Application expert system career guidance for students

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Abstract. The use of information technology and communication (ICT) is widely applied in student career guidance services. In addition to increasing student accessibility in obtaining career information, the use of ICT can also be used as a reference system in decision making known as expert systems. The focus of the research in this paper is to analyze the results of research related to the impact of the application of expert systems in student guidance on aspects of educational guidance, educational evaluation and aspects of academic career guidance and work guidance. Overall, review findings on the topics and sub-topics analyzed show that the application of expert systems in educational guidance greatly helps students achieve: learning success, specialization in education and training, student performance, achievement and self evaluation. Given the lack of development of expert systems in the field of student career guidance, it is very necessary for continuous development, especially in aspects of uncertainty arising from application and user factors.

1. Introduction

The role of mentoring vocational students by parents and school career guidance teachers in deciding career choices is very important to help students determine their career choices. Career guidance for vocational students is not only done through direct mentoring by parents and school career teachers but also by providing convenience to students in obtaining career information and independent career services. Career information systems and independent career services are currently being developed with the help of information and communication technology (ICT). In its application ICT does not only function as a medium of information and communication but can also be used as a reference system that acts like an expert in its field that supports decision making [1] and is known as an expert system.

Expert systems are branches of Artificial Intelligence in the form of software that uses science, facts, and thinking techniques to solve problems in special domains that usually require human expertise [2-4]. Expert system has several main components, namely user interface, expert system database, knowledge acquisition facilities, and inference mechanism [5]. Inference is a logical conclusion in producing information from facts that are known and in the process carried out in a module called the Inference Machine [6].

Expert systems are widely applied in various fields, including for student career guidance on aspects of educational guidance, educational evaluation, academic career guidance and vocational career guidance, such as: recognizing student characteristics [7], student performance analysis [8],

student performance predictions [9], basic evaluation of student competence [10], character-based educational evaluation [11], and evaluation of academic programs [12]. The purpose of this paper is to get an overview of the extent to which expert systems are used in student career guidance from aspects of educational guidance, education evaluation, academic career guidance and vocational guidance as well as future research opportunities trends related to the application of expert systems in student career guidance.

2. Career guidance expert system

Career selection is one of the difficult tasks faced by students when leaving secondary school considering this will determine their future plans. At this stage, it is very important for secondary school students to obtain adequate career information [13]. Many students have chosen their career paths without receiving appropriate advice from professional services because this has the potential to cause discrepancies between students' academic performance, personality, interests, and abilities. To recommend students in the right career choice, it is important to build a recommendation system that provides direction and guidance to students in choosing their careers [14].

Choosing a continuing education program that supports his career choices is important decisions for students and is a difficult and time-consuming task because many factors contribute to accurate decision making, including: student grades, personality, talents, skills, preferences, subjects of interest, and career status and parental finances, so it is important for students to get help from the recommendation system to choose the right career [15,16]. Some research findings also reveal that there are still many students who make decisions about choosing careers without getting detailed information about their career choices [17-19]. Making a decision to choose the wrong career choice will certainly damage a person's happiness in living his life [20].

To support students in overcoming difficulties in choosing the right career in accordance with what is desired in addition to the help of parents and career teachers in schools also need to be supported through the use of ICT-based applications, including expert systems based on student career guidance [1]. Expert systems are part of artificial intelligence designed based on developer analysis and design and expert knowledge [21]. To support easy access, a web-based information system application is needed that will provide guidance information for students in obtaining information about career professions [22], then with an expert system approach integrated with system information, students are expected to be able to conduct independent career guidance.

3. Method

3.1. Search and selection procedures

The focus of the study and study applied in this paper is intended to uncover and analyze the results of research related to the impact of the application of expert systems in student guidance. Analysis of the study was carried out on aspects of educational guidance, educational evaluation, academic career guidance and work guidance and to find out trends in future research opportunities regarding the application of expert systems in student career guidance. The topic of the literature review was taken from a paper published in the range of 2002 to 2018 with search keywords "expert systems, education, student guidance career, artificial intelligence".

The electronic databases sought in this review of literature studies include: International Journal on Future Revolution in Computer Science & Communication Engineering, Institute of Electrical and Electronics Engineers, Journal of Computer Assisted Learning archive. John Wiley & Sons. Inc, Multidisciplinary Digital Publishing Institute, International Journal of Advanced Research in Artificial Intelligence, Taylor & Francis Group, International Journal of Applied Information Systems, International Journal of Research in Engineering and Technology, International Journal of Information Technology and Computer Science, Springer Publishing, EURASIA Journal of Mathematics, Science and Technology Education, Elsevier Publishing, International Journal of Scientific and Engineering Research, Sri Lanka Association for Artificial Intelligence, EBSCO Publishing Agora Psycho-

Pragmatic. The results obtained 30 articles and from the articles obtained were then analyzed and coded using a spreadsheet program.

3.2. Analysis and coding scheme

The structure of analysis and coding of articles on the impact of the application of expert systems in student and career guidance includes: Topic Research (research title), Study (author, year of publication, place of study, publisher), Research method (research approach, data collection, analysis method), Basic Finding (research results and findings).

The coding will make it easier for researchers to uncover the benefits of expert system implementation in career guidance, study trends, problems and future research directions. The researchers' conclusions on the literature review emerged from the results of questions and an understanding of article analysis. The example of the literature review spreadsheet model as in table 1.

Table 1. Literature review model spreadsheet.

Topic research	Study	Method	Basic finding
Expert system design for educational and vocational guidance, using a multi-agent system.	Essaid El Haji et. Al (2014) 978-1-4799 - 3824 - 7/14/$31. 00 ©2014 IEEE	**Design,** Validation and Implementation	Design multi-expert systems for decision support in the field of vocational education guidance services.
Fuzzy Mobile Expert System for Academic Advising	Walid Mohamed Aly et. Al (2017) 978-1-5090 - 5538-8/17/$31.00 ©2017 IEEE	**Design,** Validation and Implementation	The system can be used and successfully identifies the correct decisions in training
A Prototype Rule-based Expert System with an Object-Oriented Database for University Undergraduate Major Selection	M. Ayman Al Ahmar (2012) IJAIS – ISSN : 2249-0868	**Design,** Validation and Implementation	This system provides students with a decision support system that is useful for searching and selecting majors quickly and easily

4. Result

Identification and analysis of the division of research themes is made into two main groups: (a) the impact of the expert system on student guidance and (b) the impact of the expert system on student career guidance. Table 2 shows the classification of research themes and identified sub topics.

Table 2. List of theme and sub topic identification.

Theme	Sub topic
Impact of expert systems on student guidance	Learning success, education and training specialization, student performance, achievement and evaluation
The impact of expert systems on student career guidance	Selection of career paths and academic majors

4.1. Impact of expert systems on student guidance

Implementing expert systems in student guidance includes:

4.1.1. Education guidance. Expert system applications can help students: identify characteristics of success factors in learning [7], determine and decide on the choice in the registration of education and desired vocational training [23,24], get recommendations for technical education requirements based on portfolio evaluation [25], in making decisions to obtain knowledge, explore the effectiveness of learning for the purpose of improving learning achievement [26], get recommendations for action

strategy suggestions in teaching environmental education based on an exploration of understanding students' knowledge, attitudes and intentions [27], to get recommendations for new actions based on identifying self potential and getting relevant solutions in accordance with the feedback received as an effort to improve memory skills [22], get recommendations for effective learning and are able to predict performance in class based on preparation information, attitudes and study habits [9], find the learning style and learning model as desired [28].

4.1.2. Evaluation. Furthermore, the expert system application can help students: in evaluating the web-based independent learning management system [29], getting teaching optimization based on personal evaluation analysis [30], knowing the certainty component in the educational process [11], in following learning procedures and assessment independent performance [31], in performance evaluation and advice on recommendations for performance improvement [8], evaluating academic programs based on personal views [12], improving understanding skills based on the progress of remedial learning material that is followed [32], knowing the alignment model of teaching plans and assessment of results as a standard assessment [33], choosing the preferred learning model based on recommendations for developing course content [34], choosing competencies in the curriculum with professional requirements [10].

4.2. Impact of expert systems on student career guidance

4.2.1. Student career guidance (Selection of academic majors). Expert systems can help students: get academic advice in the search and determination of the selection of academic majors quickly and easily [15], in determining the choice of majors in academic education based on factors of academic interest and personal potential [35,36], getting taking recommendations courses in education and training that are followed [37], get guidance in determining their career path by giving recommendations on the selection of subjects that need to be taken in supporting their career goals [38], selecting careers, both in choosing academic majors and supporting subjects in the career field chosen [39], in planning the selection of majors in the faculty based on personal abilities [40], looking for quick answers to the study plan and the progress of the program it runs [41], making decisions about the choice of courses based on academic status [42].

4.2.2. Student career guidance (Job). This system helps students: decide which career (occupation) is the best and priority [1], get career guidance in the form of career information guide that can help in deciding education pathways according to their career choices [16], conduct advanced vocational counselling in an integrated manner choose a career based on personality, talent, ability, motivation and preference [43].

5. Discussion and conclusion

The purpose of this paper is to present a review of studies that focus on the impact of using expert systems on student guidance and career. Study analysis emphasizes: (a) Impact of expert systems on student guidance on aspects of education and evaluation guidance, and (b) Impact of expert systems on career guidance for students with sub-topics of academic career guidance and job career guidance.

Overall, the findings of the review on the topics and sub-topics analyzed showed that the implementation of expert systems in educational guidance greatly helped students achieve: learning success, training specialization, student performance, achievement and self evaluation. While the findings from the analysis of topics and sub-topics in the implementation of expert systems in career guidance show that the implementation of expert systems greatly assists students in determining and harmonizing the choice of academic majors with their career choices. Besides the advantages and disadvantages of using expert systems, it is only a tool to help students, teachers and parents. Getting career information and guidance to experts remains a priority recommendation.

The results of the article review analysis indicate that there is still a lack of development of expert systems in the field of vocational student career guidance, therefore in the future there is a need for sustainable development especially in aspects of uncertainty arising from applications and user factors.

References

[1] Ansari G A 2017 Career Guidance through Multilevel Expert System Using Data Mining Technique *I. J. Information Technology and Computer Science* **8** 22-29
[2] Marimin 1992 Struktur dan Aplikasi Sistem Pakar Manajemen Pembangunan **1** (1) 21-27
[3] Qu Y, Fu T and Qiu H 2008 A Fuzzy Expert System Framework Using Object-Oriented Techniques *In Computational Intelligence and Industrial Application* **2** 474-477
[4] Erdani Y 2011 Developing Recursive Forward Chaining Method in Ternary Grid Expert Systems *International Journal of Computer Science and Network Security* **11** (8) 126-130
[5] Nada Y A 2013 Construction of Powerful Online Search Expert System Based on Semantic Web *International Journal of Advanced Computer Science and Applications* **4** 181-187
[6] Martin J and Oxman S 1988 *Building Expert Systems a tutorial* (New Jersey: Prentice Hall)
[7] Van Hecke T 2011 Fuzzy Expert System to Characterize students *PRIMUS* **21** (7) 651-658
[8] Kaur P, Agrawal P, Singh S K and Jain L 2014 Fuzzy rule based students' performance analysis expert system *Issues and Challenges in Intelligent Computing Techniques (ICICT), 2014 International Conference on* (pp 100-105) IEEE
[9] Kuehn M et al. 2016 An Expert System for the Prediction of Student Performance in an Initial Computer Science Course *Proceedings of the 47th ACM Technical Symposium on Computing Science Education*
[10] Sánchez L E, Santos-Olmo A, Álvarez E, Huerta M, Camacho S and Fernández-Medina E 2016 Development of an Expert System for the Evaluation of Students' Curricula on the Basis of Competencies *Future Internet* **8** (2) 22
[11] Sanjaya D B and Divayana D G H 2015 An expert system-based evaluation of civics education as a means of character education based on local culture in the Universities in Buleleng *International Journal of Advanced Research in Artificial Intelligence* **4** (12) 17-21
[12] Muntean M V 2017 Intelligent agent based expert system for blended learning evaluation *Networking in Education and Research (RoEduNet* Conference) IEEE
[13] Ehigbor B O and Akinlosotu T N 2016 Parents' occupation as correlate of students' career aspiration in Public Secondary Schools in Ekpoma Metropolis *AFRREV IJAH: An International Journal of Arts and Humanities* **5** (3) 197-212
[14] Razak T R, Hashim M A, Noor N M, Halim I H A and Shamsul N F F 2014 Career path recommendation system for UiTM Perlis students using fuzzy logic *In Intelligent and Advanced Systems (ICIAS)* (pp 1-5) IEEE
[15] Ayman M and Ahmar A 2012 A Prototype Rule-based Expert System with an Object-Oriented Database for University Undergraduate Major Selection *IJAIS* **4** (8)
[16] Saraswathi S, Reddy M H K, Kumar S U, Suraj M and Shafi S K 2014 Design of an online expert system for career guidance *The International Journal of Research in Engineering and Technology* **3**
[17] Olayinka F 2009 Choosing librarianship as a career: a study of public Secondary School Students in Ekiti State *International Journal of African & African-American Studies* **7** (2)
[18] Ezeani Nneka S 2013 Career Choice: A Basic Issue In Primary And Secondary School Level *Arabian Journal of Business and Management Review* **1** (2) 1-11
[19] Eremie M D 2014 Comparative analysis of factors influencing career choices among senior secondary school students in Rivers State, Nigeria *Arabian Journal of Business and Management Review* (OMAN Chapter) **4** (4) 20-25
[20] Olamide S O and Olawaiye S O 2013 The factors determining the choice of career among secondary school students *The International Journal of Engineering and Science* **2** (6) 33-44

[21] Agarwal M and Goel S 2014 Expert system and it's requirement engineering process *In Recent Advances and Innovations in Engineering (ICRAIE*) (pp 1-4) IEEE
[22] Afolabi A, Ojelabi R, Amusan L and Adefarati F 2017 Development of a web-based building profession career portal as a guidance information system for secondary school students *In Computing Networking and Informatics (ICCNI)* (pp 1-10) IEEE
[23] El Haji E, Azmani A and El Harzli M 2014 Expert system design for educational and vocational guidance, using a multi-agent system In *Multimedia Computing and Systems (ICMCS)* (pp 1018-1024) IEEE
[24] Aly W M, Eskaf K A and Selim A S 2017 Fuzzy mobile expert system for academic advising In *Electrical and Computer Engineering (CCECE)* (pp 1-5) IEEE
[25] Nakamura T, Kai U and Tachikawa Y 2014 Requirements engineering education using expert system and role-play training In *Teaching, Assessment and Learning (TALE)* (pp 375-382) IEEE
[26] Wang C and Wu F 2018 An Expert System Approach to Support Blended Learning in Context-Aware Environment In *International Conference on Blended Learning* (pp 45-56) Springer, Cham
[27] Huang S P 2018 Effects of Using Artificial Intelligence Teaching System for Environmental Education on Environmental Knowledge and Attitude *EURASIA Journal of Mathematics, Science and Technology Education* **14** (7) 3277-3284
[28] Bajaj R and Sharma V 2018 Smart Education with artificial intelligence based determination of learning styles *Procedia Computer Science* **132** 834-842
[29] Cavus N 2010 The evaluation of Learning Management Systems using an artificial intelligence fuzzy logic algorithm *Advances in Engineering Software* **41** (2) 248-254
[30] Dong S L 2016 Application of Distributed Artificial Intelligence in Network Teaching In *First International Conference on Real Time Intelligent Systems* (pp 345-354) Springer, Cham
[31] Stella N N and Madhu B K 2017 Expert System as Tools for Efficient Teaching and Learning Process in Educational System in Nigeria, First Step *International Journal on Future Revolution in Computer Science & Communication Engineerin*g **3** (12) 165–168
[32] Lin C C, Guo K H and Lin Y C 2016 A simple and effective remedial learning system with a fuzzy expert system *Journal of Computer Assisted Learning* **32** (6) 647-662
[33] Reddy P D and Mahajan A 2016 Expert System for Generating Teaching Plan Based on Measurable Learning Objectives and Assessment In *Advanced Learning Technologies (ICALT), 2016 IEEE 16th International Conference on* (pp 207-208) IEEE
[34] Kumar A and Kumar M N 2016 Designing an Expert System for learning improvement. *International Journal of Scientific & Engineering Research* **7** (5)
[35] Grupe F H 2002 An Internet-based expert system for selecting an academic major: www.MyMajors.com *The Internet and higher education* **5** (4) 333-344
[36] Deorah S, Sridharan S and Goel S 2010 SAES-expert system for advising academic major In *Advance Computing Conference (IACC), 2010 IEEE 2nd International* (pp 331-336) IEEE
[37] Engin G, Aksoyer B, Avdagic M, Bozanlı D, Hanay U, Maden D and Ertek G 2014 Rule-based expert systems for supporting university students *Procedia Computer Science* **31** 22-31
[38] Hendahewa C et al. 2006 Artificial intelligence approach to effective career guidance *Sri Lanka Association for Artificial Intelligence*
[39] Thakar S and Nagori V 2017 Analysis of Rule Based Expert Systems Developed and Implemented for Career Selection In *Proceedings of International Conference on Communication and Networks* (pp 723-731) Springer, Singapore
[40] Naser S S A, Baraka M H and Baraka A 2008 A Proposed Expert System For Guiding Freshman Students In Selecting A Major In Al-Azhar University, Gaza *Estudios de Economía Aplicada* **26** (2)

[41] Nambiar A N and Dutta A K 2010 Expert system for student advising using JESS In *Educational and Information Technology (ICEIT), 2010 International Conference on* **1** V1-312 IEEE
[42] Onyeka E, Olawande D and Charles A 2010 CAES: A model of an RBR-CBR course advisory expert system In *Information Society (i-Society), 2010 International Conference on* (pp 37-42) IEEE
[43] Yannakoudakis H and Yannakoudakis E J 2015 The architecture of the ARISTON expert system for vocational counselling In *Industrial Engineering and Operations Management (IEOM), 2015 International Conference on* (pp 1-6) IEEE