# The Implementation of Career and Educational Guidance System (CEGS) as a Cloud Service

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**Abstract**—The present tools of career and educational guidance provided by educational organizations do not seem to address the problems faced by students, and graduates for applying to their promised job. The growing benefits of cloud software as services increase the requirements of implementing novel applications for career and educational guidance as a cloud service provided by the universities' portal. In this research, the authors present the benefits of using career guidance apps and introduce the implementation of career and educational guidance system (CEGS) in Higher Education. The system is designed specifically for school-level, university students, and graduates. Fuzzy logic operations were used to represent the system inputs, outputs, and rules. The paper aims to present a career and educational guidance application as a digital transformation application in the area of career counseling. The proposed system provides a student with interactive tools to select suitable colleges that match their educational skills and help graduates to select suitable careers for their practical experiences as well as provide them with essential training programs that are needed for particular jobs. The authors used the 2*3 factorial design method for the initial evaluation of the proposed system and to evaluate both students' and graduates' feedbacks. The researcher also uses the one-way ANOVA to find out if there is a remarkable difference between the users' perceptions scores.

**Keywords**—Educational guidance, Career guidance, Cloud computing, Digital transformation, Higher education, Fuzzy logic, ANOVA.

## 1 Research Problem

In recent days, students always face problems in choosing a college that interests them and matches their qualifications and skills. Graduates also have the same challenge of choosing a job that suits their experiences. In addition to their abilities, educational experience, and motivation, many factors influence graduates to choose their career life. After graduating, students normally start seeking a career path that suits

their experiences, and qualifications. Many factors have an impact on student/graduate career guidance and some difficulties have motivated researchers to use several scientific approaches and methodologies to provide guidance systems for job hunting and to provide further solutions. In this paper, a cloud based CEGS is implemented to assist students and graduates in their transition into the professional path. Besides, the proposed system answers the research questions below:

- What are the most important things you should have to focus on in the early stage of your academic (learning and research) career?
- How to build a successful and excellent academic career?
- What are the best steps for success in your career?
- Is the proposed system providing you with the college that you hope to join?
- Is the proposed system providing you with your interested major that you hope to work with it as a career?
- Is the proposed system provide you with the required training courses needed to get an interesting career?
- Are you satisfied with your job after using the educational and career guidance program focused on cloud computing?

## 2 Digital Transformation and its Strategy for Education

Digital transformation is a physical and conceptual transition to meet the students, faculty, and college demands, and building a learning atmosphere in which all things interconnect. This ecosystem bridges the digital gap to create a collaborative, interactive, and personalized learning experience by bringing technology, services, and security together. Digital transformation starts with a clear strategy that exploits new technology opportunities while fulfilling stakeholder objectives. The following four measures assist the organization to create a digital transformation strategy for education [1]:

1. *Connect everything to the digital world of tomorrow:* Establish strong strategic alliances and create an ecosystem connecting your people, processes, and stuff to grow a highly efficient, secure, and smart communications network. Use real-life and time information to drive strategic initiatives that increase performance, develop upgrades, and make good decisions to automate, understand, and save money.
2. *Roll out new Business Models:* Services and apps of "freemium" on-demand are cheaper, more adaptable, and easier to handle than conventional systems and perhaps only your campus ticket.
3. *Move to a single, simple platform:* Whether it be on-site or in the cloud, digital transformation aims to build your network and communication infrastructure on a single platform.

Students identified technology and innovations that can provide their highest priority for internships and work pathways. The technology-enabled administrative processes were closely followed by this. Although universities are extremely important as

a way to work, two-thirds of universities think that in the next decade, universities will play this role adequately or very effectively. Students want workflows, so students give far greater priority than academics to technologies that support internships and workflows [2].

## 3    The Benefits of Using Career and Educational Guidance App

Students' main goal is to choose their major and career at a young age, based on various factors and criteria. The correct choice of major and career will have a positive impact on the educational level of students and the professionality of graduates and vice versa. Therefore, the value of career advice is growing accordingly to these factors. The term "career," refers to a person's lifestyle that includes work, learning, and leisure [3, 4]. Career development helps graduates to focus on choosing an appropriate career or field in the future. Some educational organizations provide students with the education and career development by specialized career counselors or "employment events" for their educational and career development [5-12]. The proposed career and educational guidance system provide many benefits to the community, students, graduates, and parents include:

1. Career guidance can act as a decision-making tool for participation in the labor and learning sectors.
2. The career guidance apps can comprehensively express the abilities and skills of students and graduates and provide them with accurate advice to select their future career.
3. The career and educational guidance apps provide students and graduates with an understanding of themselves and their potential choices, thus improving their ability to choose the appropriate career path.
4. The career guidance apps can help students and graduates to increase their experiences, knowledge, and capacity to join the labor market.
5. Essentially, the career guidance app focuses on and for individuals, it supports them to make choices, to build their skills and to participate positively in the labor market, this leads to several major economic results for the country such as increased labor market participation, improve knowledge base and skills of individuals, and decreased unemployment.
6. Career and educational guidance apps can improve the development by encouraging participation and success in the academic and training systems available in private and public sectors.
7. Career guidance applications can help promote the transition from school to employment and help improve individual self-confidence, self-efficacy and recruitment.
8. Career guidance apps decrease shocks between individuals and the labor market which may arise from inadequate job matching for individuals. Therefore, it supports individuals to move into the most suitable job for them.

9. The career and educational guidance apps lower the effect of unemployment by reducing the time spent by individuals in searching for work and increasing the probability of finding appropriate work.
10. Career guidance apps support the development of human capital and its effective employment, this can help individuals to innovate, increase their incomes, and take risks when building their projects

## 4 Cloud Computing and Fuzzy Logic for Career Guidance

For the design of the proposed career and educational guidance model, researchers have used cloud computing architecture. The popular service-oriented computing model is cloud computing and it is responsible for the development of the use and management of the computing infrastructure. It also saw the provision of resources and career services to consumers as a new model. It provides useful and requested access to a centralized shared computing pool that could be distributed with great efficiency and minimal education and career management. [6]. This cloud computing model consists of five critical features that include:

1) High elasticity, and scalability
2) Flexibility and efficiency
3) Usability and portable applications
4) Interoperability and management

The proposed career and educational guidance model is presented in five components including clients, apps, platforms, infrastructure, and servers [13-15].

The authors used Fuzzy logic concepts in this work to control the process of the proposed CEGS. The structured recruiting of new applicants includes interviews and some tests to evaluate the availability of appropriate skills. The right selection of candidates is based on the correct judgment of the examiner. The proposed application helps organizations to improve their career experience. This paper aims to develop a Fuzzy app that helps organizations combine their knowledge as input and make the right choice as an output.

The authors defined a set JOB of n jobs (or careers) as, JOB = {$j_i$: $j_i$ is a job i, $1 \leq i \leq n$}, and F be the set of m corresponding career' characteristics, i.e., F = {$f_j$: $f_j$ is a characteristic of a selected job in JOB, $1 \leq j \leq m$}. The researchers denoted the set of fuzzy values corresponding to each characteristic by V; V={$v_j$: $v_j$ is a fuzzy value, $1 \leq j \leq m$}, these values are selected from the set {weak, good, very good, excellent}. The CEGS provides the user to search against all m job characteristics in F to map it with the corresponding fuzzy value $v_j$.. The system creates the set of user's skills S such that: $S_m$={<$f_j$, $v_j$>: $f_j \in F$, $v_j \in V$, $1 \leq j \leq m$}. The authors used three fuzzy sets: Yes, Maybe, and No, to represent a certainty of job presence for a candidate. Therefore, for a selected job $j_i \in$ JOB there is a set $f_j \in F$ of m relevant characteristics; $1 \leq j \leq m$, each characteristic takes a score $v_j \in$ {weak, good, very good, excellent}. The career records are represented as a triple set: <$j_i$, $f_j$, $v_j$>. For each career $j_i$, the proposed application identifies the set of corresponding features and store its appropriate fuzzy

value vj in the job database table. The skills and experiences table Sm is created contains the main two attributes <fj, vj>, when the user uses the proposed CEGS to find his appropriate career. The effectiveness of the fj characteristic on the job decision can be obtained from the job table Jtable {<ji, fj, vj>}. The fuzzy value vj is created from the used skills tables for the characteristic fj as S(fj) by join operation. This effect will be denoted by Eij, where Eij → Ct {<fj, S(fj)>} = one of the values {Yes, Maybe, No}. Hence, the system computes all m relevant characteristics Ei, for all jobs, to get the final job decision, for the ith career.

$$E_i = \sum_{j=1}^{m} < f_j, s(f_j) >$$

(1)

The final step in the proposed Fuzzy-based application is the De-fuzzification step that uses to convert fuzzy output set to crisp values that define the certainty of presence for every job in the set JOB. The authors suppose the given job ji has a set of m related characteristic fj, then the final selection decision of this job is presented by equation (1). The authors represented the result for the certainty of job presence using the three fuzzy sets {Yes, Maybe, No}, as a*Yes, b*Maybe, and c*No; where a + b + c = m, and a ≥b≥c. Therefore the total selection decision is evaluated by,

Ei = a*Yes + b*Maybe +c*No        (2)

The crisp percentage value for the selection decision of job ji is computed by J = (Ji /Jj)*100%; where Ji is the centroid of the overall selection decision, and Jj is the centroid for the Yes fuzzy set. The model of the proposed CEGS is shown in Figure 1 [16-21].
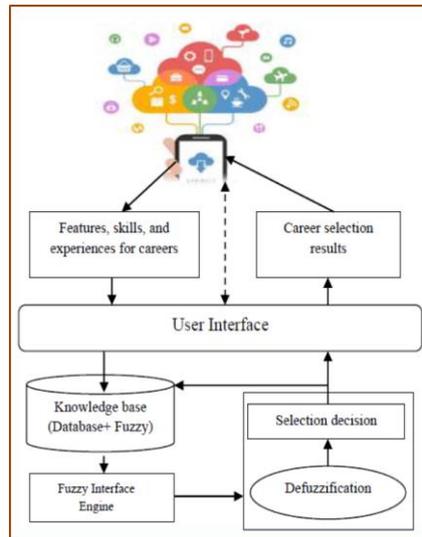


**Fig. 1.** The model of the proposed CEGS

# 5 Analysis and Design of CEGS

Firstly, the authors presented the system architecture and design that incorporates both the graphical user interface and the database. The following phases were implemented to achieve the research goals:

## 5.1 System architecture

The GUI of the proposed CEGS is completely Web-based and requires no technical expertise from potential and possible users. The system includes four applications called "School", "University", "Graduates" and "System Administrator". CEGS access is easy and ideal for on-campus or off-campus users. The main three components to the proposed system architecture include client, server, and the database.

## 5.2 System analysis

The analysis process of the proposed CEGS is a major step in determining the criteria of the system in detail. The aim is to reflect system goals into specified functions and operations of the proposed cloud-based services at this stage in system development. A complementary series of diagrams such as sequence, use cases, and flowcharts, etc., for the career and educational guidance application, was created. Each diagram offers a different view of CEGS and presents different demands and requirements. CEGS requirements are divided into a non-functional requirement and a functional requirement.

- **Non-Functional requirements**: The features and interfaces that are not directly related to the system's functional behavior, such as accessibility, supportability, reliability, security, and performance that have been checked and demonstrated by the authors.
- **Functional requirements**: Different users are allowed to benefit from the proposed CEGS according to the specified privileges. There're three main CEGS users including *administrators, school students, university students, and graduates.* The proposed career and educational guidance app provide each user with the following services:

  ○ School app: School students in Saudi Arabia's universities are using the proposed to search for a major, throughout each university (or university branches), the system provides students and parents with all majors and departments in each college. The students' table includes "st-id, st-name, st-add, st-phone, st-email, st-school-name, st-school-add, st-school-phone, etc.". The parents' table includes "parent-id, parent-name, phone, email, etc.". The university table includes "univ-id, univ-title, univ-add, etc.". The college table includes "college-id, co-name, co-phone, co-email, etc.". The department table includes "dept-no, dept-name, dept-location, dept-head, dept-phone, dept-email, etc.".

○ University app: University students can use the proposed system to seek training courses (provided by training public centers) to develop their practical experience. Students use system apps to be informed of the job requirements advertised by both private and public organizations to prepare themselves for their future job. The university's student table includes (st-id, st-name, st-add, st-phone, st-email, st-unvid, etc. The course table includes (co-id, co- name, co-title, co-hours, etc. The training center table includes (center-id, c-name, c-add, c-phone, c-email, etc.

○ Graduates app: The proposed system is used by graduates to investigate job opportunities in both public and private educational sectors that are currently available, and thus, apply for an available position. The system displays a list of available careers in each company sorted by the advertising date. The graduates can also use the system to inquiry about training courses required for a specific career. The graduates' table includes (st-id, st-name, st-add, st-phone, st-email, college-id, dept-no, etc.). The job table includes (job-id, job-title, dept-no, company-id, requirements, address, rules, etc.). The company table includes (co-id, co-name, co-type, co-add, co-phone, co-email, etc.).

○ Admin app: The proposed system provides the administrator with some tools to manage all system services including, "add new records, update existing records, delete records, as well as print required information."

Figure 2 illustrates the data flow diagram (context diagram) that initially created for the implementation of the proposed CEGS.
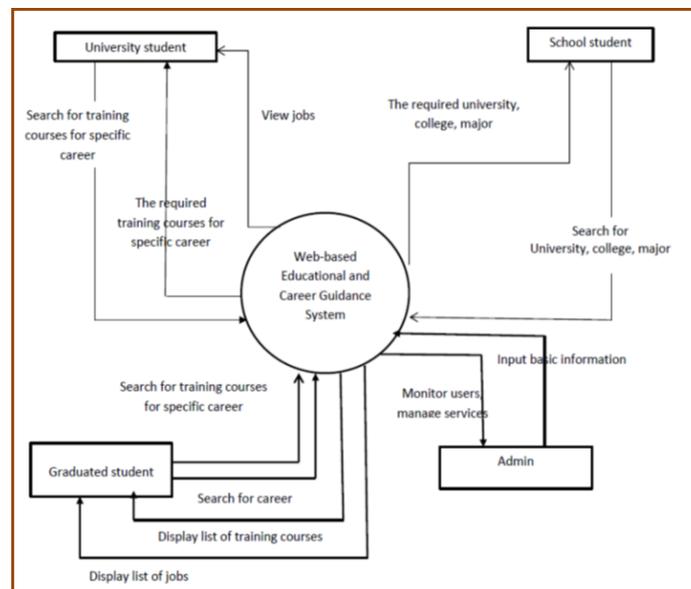


**Fig. 2.** Data flow diagram of the proposed system

### 5.3    System design

The authors used object-oriented design methodologies to develop the proposed CEGS. Besides, to create the required UML diagrams, the researchers implemented the following tasks:

1) Identify the system' actors and their functions
2) Identify the internal and external interactions of the CEGS
3) Create system architecture
4) Identify the principal classes of the system
5) Identify the associations among classes
6) Create the design models
7) Develop users' interfaces

On the other hand, the authors design and implemented the system's database according to the defined requirements.

## 6    System Implementation

The cloud-based services of the proposed CEGS were implemented as described previously. The system contains the following main applications: admin, school, university, and graduates. Users should log into to the system using the following information "username, password, confirmed password, user-phone, user-email, and user-type". Therefore, the users can access the system by username/password authentication. Figure 3 shows how users can access the system by the login page.
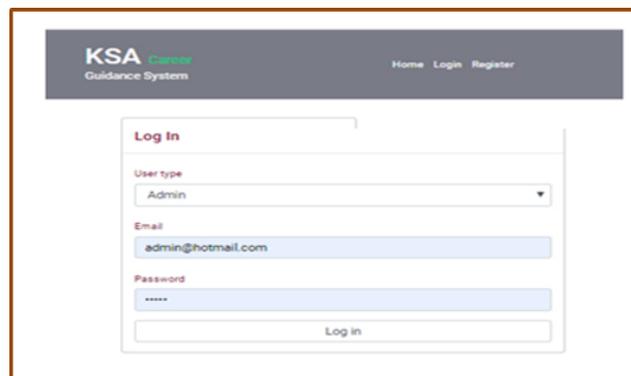


**Fig. 3.**  System Login

If the user accesses the system as an "Administrator", then he/she can manipulate whole system information such as "address, update, delete users, universities, branches, colleges, department requirements, job requirements, companies, training centers, and courses". Figure 4, shows the system administrator form.
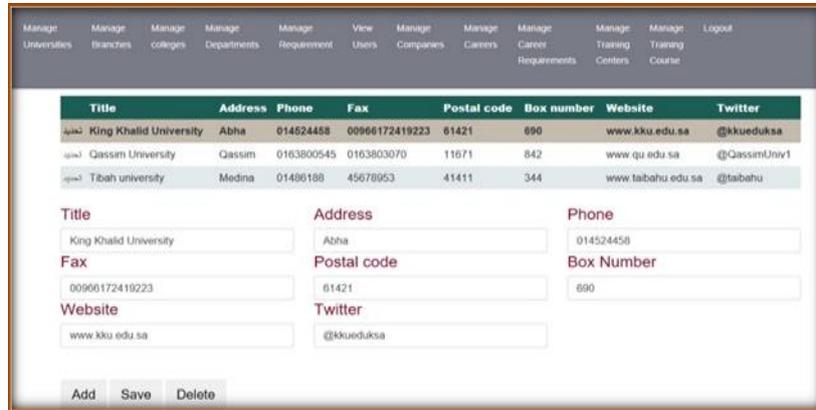
**Fig. 4.** Manage universities by system admin app

If the user accesses the system as a "School Student", they will be able to use CEGS to look for a certain required major in specific colleges. Also, students could use this system to explore the requirements of each department in different colleges, as shown in Figure 5.
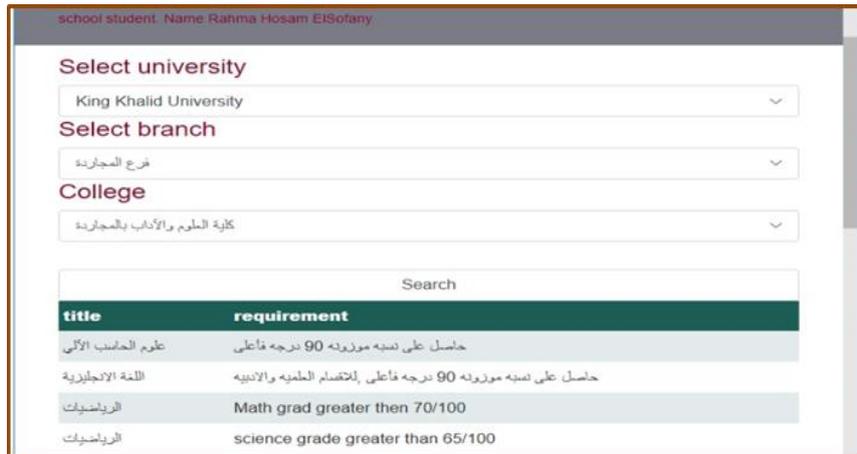


**Fig. 5.** Searching for the requirements of college' departments

If the user accesses the system as a "University Student", they could use this system specifically to seek different training courses that are offered by the selected center. The user also uses the system to search for job requirements offered by selected organizations, this will help students to make the right career decision for working in the future, as shown in Figure 6.
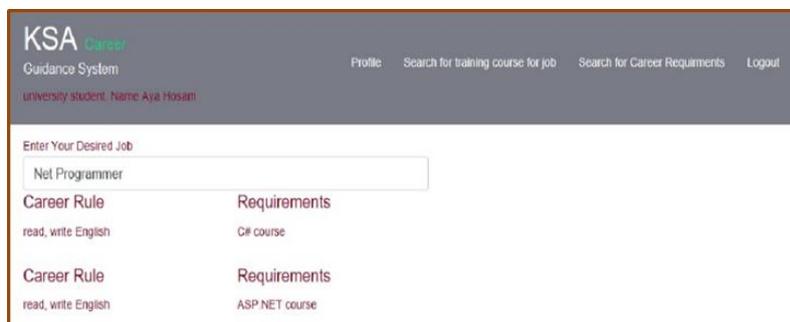
**Fig. 6.** Searching for job requirements

If the user accesses the system as a "Graduate", they can easily use the system to look for offered and advertised jobs and thus, put in an application the requested job. The proposed system provides the graduates with detailed lists of all advertised jobs for each company. Also, it provides the graduates with training course information needed for a particular job, as shown in Figure 7.
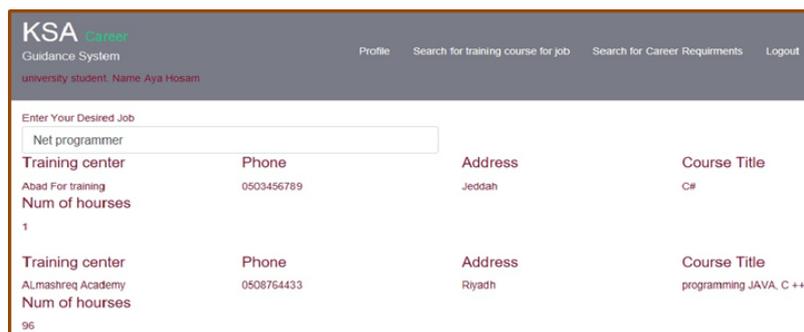


**Fig. 7.** Searching for training course requirements for a selected job

## 7 Evaluation and Results Analysis

In this paper, the authors used the 2*3 factorial design method to identify the initial evaluation of the proposed CEGS and to get feedback from both students and graduates. The users are split into two main groups: The "Experimental Group" and the "Control Group". The initial participants consist of two groups, in the first group, the authors selected 200 students from the school level, forming the experimental group and other 300 students from the university-level (150 of them are undergraduates and the others are graduates) as a control group. The researchers conducted a survey that is validated, checked, and revised by a group of professional experts. The questionnaire contains 20 questions and uses a 5-point Likert type of question, "Strongly-Agree, Agree, Disagree, Strongly-Disagree, and Not applicable". The authors collected and evaluated the user responses through the use of one-way ANOVA (variance

analysis) for measurement repetition to find out if there is an obvious difference between the perceptions scores of the users. Table 1 shows the mathematical means, standard deviations, standard deviations errors, lower bound, upper bound, and variance between components of the evaluations that are computed.

**Table 1.** The descriptive measure for student perceptions

| | | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean Lower Bound | 95% Confidence Interval for Mean Upper Bound | Minimum | Maximum | Between-Component Variance |
|---|---|---|---|---|---|---|---|---|---|---|
| CEGS_via_School | 15 | 3 | 23.33 | 7.638 | 4.410 | 4.36 | 42.31 | 15 | 30 | |
| | 20 | 1 | 20.00 | . | . | . | . | 20 | 20 | |
| | 25 | 1 | 30.00 | . | . | . | . | 30 | 30 | |
| | 30 | 2 | 40.00 | .000 | .000 | 40.00 | 40.00 | 40 | 40 | |
| | Total | 7 | 28.57 | 9.449 | 3.571 | 19.83 | 37.31 | 15 | 40 | |
| | Model Fixed Effects | | | 6.236 | 2.357 | 21.07 | 36.07 | | | |
| | Random Effects | | | | 4.961 | 12.78 | 44.36 | | | 62.255 |
| CEGS_via_University | 15 | 3 | 21.67 | 7.638 | 4.410 | 2.69 | 40.64 | 15 | 30 | |
| | 20 | 1 | 15.00 | . | . | . | . | 15 | 15 | |
| | 25 | 1 | 30.00 | . | . | . | . | 30 | 30 | |
| | 30 | 2 | 20.00 | 7.071 | 5.000 | -43.53 | 83.53 | 15 | 25 | |
| | Total | 7 | 21.43 | 6.901 | 2.608 | 15.05 | 27.81 | 15 | 30 | |
| | Model Fixed Effects | | | 7.454 | 2.817 | 12.46 | 30.39 | | | |
| | Random Effects | | | | 2.817[a] | 12.46[a] | 30.39[a] | | | -9.804 |

Table 2 shows the ANOVA results for the descriptive measures for student perceptions that include (sum of squares, df, mean square, F, and Sig.) analysis results between and within groups of the proposed system. Figure 8, shows the ANOVA measure between the mean of the school level group and control group, while Figure 9, shows the ANOVA measure between the mean of university level and control group.

**Table 2.** The ANOVA measures for student perceptions

| | | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|---|
| CEGS_via_School | Between Groups | (Combined) | 419.048 | 3 | 139.683 | 3.592 | .161 |
| | Linear Term | Unweighted | 378.947 | 1 | 378.947 | 9.744 | .052 |
| | | Weighted | 345.714 | 1 | 345.714 | 8.890 | .059 |
| | | Deviation | 73.333 | 2 | 36.667 | .943 | .481 |
| | Quadratic Term | Unweighted | 62.745 | 1 | 62.745 | 1.613 | .294 |
| | | Weighted | 63.894 | 1 | 63.894 | 1.643 | .290 |
| | | Deviation | 9.440 | 1 | 9.440 | .243 | .656 |
| | Cubic Term | Unweighted | 9.440 | 1 | 9.440 | .243 | .656 |
| | | Weighted | 9.440 | 1 | 9.440 | .243 | .656 |
| | Within Groups | | 116.667 | 3 | 38.889 | | |
| | Total | | 535.714 | 6 | | | |
| CEGS_via_University | Between Groups | (Combined) | 119.048 | 3 | 39.683 | .714 | .606 |
| | Linear Term | Unweighted | 10.526 | 1 | 10.526 | .189 | .693 |
| | | Weighted | .402 | 1 | .402 | .007 | .938 |
| | | Deviation | 118.646 | 2 | 59.323 | 1.068 | .446 |
| | Quadratic Term | Unweighted | 3.922 | 1 | 3.922 | .071 | .808 |
| | | Weighted | 3.012 | 1 | 3.012 | .054 | .831 |
| | | Deviation | 115.634 | 1 | 115.634 | 2.081 | .245 |
| | Cubic Term | Unweighted | 115.634 | 1 | 115.634 | 2.081 | .245 |
| | | Weighted | 115.634 | 1 | 115.634 | 2.081 | .245 |
| | Within Groups | | 166.667 | 3 | 55.556 | | |
| | Total | | 285.714 | 6 | | | |
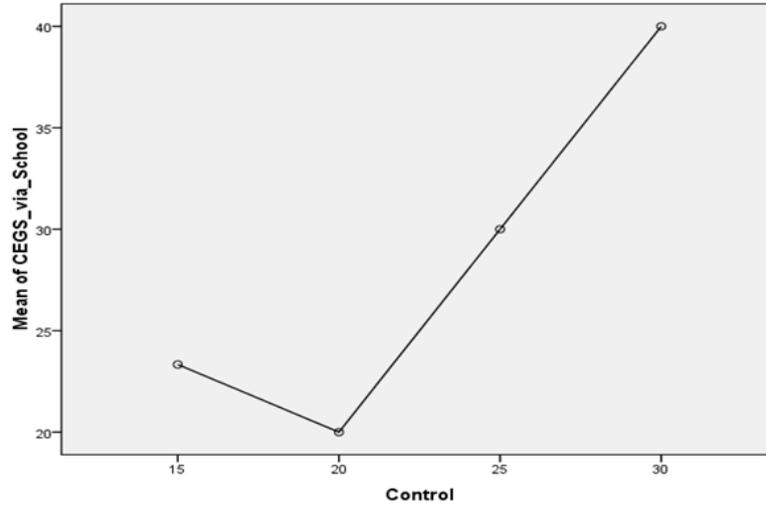
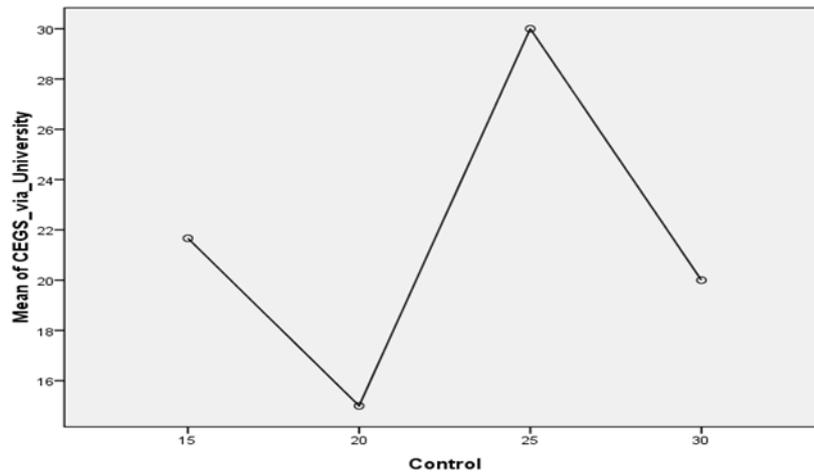**Fig. 8.** ANOVA measure between the school-level and control groups



**Fig. 9.** ANOVA measure between the university-level and control groups

The researchers use a mixed-methods approach and emphasized qualitative data collection in this study. The research data were collected from different resources include:

- Initial data were collected from the prototype of the CEGS, presented in the ICSIE 2019 conference [21].
- Qualitative data were collected from the implementation of the proposed system on some school sites and through scheduled interviews with the current system users, and the analysis of the open questions of the conducted questionnaires.

- The secondary data were gathered from the "E-career guidance system" literature. A lot of research literature on career and educational guidance in conjunction with traditional career guidance is available. The authors also used international libraries such as ISI Web of Science, ACM Digital Library, CiteSeerX, IEEE Xplore, and Google Scholar.
- The supplementary data were taken from the BUE, as a cooperative university in this research study.

## 8    Conclusion

In this paper, the authors introduce the benefits of using career and educational guidance apps and present the implementation of career and educational guidance system (CEGS) in Higher Education. The system is designed specifically for school-level students, university-level students, and graduates. This study used Fuzzy logic operations to represent the system inputs, outputs, and rules. The paper aims to present a CEGS as a digital transformation application in the area of career counseling. The proposed system provides a student with interactive tools to select suitable colleges that matching to their educational skills and helps graduates to select suitable careers for their practical experiences as well as provide them with the essential training courses that needed for particular career paths. The authors used the 2*3 factorial design method for the initial evaluation of the proposed system and to evaluate both students' and graduates' feedbacks. The researcher also uses the one-way ANOVA to identify the significant and obvious differences between the perceptions scores of the users.

## 9    Acknowledgment

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