiple Choices) proportional to their choice of academic disciplines. The multiple responses to these questions must include clear indications and evidence pertaining to a specific specialty or family of specializations.

We will create software that will be installed on computers for students to use. Here, the student must answer a series of questions with specific indications, after which the student receives a printed and customized report that directs him to the academic path best suited to his personality, inclinations, abilities, desires, and practical goals. The student has the option to accept or reject the advice. Such report would be generated after conducting a long term study that gathers answers from previous students and correlate them with their personal achievements

later in life. State-of-art methods are used to learn from the data. Finally, these methods are used to generate the recommendation to a new student based on scientific factors.

Research Questions

Students make major and fateful decisions before entering the university based on incomplete information, which may lead to inefficiency in choosing the appropriate major.
Accordingly, the choice will be inaccurate and does not meet the student's true desire, passion and traits.

The aim of this research paper is to describe how key decisions can affect student outcomes such as time factor and inclinations and an explanation of the key decision-making process in order to control external interventions that influence student decisions. The behavior of choosing the best major for the student will be controlled through a set of questions that this conceptual research paper seeks to answer as follows:

- Is the presence of a smart application and a digital platform for mentoring important in our time?
- Is digital mentoring, based on artificial intelligence, considered part of the digital transformation system?
- Can we consider this new and unique model an Innovation in mentoring and directing students towards specializations related to the students personally and match with their passion and ambitions?
- Is there a need to further research on the mentoring process of choosing a major and the mechanisms of linking it with the labor market, future specializations and future skills?
- What data sources would have the potent to optimize the major recommendation system.

Literature Review

For decades, Word of Mouth (WOM) has been popularized as the most powerful form of marketing communication. However, there is scant evidence that validates its powerfulness from the receivers' perspective. David (2022) examined the powerfulness of WOM by testing its perceived usefulness in choosing the Universities major from 358 undergraduate students from the public university. Data were analyzed by using Structural Equation Modeling and the findings indicate that students choose Universities and majors through the influence of WOM. Therefore, the University should focus on delivering quality services that

influence the spread of positive WOM messages by its current students to prospective students (Amani. D, 2022).

Hui-Tzu Chang (2022), built a personalized hybrid course recommendation system (PHCRS) that considers student's interests, abilities and career development. To meet students' individual needs, she adopted the five most widely used algorithms, including content-based filtering, popularity-based methods, item-based collaborative filtering, user-based collaborative filtering, and score-based methods, to build a PHCRS.

(Hawashin, 2022) proposed the extraction of student aptitudes based on their grades. This was this first phase in order to recommend courses to students that would fit their abilities and strengths. (Polyzou, and Karypis, 2019) concentrated on the issue of predicting poorly-performing students at the beginning of the semester. They insisted on the importance of this topic and used student previous grades to assist in the prediction process.

(Huang et al, 2019) proposed a recommender system for courses is proposed. This recommender system uses the concept of collaborative filtering and similarity among students. (Ibrahim et. Al, 2018) adopted the use of both collaborative filtering and content-based filtering to recommend courses to students.

First, Chang collected course syllabi and labeled each course (e.g., knowledge/skills taught, basic/advanced level). Next, she used course labels and students' past course selections and grades to train five recommendation models. To evaluate the accuracy of the system, she performed experiments with students in the Department of Electrical and Computer Engineering, which provides 1794 courses for 925 students and utilizes the receiver operating characteristic curve (ROC) and normalized discounted cumulative gain (NDCG) as metrics.
The results showed that the proposed system could achieve accuracies of 80% for ROC and 90% for NDCG. She invited 46 participants to test the system and complete a questionnaire. Overall, 60 to 70% of participants were interested in the recommended courses, while the course recommendation lists produced by content-based filtering were in line with 67.4% of students' actual course preferences.

This study also found that students were more interested in courses at the top of the recommendation lists, and more

students were autonomously motivated than held extrinsic informational motivation across the five recommendation methods. These findings highlighted that the proposed course recommendation system can help students choose the courses that interest them most (Hui-Tzu Chang et al. 2022).
Bordon and Fu, conducted a welfare analysis of the different major selection regimes. They found that forcing students to choose their college and their major by admitting students to specific college/major combination, as currently occurs in Chile, gives a higher potential for a student/major mismatch. The authors found that switching from a Chilean model to an open major choice system like the one that is in place in the United States would increase student welfare by one percent. This improvement in welfare was found to be even more pronounced for low income, low ability, and female students (Bordon and Fu, 2015).

(Bridet and Leighton, 2015) examines the tradeoff between the additional occupation-specific skills that are obtained with early major choice versus additional time of multidisciplinary study. Early major choice was thought to allow more credit hours to be focused on major-specific skills that apply to the occupations tied with particular majors. On the other hand, later major choice allows for a longer exploratory period that gives students more time to discover their particular area of competitive advantage. Switching from an open major choice model like the one that is in place in the United States to a required early major decision, as is the case for many European systems, would cause expected earnings to fall by 1.5 percent (Bridet and Leighton, 2015).

Students select a college major for many reasons. Relative to other aspects discussed in this paper, these personal determinants of major choice are fairly well studied. Much of the literature comes from economics, motivated by the potential labor market impacts of the choice of major by college students.

Beffy, Fougere, and Maurel as with much of the work on college major selection, they estimated a dynamic model of post-secondary decision-making. Using administrative data from French universities, they found that expected earnings had only a small effect on major decision-making. Instead, major choices were largely driving by non-monetary considerations such as student ability and preferences type of schoolwork (Beffy, Fougere and Maurel, 2008).

Wiswall and Zafar published two papers on this subject in 2015, both data collected from a non-representative sample collected from a group of high-income high-ability students at New York University. The first simply examined the role of expected earnings in major decision-making. They found that earnings expectations (along with perceptions regarding their own ability) play a big role in a student's major decision-making. However, they found that major decisions were largely driven by major-specific and unobserved tastes. They explained that this includes enjoyability of the coursework and the non-pecuniary aspects of careers associated with particular majors (Wiswall and Zafar, 2015a).

Studying at a university involves taking a wide variety of optional courses, especially for students in larger departments, where students have to consider carefully which of the numerous optional courses would be best for them to take. Course options are important for fulfilling degree requirements and determining future careers (Taylor, R,2002).

Given the large number of optional courses, students may need to dedicate a great deal of time to researching information for each course to select the best options for their situation. Since students do not always have enough information, it can be challenging them to make the right decision, students are often influenced by the opinions of other students, under these conditions, it is important to collect course information and then perform further analysis to determine which courses might meet each student's personal needs. One solution would be through a course recommendation system that helps students make a good decision (Hui-Tzu Chang et al. 2022).

Course recommendation systems use different techniques to collect students' past educational data and then automatically provide course match predictions and recommendations by analyzing the data (Aguilar et al. 2017, Romero & Ventura, 2013). The collaborative filtering method (Chang et al. 2020, Wang et al., 2020), demographic-based filtering method (Dwivedi & Roshni VS, 2017, Zhang et al., 2015), content-based filtering method (Apaza et al., 2014), and knowledge-based filtering method (Aher & Lobo, 2013. Kurniadi et al. 2019) are common methods used in the existing recommendation systems, although no existing course recommendation system uses more than one of these methods.

Since each student has different motivations and different needs from optional courses, different recommendation methods

should be combined into a single recommendation system. In addition, all recommendation methods have positive and negative aspects. To mitigate any disadvantages, many systems choose to use hybrid recommendation methods (Cano & Morisio, 2017, Zhang et al. 2015).

Obviously, natural language processing plays an important role in this context, as several inputs are represented as text such as course descriptions. Many previous works in the literature proposed solutions to improve various aspects of text processing. For example, (Kanan & Fox, 2016) proposed a novel stemming method for Arabic text. This method proved its efficiency in Arabic text classification.

Other studies compared various stemming approaches using various classification methods. The aim of these studies is to optimize the classification process by finding the best stemming/classification combination that would lead to the optimal classification performance. One of these studies is (Kanan et. al., 2019), which compared p-stemmer, khoja stemmer, and light10 stemmer on Arabic text. For this objective, they used both SVM and naïve Bayse. P-Stemmer proved to be the best stemmer when combined with SVM. Other studies were more specific by concentrating on a specific domain of interest. For example, (Kanan et. al., 2019) compared various NLP methods and classifiers according to their performance in the classification and clustering of social media. The important role that the social media has been playing is indisputable. Social media is a rich source for various types of information. This study compared the performance of the important NLP techniques and machine learning methods on the social media platform.

Conclusion

Through this conceptual paper, which presented many methodologies, tools, and previous studies that focused on the mechanisms of students choosing their university majors, and the need for a smart application and platform to improve decision-making based on the student's external and internal tendencies and environment, and the mechanisms for controlling student behavior towards choosing the best university major, and this will be as our paper serves as a focal point for the upcoming studies, in which the smart model will be built using technologies and digital orientation in line with the students' orientations and passions, as our paper seeks to direct researchers to conduct more studies that are related to future skills and future jobs as well.

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