MyMajor: assisting IT students with major selection

Mohammad A. Kuhail, Haseena Al Katheeri & Joao Negreiros

Zayed University
Abu Dhabi, United Arab Emirates

ABSTRACT: Information technology (IT) in university education plays a crucial role in preparing students for future technological jobs. University students desiring to select an IT major can access a plethora of on-line information about the majors in the form of university brochures, videos, articles, job prospects, and more. Nevertheless, such information is scattered, not interactive, and often presented without usability in mind, hence students have to spend considerable time and effort to obtain an overview of a desired major. In response, the authors present, MyMajor, a tool that helps IT students to select a major by providing all relevant information in one space: relevant job demand, job salary distribution, overview of vacancies, notable employers and expert interviews. The tool was designed to pack much information using user-centric visualisations, as well as insights. Preliminarily evaluation of MyMajor shows that students find the tool useful, easy to navigate and understandable.

Keywords: Major selection, career choices, university education, usability

INTRODUCTION

Universities offering information technology (IT) degrees are currently experiencing a surge in undergraduate enrolments. This is potentially driven by the demand for IT workforce and the steady rise of wages of IT-related careers [1]. Following this global trend, IT education has been prioritised in the UAE as it prepares the young population for future technological jobs [2][3].

Despite the global growth of university education enrolments, many students still base the crucial decision of major choice on assumptions rather than facts and understanding their career goals and interests [4][5]. As such, it is crucial to provide a mechanism to support how students choose their prospective IT majors as their choices about what and where to study may have long-term personal and societal effects.

Existing studies indicate that there are several factors that influence students' choice of major, including expected earnings [6], social factors [7], skills, interests [8] and enrolment criteria [9]. To help students choose an IT major that matches their needs, universities provide brochures, Web-based informative guides and video-based promotions. Nevertheless, such efforts, while useful, often have two major shortcomings: 1) the information presented is not interactive, and thus may not allow students to efficiently find interesting information; and 2) the presented information is spread across multiple disintegrated resources, and as such, students may need to spend considerable time and effort to obtain an overview of a desired major.

In this article, the authors present MyMajor, a tool aimed at freshman students desiring to choose an IT-related major. The tool presents several pieces of relevant information in one space including job demand, salary distribution, related skills, notable employers and interviews with experts. The tool was designed to convey much information using user-centric interactive visualisations, as well as insights related to the major of interest. The preliminary evaluation shows that students find the tool easy to understand, and largely agree that the elements presented in the tool are helpful in the process of deciding on a major.

METHEDOLOGY

Using a questionnaire, the authors asked first-year students to rate the usefulness of information related to major choice on a scale from 1 to 5, where 1 means not useful and 5 means very useful. Figure 1 shows the results of the questionnaire

collected from 19 students. Most students (16 out of 19) thought that job demand for the prospective major is very or moderately useful, while 15 students thought related skills and job responsibilities are very or moderately useful information for the decision of major choice. Fewer numbers were observed in support of other information, such as: nature of job (14), expert interviews (14) and research (11).
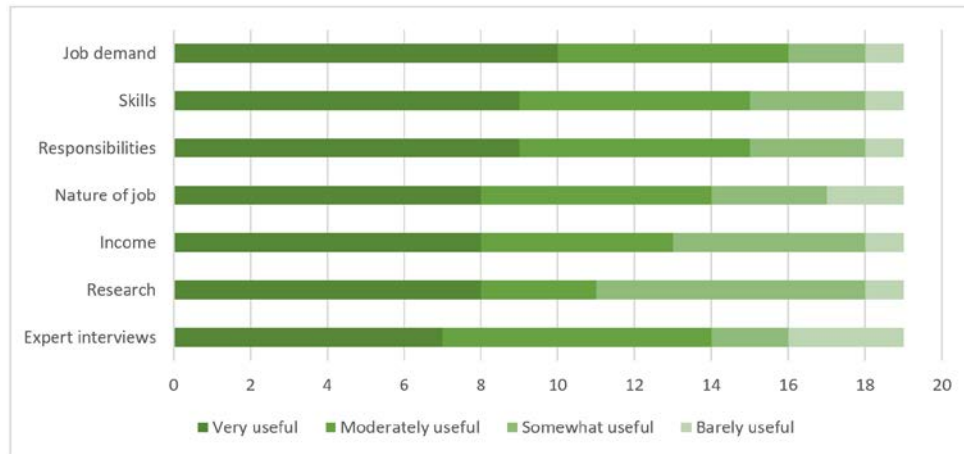

Figure 1: Results of the questionnaire asking students about useful information for major choice.

Based on the literature and the results of the questionnaire, the authors designed MyMajor to combine several pieces of information that could potentially help students in choosing an IT major. Currently, MyMajor is a prototype, and thus, the information presented is simulated, and not based on real data. Despite covering much information, the authors aimed at developing a user-friendly tool to increase adoption and interest. As such, MyMajor was designed with ease of learning and task efficiency in mind.

In short, MyMajor was created to fulfil the following requirements, and it shall:

1. provide students with guidance on factors to consider when choosing a major (e.g. passion, job demand, future trends, etc);
2. present information about existing jobs, skills, employers, salaries, and industry expert interviews using insights and user-friendly visualisations;
3. be easy to learn;
4. be efficient to use.

Homepage

MyMajor homepage uses tabs to organise the content, a technique that is proven to be effective in making content easy to navigate and well organised [10].

Figure 2 shows the homepage of MyMajor that students first see upon accessing the tool. The page directs the student to consider factors crucial to major selection, such as: passion, demand, trends, income and abilities. The student can click on each of the factors in the Ven diagram to read more information about the corresponding factor. The tool shows the available IT concentrations (sub-majors) that show up when the student clicks the *Offered concentrations*.
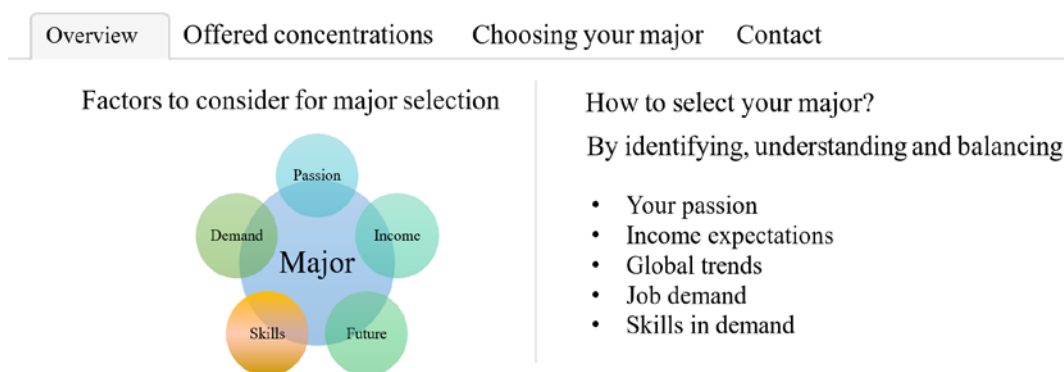

Figure 2: Homepage of MyMajor.

Overview Page

In designing the overview page, the authors followed the overview-first-details-on-demand approach [11]. Upon clicking on a certain concentration, such as *Web and mobile development*, students can first see an overview of the concentration.

The overview includes a brief description, a bar chart showing demand of recent relevant jobs, the salary distribution of all the combined relevant jobs and an overview of the relevant skills in demand (Figure 3).

Relevant jobs in demand
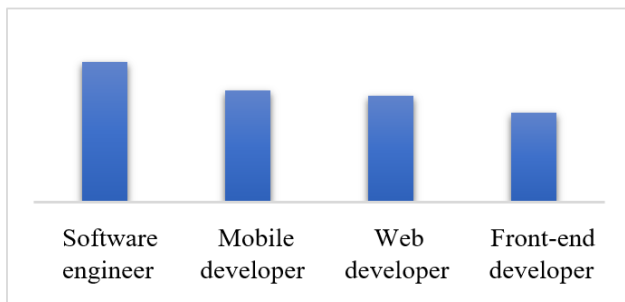
The data was collected from indeed.ae in February 2021

Salary

25,000 AED per month

Most reported

15,000 AED   45,000 AED

Salary distribution
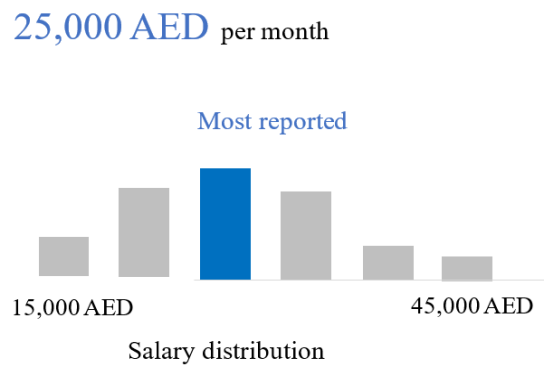
Skills in demand

Python is on top of the list by appearing more than 34,426 times in search results, followed by JavaScript (33,619) and Oracle (24,218).
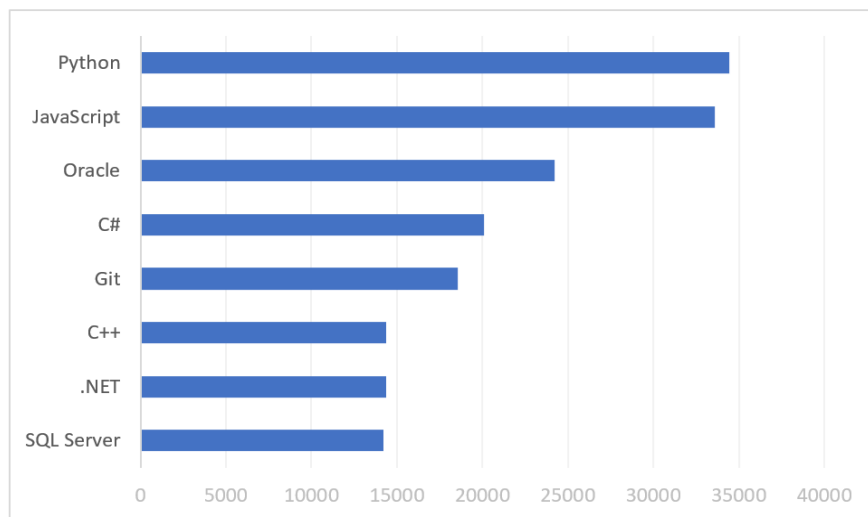

Figure 3: Overview page of a specific major (Web and mobile development).

To obtain details on demand, all the charts are designed to be interactive. For example, if a student clicks on a bar showing the demand of a certain job, the number of job vacancies will appear. Further, the authors included an insightful statement on top of some charts to help students read the charts efficiently.
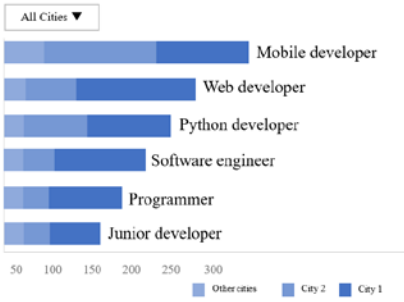
Job Information

The job information page shows the demand for jobs related to the concentration (Figure 4). The demand is broken down per city, and students can filter the information based on the city of their interest. Further, students can hover over a certain job to obtain the number of vacancies for that job, as well as examples of vacancies. The chart includes directions in a grey colour underneath it to guide students on usage. The page also shows a distribution of salaries for several related jobs, which gives students an idea about the range of salaries available for such a job. Further, students can see an overview of notable employers in different cities plotted against job titles. This visualisation is a variation of heat maps [12]. The elements use colour shades to represent the number of jobs. A legend was shown to help students accurately interpret the chart. Students can hover over an element to get details on the number of jobs.

Skills

The skills page shows the skills in demand that are related to the concentration (Figure 5). An overview of the skills is shown using a tree map [13]. The tree map was chosen as it allows for visualising hierarchical and quantitative information. Skills are hierarchical information. For instance, back-end programming is considered a subcategory of programming, and Python is a skill categorised as part of back-end programming. Students can explore the tree map by clicking on a box representing a skill category. As a result, the box will be expanded, and the student will be able to view the details of that category.

Job demand for Web and mobile development

Currently the demand for Web and mobile development jobs is high, with mobile developer being the highest on the market particularly in the emirates of City 1 and City 2.

Example vacancies for Web and mobile development

Major	Skills	Salary	Level	Emirate
Mobile developer	Java, Objective c	● 25,000 AED	Senior	Abu Dhabi
Web developer	PHP, NodeJS	● 23,000 AED	Senior	Dubai
Mobile developer	Flutter	● 21,000 AED	Junior	Dubai

Notable employers

Employers in City 1 such as companies 3 and 4 are looking for IT analysts and Web developers.

Distribution of salaries

Hover over the bars to precisely know the number of job positions distributed over the salaries.
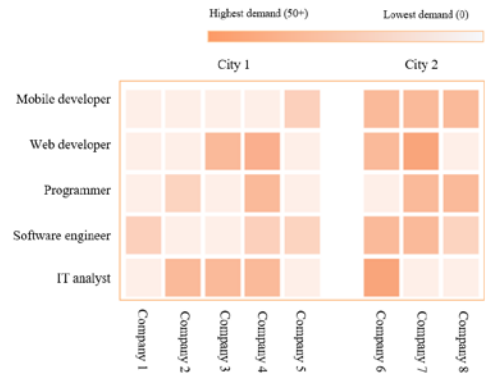
Hover over the squares to know the demand of a job by a certain company.

Figure 4: Job information charts.

The colour of each skill represents the level of demand for that skill based on the vacancies. Further, students can see an overview of skills plotted against job titles. The elements use colour shades to represent the demand of the skill (the number of times it was mentioned in relation to that job). Students can hover over an element to get details on the skill demand. As with previous visualisations, minimalistic instructions on how to interact with the visualisations is shown in grey colour, in addition to insightful statements included as additional information.
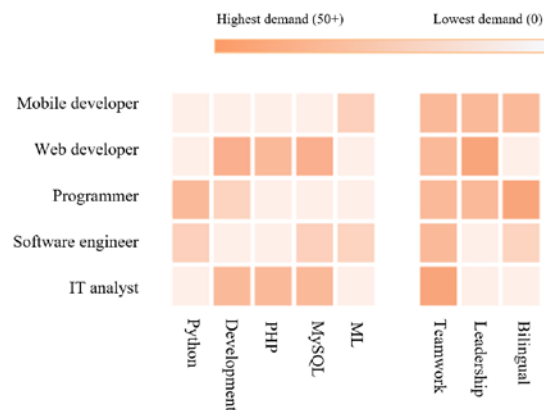

Skills in demand

Various skills are needed for the IT market. The four main categories are: development, data science, Internet of Things and user experience.
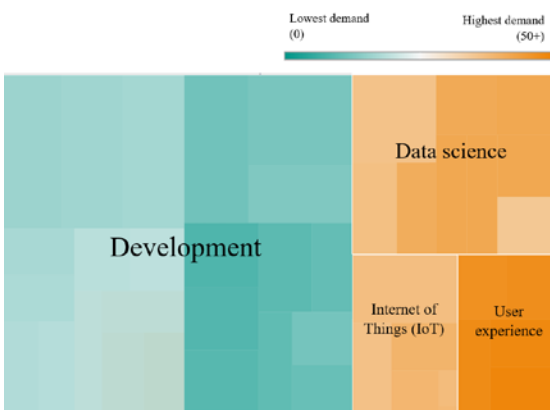
Click on the main categories of skills (programming, database, analytics) to view the subcategories of the skills. Colour intensity represents demand for skills as per job advertisements.

Skills vs positions

Several hard skills are needed in the IT job market. Most notably MySQL, PHP, and development (50+ mentions) for Web development and IT analyst jobs. Soft skills, such as teamwork skills are also highly needed for all IT jobs.

Hover over the squares to precisely know the demand for certain skills for certain positions.

Figure 5: Skills information charts.

Expert Interviews

Figure 6 shows a part of an expert interview. Students can play an audio clip of the interview or read through a summarised version of the interview with highlights on the left side. The selected experts have significant experience in the industry in fields related to the IT concentration of interest.

Ms Ann Smith
Software architect (11 years of experience)

▶ Play the audio of the interview here

There are always new problems to solve in this domain

As a senior architect, Ms Ann Smith finds her job to be very rewarding as there are always new challenges and innovative ways to address them.

Ms Ann Smith regularly meets with clients, discusses the requirements with them and identifies possibilities for achieving them within the needed deadline.

…

Figure 6: Part of an expert interview.

EVALUATION

To evaluate MyMajor, a survey with 15 students was conducted in which the authors showed them the prototype, checked their understanding of the charts and asked their opinions of several characteristics of the tool. The students filled a questionnaire with seven questions that had to be answered on a scale from 1 to 5, where 1 means strongly disagree and 5 means strongly agree. In general, the results of the survey were encouraging (Figure 7).
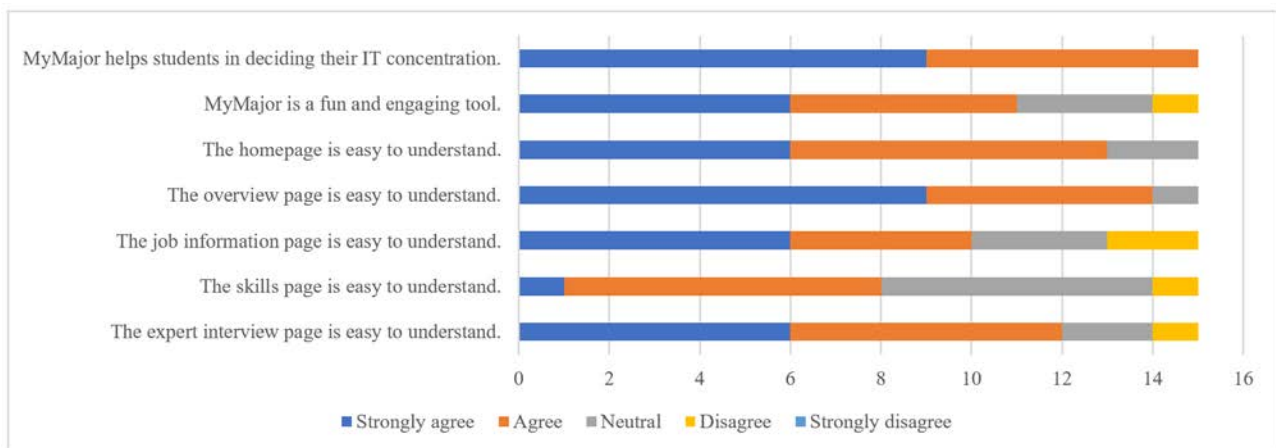

Figure 7: Results of the MyMajor questionnaire.

Nine out of 15 (60%) of the students strongly agree that MyMajor helps them in deciding their IT concentration. Eleven (73%) students agreed, including six who strongly agreed, that MyMajor is a fun and engaging tool. When it comes to understandability, there is an agreement that the homepage is easy to understand (six strongly agreed and five agreed). Similar opinions can be observed about the overview page (nine strongly agreed and five agreed), the job information (six strongly agreed and four agreed), and the expert interview page (six strongly agreed and six agreed). The only page that a good number of students struggled with was the skills page (six neutral and one disagree).

To collect some qualitative data, the authors asked the students what they liked about the tool. The students' replies were overwhelmingly positive. One student cited, *simplicity and significance*. Another student mentioned *...I like the fact the tool shows details that [have] been researched and there is some effort [behind] it*. That student thinks it will simplify things for those who are interested in IT. Moreover, a student mentioned that they liked how much information the tool gave them about the major and the specific concentrations with so many different details and examples relevant to a UAE student. Further, a student commented on the user interface by saying *...it is clean and clear with lots of interactable parts that should give the students the essential information they would need to help make their decisions*. Interestingly, another student commented on the data *...I like the fact that it is clear and based on the actual data. Students do not have to obtain opinionated information related to a major to choose, which is a waste of time and leaving the student to not being able to decide or regret their decision later*.

When the students were asked what they disliked about the tool, a common theme emerged. Four students thought the skills page was confusing or complicated. This could be attributed to the fact that the students had not interacted with a tree map visualisation before. In terms of the visual presentation, a student mentioned *...I would have liked to see other forms of visuals or videos to present the information better*. In the next version of MyMajor, the authors believe it is worthwhile to explore other visualisations and possibly videos to present the information.

When asked about ideas to improve MyMajor, a student suggested an on-line chatting tool with an advisor for each major. This idea is valuable, but costly. An alternative could be building a chatbot to help students with answering questions about several IT-related majors. Another student suggested an assessment tool to evaluate students' preferences and tendencies towards a certain concentration. Finally, a student mentioned that it would be beneficial to list advantages and disadvantages of each concentration. The authors understand the student's view, but such information would be too subjective, and thus potentially misleading.

CONCLUSIONS

In this article, the authors discuss MyMajor, a tool that helps IT students decide a major by showing relevant insightful information in one place: job demand, salary distribution, overview of vacancies, notable employers and expert interviews. The tool shows comprehensive information using user-centric visualisations and insights. Preliminarily evaluation of MyMajor shows that students largely understand the visualisations and find the tool useful for prospective students. Nevertheless, some students experienced difficulties with unfamiliar visualisations, such as tree maps. For future work, the authors plan the following:

1. Implement and deploy the tool with realistic data from job sites in the UAE.
2. Conduct usability tests, and check the students' understandability of the visualisations by asking them to read the charts.
3. Experiment with another set of visualisations.
4. Implement a chatbot to help students ask specific questions about the IT concentration of their choice.

ACKNOWLEDGEMENTS

REFERENCES

1. *National Academies of Sciences, Engineering, and Medicine. Assessing and Responding to the Growth of Computer Science Undergraduate Enrolments*. Washington, DC: The National Academies Press (2018)
2. Al Murshidi, G., STEM education in the United Arab Emirates: challenges and possibilities. *Inter. J. of Learning, Teaching and Educational Research*, 18, **12**, 316-332 (2019).
3. Parthenon, Higher education in UAE key trends and opportunities. *IHC's Education Summit*, Dubai (2015).
4. Freeman, L., The developmental disconnect in choosing a major: why institutions should prohibit choice until second year. *The Mentor: An Academic Advising J.*, 15 (2013).
5. Hastings, J.S., Neilson, C.A., Ramirez, A. and Zimmerman, S.D., (Un)informed college and major choice: evidence from linked survey and administrative data. *Economics of Educ. Review*, 51, 136-151 (2016).
6. Boudarbat, B. and Montmarquette, C., Choice of fields of study of university Canadian graduates: the role of gender and their parents' education. *Educ. Economics*, 17, **2**, 185-213 (2009).
7. Sojkin, B., Bartkowiak, P. and Skuza, A., Determinants of higher education choices and student satisfaction: the case of Poland. *High Educ*, 63, 565-581 (2012).
8. Mahani, S. and Molki, A., Factors influencing female Emirati students' decision to study engineering. *Global J. of Engng. Educ.,* 13, **1**, 26-31 (2011).
9. Šorgo, A. and Virtič, M.P., Engineers do not grow on trees. *Global J. of Engng. Educ.,* 22, **3**, 168-173 (2020).
10. Krug, S., *Don't Make Me Think, Revisited: a Common Sense Approach to Web Usability*. (3rd Edn), New Riders Publishing (2013).
11. Shneiderman, B., The eyes have it: a task by data type taxonomy for information visualizations. *Proc. 1996 IEEE Symp. on Visual Languages*, 336-343 (1996).
12. Wilkinson, L. and Friendly, M., The history of the cluster heat map. *The American Statistician*, 63, **2**, 179-184 (2008).
13. Bederson, B.B., Shneiderman, B. and Wattenberg, M., Ordered and quantum treemaps: making effective use of 2D space to display hierarchies. *ACM Trans. on Graphics*, 21, **4**, 833 (2002).

BIOGRAPHIES

Mohammad Amin Kuhail received his MSc degree in software engineering from the University of York, UK, and a PhD degree in computer science from the IT University of Copenhagen, Denmark. He has served as an Assistant Teaching Professor at the University of Missouri-Kansas City, USA, for six years. He is a computer scientist and a software engineer with a diverse skill set that spans Web development, object-oriented programming, algorithms, usability and data science. He also serves as an Assistant Professor with Zayed University. His research interests include end-user development, usability analysis and computer science education.

Haseena Al Katheeri is a DBA candidate at the College of Business in Abu Dhabi University, in the United Arab Emirates. She holds a Master's degree in information technology from Zayed University. She also has a diploma in IT education from Emirates College of Advanced Education (UAE). Her research interests are in the areas of information technology, management and education. She has a long, almost 18 years' experience in the educational field. She is currently serving as an Associate Director of the Student Success Centre.

Joao Negreiros is an Associate Professor at Zayed University. He has published numerous books and articles in English and Portuguese, spanning multiple disciplines - business, technology, education and geographic information systems.