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E-Portfolio Effectiveness in Seeking IT Jobs

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Abstract: The fact that graduate students usually have no experience and similar backgrounds might cause job vacancy placement and applicant evaluation to be complicated and stressful tasks for employers. This research project focuses on the role of e-portfolios in facilitating the hiring process and assisting job seekers in finding IT jobs. By using e-portfolios, employers would be able to assess IT applicants during the evaluation process more efficiently than using conventional CVs. A hybrid method was used to assess the e-portfolio effectiveness involving HR/IT interviewees after the experimentation of using simulated e-portfolios. Accordingly, Interviewees previewed the results of compression between a CV and an e-portfolio conducted in a focus group experimentation to get their feedback. The findings of this research indicate a high probability of acceptance to use the e-portfolio for seeking jobs and evaluation purposes by both employers and job seekers.

Keywords: Applicant evaluation, e-portfolio, fresh IT graduates, IT job application, IT job seekers.

1 Introduction

The current automation in all areas necessitates a high demand for hiring IT specialists. The estimated increase in their employment in the next 15-20 years would be about 25% and might rise even more. Recruiters often take a long time to find a suitable candidate. These candidates are usually subject to further training to gain the role's skills [1].

An e-portfolio is used as an archive for managing lifelong education and skills artifacts. It can be published, accessed, and edited by the owner or the organization. Previously, an e-portfolio was shared with limited parties, such as teachers, managers, colleagues, et cetera. Nowadays, e-portfolios represent a wider digital identity concept used within social networks, job platforms, artwork, and more [2]. An e-portfolio is not a CV, blog, or social media profile. It is more informative and authentic than a CV, more accountable than a blog, and more professional than a social media profile. An e-portfolio is an electronic medium that includes information, evidence, reflection, and accessibility [3].

There are three main issues facing HR while evaluating IT job candidates. The first issue is that many job seekers lack essential knowledge and skills [4]. The second issue is observed based on the first issue. Many job seekers apply for limited job opportunities. Most of the applicants are fresh graduates who lack significant experience within the IT sector. All background details in their CVs are very similar. This makes it difficult for employers to classify CVs and carry out a successful selection process. The third issue is related to the CV itself as it reveals little information about the candidate. A CV is usually composed of a single page that includes a very brief overview describing a candidate's knowledge and skills. This might drop out some essential IT skills and other important information. In the IT jobs market, employers need to have a comprehensive view of the candidate's skills based on their IT courses, projects, professional certificates, training, et cetera, supported by various documents. Most of these applicants do not match the jobs' requirements due to the limited number of skills presented on their CVs or due to the poor CV design. Typically, employers would target candidates with excellently presented work experience laid out in well-written CVs, which is not the case for most fresh graduates. Eventually, the failure of employers to evaluate the candidates' skills leads to an increase in unemployment and lower job satisfaction rates [4].

An e-portfolio would enhance the evaluation process of selecting the best candidates. Accordingly, the research null hypothesis (H0) assumes that using an e-portfolio as a facilitation medium within the employment process in the IT job sectors will add no value to enhancing job placement and employee selection. On the other hand, the alternative hypothesis (H1) assumes that using an e-portfolio as a facilitation medium within the employment process in the IT job sectors will enhance job placement and employee selection.

Most researchers, such as [5], [6], [7] and [8], have evaluated e-portfolios from both higher education and students' perspectives. They investigated the importance of e-portfolios in enhancing student learning outcomes [8]. However,

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very few studies were found to have discussed the effectiveness of e-portfolios from an employment perspective [9], [10], [11].

It is worth mentioning that many recent studies discussed the role of social media in the employment process, especially Twitter, Facebook, and LinkedIn [12] and [13]. In spite of LinkedIn being considered the most professional platform, the researchers in [14] argue the ambiguity and validity of evidence included in LinkedIn profiles might not meet the specified criteria written in the organization's job posts. The candidates' evaluation mechanism should be re-assessed to ensure fairness and accuracy of selection. Nevertheless, most of these studies raised several issues in the recruitment process, such as insecurity, low accuracy, and the legal implications of using profile data. On the other hand, some technical studies focused on career recommendation algorithms based on extracting data from CVs, curriculum courses, personal preferences, and so on [15] and [16].

This research proposed a new e-portfolio model that would facilitate successful employee job matching. It identifies the key components and structure needed within the e-portfolio according to the employers' preferences, and at the same time, it examines the effectiveness of the e-portfolio on the job market.

2 Methodologies

2.1 Research Design and Structure

The e-portfolio concept, especially in seeking jobs, is still new and needs a lot of work to gain publicity and awareness among societies. This research faced some obstacles in conducting data collection. Many graduates still consider their CV information sensitive data and should not be shared. Another obstacle was finding volunteers due to the long time needed to conduct assessment sessions which include prior training sessions, e-portfolio development, and filling out lengthy surveys and questionnaires.

To measure the effectiveness of the e-portfolio model usage, the research was conducted through four different stages which began with identifying CV limitations and shortages. The next stage was developing and constructing an e-portfolio model. The following stage was testing using the e-portfolio model with IT job seekers. Finally, the last stage was conducting HR/IT interviews to validate the research findings.

2.2 Methods

This research initially started by identifying the required soft and hard skills needed for, for instance, a web developer job. Using Tableau, a large group of job advertisements related to web development was collected. These ads were manually analyzed, and the required skill set was successfully extracted. Then, over fifty IT graduate CVs were also analyzed to validate their shortages and limitations. To accomplish this, Exploratory Data Analysis (EDA) was applied to these CVs using Python in order to analyze and visualize data. Based on the identified skill set, an e-portfolio model was proposed. This model was initially assessed by a focus group of IT job seekers. The focus group outcomes were analyzed and visualized using the same EDA tool to compare the CVs and e-portfolio results and to measure which is more effective. In addition, interviews were also conducted with IT/HR managers to further verify these outcomes.

2.3 Stage 1: Problem Declaration

The first stage mainly focused on the identification of the hard/soft skills required for a standard web developer job description. The initial step was collecting IT-related CVs via social media after posting a participation request. To minimize the scope, the study was limited to the Saudi IT field. Fifty CVs were collected and analyzed. At the same time, eleven web developer job descriptions were collected from LinkedIn and other sources and were analyzed as well. To further limit the research scope, the collected CVs and job descriptions were mainly related to web development, such as front-end, back-end, and full-stack developers. A list of skills was extracted manually from these job descriptions and then used within the Application Tracking System (ATS) for CV skills extractions based on candidates' information, such as courses, projects, training, certificates, years of experience, and so forth. In this research, an ATS code was developed using Python to facilitate the search process of candidates. It was used to extract skills from the targeted job description and match them with skills extracted from the candidates' CVs. Since CVs were usually formatted in Word and PDF, Python was selected due to its various libraries that support reading and analyzing texts, such as docx2txt and PyPDF2.

At the beginning of examining the CVs, most of the hard skills were formatted in non-standard multi-keywords. In addition, the soft skills were also formatted in a non-standard way. This obstacle of poor formatting was due to the candidates' ways of inception when describing their skills which made it challenging for ATS to find and extract.

2.4 Stage 2: Developing and Designing an E-portfolio Model

To overcome the above problem, an e-portfolio model was designed with a specific structure and components using MS

Word. This platform was selected due to its easiness and popularity. It facilitates maximum delivery to all participants. Using the MS Word platform relieves participants from downloading specialized software or registering at a web application.

The e-portfolio model development process is presented in Figure 1. A minimum viable product (MVP) was first developed and experimented with by the focus group for evaluation. Furthermore, the focus group's suggestions were applied to the next version of the e-portfolio model. Finally, MVP2 was presented to the interviewees to be further evaluated. The final e-portfolio model was proposed based on the interviewees' recommendations and expectations.
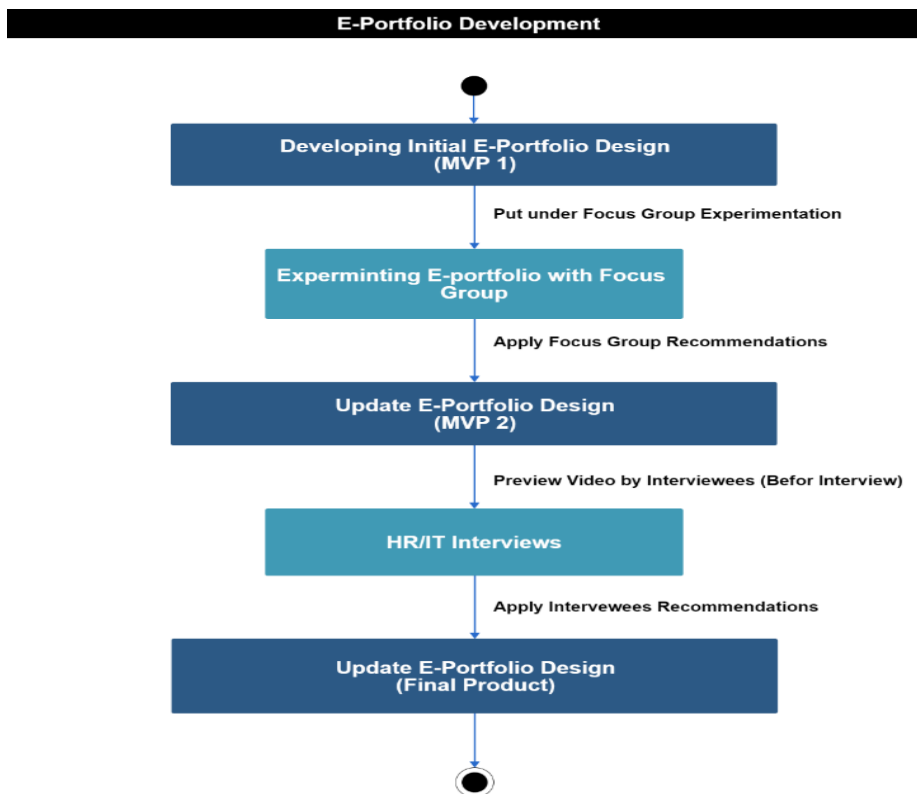

Fig. 1: E-portfolio Model Development Process

2.4.1 E-portfolio Components

The proposed e-portfolio model consists of components, guidelines, and structure. The definition of the components was based on IT experts' recommendations regarding the elements that applicants need to include in their CVs. However, the final e-portfolio components were adjusted and confirmed after the experimentation and the interviewing stage. It is worth mentioning that the e-portfolio components are not limited to those identified since users can design and add new components as needed. The recommended e-portfolio components are listed as follows:

A. The Contact Information Component.

B. The Background Component: summary, education, work experience, courses, projects, and quantifiable achievements.

C. The Activities Component: memberships, conferences, publications, boot camps, competitions, volunteering activities, languages, hobbies and interests, ambitions, and future goals.

D. The Skills Component (one of the most important components): hard skills, soft skills, and certificates.

E. The Attachments Component (one of the most important components): the evidence of the other components of the e-portfolio to be attached using this feature.

The two main components that have been highlighted in this paper are the Skills and Attachments components. As presented in Figure 2, an e-portfolio is designed to enable job seekers to organize their qualifications in alignment with the employer's posted requirements. After attaching all files and filling in the e-portfolio sections, the candidate can simply zip the file to share it with potential employers.
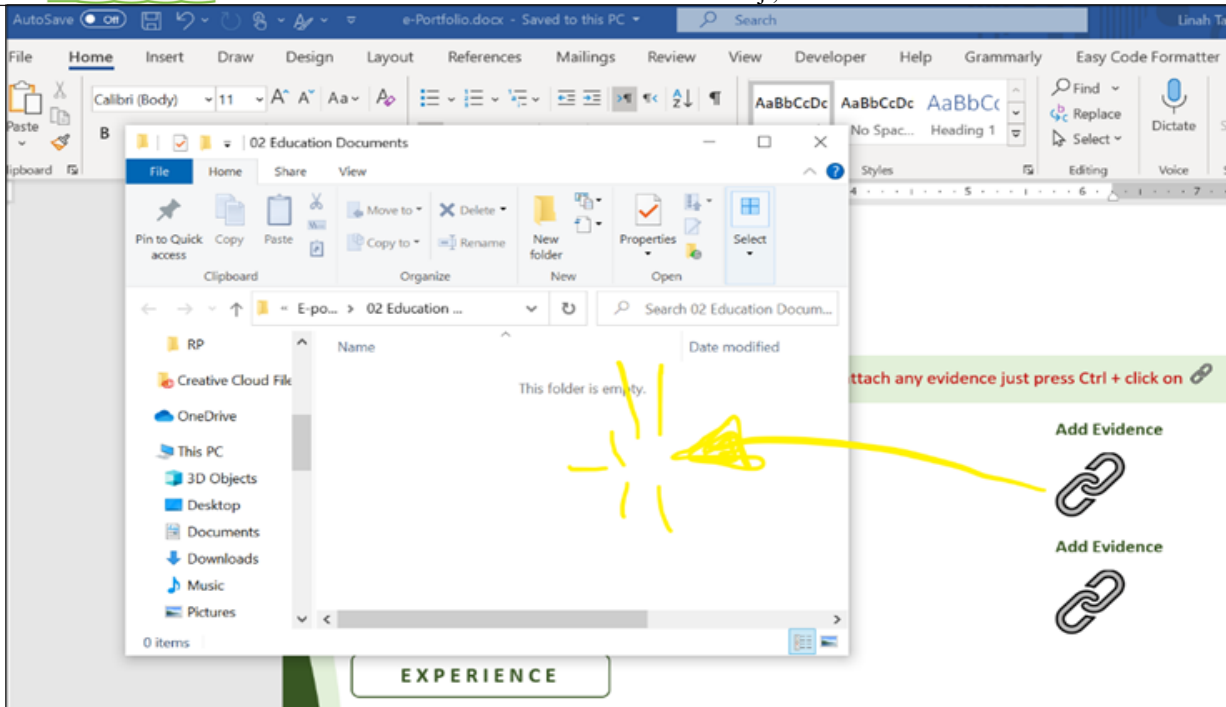
Fig. 2: E-portfolio Attachment Feature

The skills component was designed to facilitate the presentation of applicant skills in a standard and efficient way. At the same time, skills could be extracted easily via ATS along with their proficiency levels. Applicants can easily add their skills by simply selecting a skill from a predefined list of skills or by inserting a new skill manually (see Figure 3).
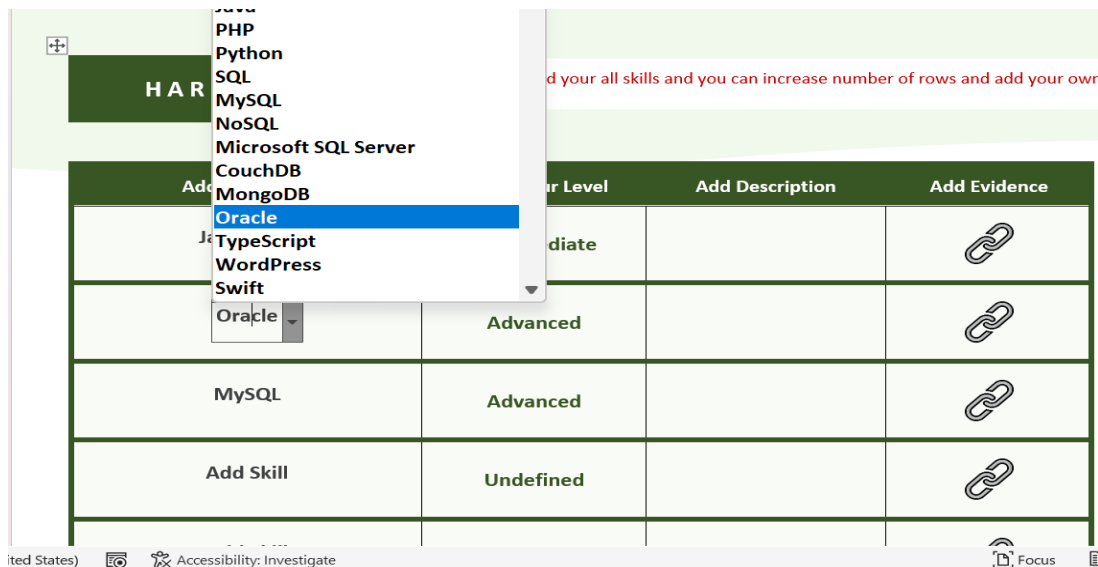
Fig. 3: E-portfolio Skills Section

2.5 Stage 3: Assessing E-portfolio in Relation to Job Seekers

After creating the first version of the e-portfolio model (MVP1), a focus group was used for assessment. The focus group contained ten members who were seeking web development jobs. All the participants were Saudi nationals: eight females and two males. Some of them were graduates with some IT job experience, others were fresh graduates with IT specializations, and the rest were searching for IT jobs while perusing their postgraduate degrees.

In this stage, two non-probability sampling techniques were mixed to sample the group's results faster. The first technique was used with the voluntary response sampling approach. This technique intends to reach a larger number of participants by sharing a survey to be filled out by self-motivated volunteers [17]. Consequently, the researchers used a

second technique, which is the snowball sampling approach as a supportive method. It was mainly intended to request assistance from those who participated in the study by asking their friends to join the experimentation. A focus group was formed for experimentation, observation, and getting reviews. The expected time to finish all these activities was determined to be a minimum of two days and a maximum of one week. Each participant had the chance to participate in a training session that explains the e-portfolio usage and its process. All inquiries and questions were answered and pinned for others who had related questions. In the end, everyone was asked to fill in a survey including general information and e-portfolio (MVP1) usage acceptance along with their feedback on whether to integrate the e-portfolio within the employment process or not.

2.6 Stage 4: HR/IT Managers' Interviews

Interviews were conducted at the last stage to investigate HR/IT managers' perceptions of e-portfolio usage. This stage was important to validate the effectiveness of the e-portfolio since this research studied both sides' perceptions: employers and job seekers. A pre-recorded video introducing the (MVP2) model was sent to all interviewees before the meeting. In addition, during the meeting, the problems related to the current job-seeking process were reviewed to ensure that the e-portfolio importance was realized. At the end of the meeting, the interviewees were given space to elaborate more on the e-portfolio usage and its design.

3 Results and Discussion

3.1 Results

3.1.1 Skills Identification

Several job post descriptions were collected and analyzed to define a list of the necessary skills needed by a web development applicant. The skills list included the three job categories: front-end, back-end, and full-stack development. Based on this list, the e-portfolio skills component was designed and formulated.

3.1.2 The Analysis of CVs: Results of the Initial Dataset

After conducting the skills definition phase, an automated analysis, using ATS on the collected CVs, was performed to extract the applicants' skills along with their proficiency levels. Then, a ranking process was carried out to rank the collected CVs according to the job skills requirements. Weighting skills were also formulated according to the posted job skill category: required, essential, and preferable skills. In general, these results showed that most of the CVs indicated limited applicants' skills or uncaught skills by ATS due to spelling mistakes or poor formatting.

Figure 4 shows the results of matching CVs with jobs. According to the results, most CVs presented a low percentage of matching required skills with the job descriptions since the highest match reached 50%.

ID	JD01	JD02	JD03	JD04	JD05	JD06	JD07	JD08	JD09	JD10	JD11
ID001	8.33%	7.69%	12.50%	7.14%	6.25%	0.00%	5.26%	5.26%	10.00%	10.00%	4.00%
ID005	8.33%	0.00%	6.25%	14.29%	9.38%	25.00%	15.79%	21.05%	10.00%	20.00%	8.00%
ID006	8.33%	15.38%	6.25%	10.71%	6.25%	18.75%	0.00%	15.79%	5.00%	5.00%	16.00%
ID020	25.00%	0.00%	43.75%	35.71%	15.63%	37.50%	21.05%	21.05%	30.00%	25.00%	24.00%
ID024	33.33%	23.08%	37.50%	42.86%	28.13%	37.50%	26.32%	47.37%	50.00%	35.00%	36.00%
ID026	33.33%	0.00%	25.00%	25.00%	18.75%	37.50%	21.05%	31.58%	15.00%	25.00%	24.00%
ID029	16.67%	15.38%	31.25%	21.43%	21.88%	18.75%	10.53%	15.79%	15.00%	30.00%	16.00%
ID033	25.00%	23.08%	25.00%	35.71%	46.88%	43.75%	36.84%	36.84%	45.00%	40.00%	32.00%
ID043	41.67%	7.69%	37.50%	28.57%	18.75%	37.50%	31.58%	42.11%	25.00%	30.00%	28.00%
ID047	33.33%	7.69%	31.25%	25.00%	18.75%	31.25%	21.05%	31.58%	25.00%	40.00%	16.00%

Fig. 4: Initial Job Matching Results

The light-shaded blue color presents a low percentage of matching CVs with job requirements. On the other hand, the dark-shaded blue cells present a high percentage of job matches. These results verified the problems associated with CV usage in job applications.

3.1.3 Focus Group: Experimentation Results

A focus group was used to compare the ATS job matching results when using a CV against the e-portfolio model. Each

participant within the focus group was asked to attach his latest CV used in his job search. Figure 5 represents similar job-matching results with the explored dataset in Figure 4. The highest percentage score was 43.75%, which is also a low score.

ID	JD01	JD02	JD03	JD04	JD05	JD06	JD07	JD08	JD09	JD10	JD11
					Focus Group CVs Job Match						
ID001	25.00%	0.00%	18.75%	14.29%	9.38%	25.00%	15.79%	26.32%	10.00%	20.00%	20.00%
ID002	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ID003	8.33%	7.69%	12.50%	14.29%	6.25%	18.75%	15.79%	21.05%	10.00%	5.00%	12.00%
ID004	16.67%	7.69%	25.00%	28.57%	21.88%	43.75%	15.79%	21.05%	25.00%	40.00%	8.00%
ID005	16.67%	7.69%	31.25%	28.57%	15.63%	37.50%	15.79%	15.79%	25.00%	25.00%	16.00%
ID006	8.33%	0.00%	12.50%	7.14%	3.13%	6.25%	0.00%	5.26%	5.00%	0.00%	20.00%
ID007	8.33%	7.69%	12.50%	14.29%	15.63%	18.75%	5.26%	21.05%	15.00%	25.00%	8.00%
ID008	0.00%	0.00%	12.50%	10.71%	3.13%	18.75%	10.53%	15.79%	5.00%	5.00%	8.00%
ID009	16.67%	0.00%	25.00%	17.86%	6.25%	25.00%	15.79%	21.05%	5.00%	10.00%	24.00%
ID010	0.00%	0.00%	6.25%	7.14%	0.00%	12.50%	0.00%	0.00%	5.00%	0.00%	4.00%

Fig. 5: Focus Group CVs Job Match

On the other hand, Figure 6 presents the focus group e-portfolio usage for job matching. The results present an obviously higher chance of winning a job. The highest percentage was about 76.36%, which means that the e-portfolio enabled users to present their skills better than the CV.

ID	JD-01	JD-02	JD-03	JD-04	JD-05	JD-06	JD-07	JD-08	JD-09	JD-10	JD-11
					Focus Group E-Portfolios Job Match						
ID001	48.15%	24.10%	42.22%	30.51%	17.14%	44.44%	32.33%	38.04%	21.67%	22.81%	43.64%
ID002	55.56%	20.00%	33.33%	46.67%	33.81%	62.22%	30.00%	35.29%	41.00%	47.37%	31.82%
ID003	51.85%	5.13%	43.11%	18.46%	7.14%	49.78%	43.33%	39.22%	15.67%	12.98%	39.39%
ID004	51.85%	15.38%	52.89%	45.90%	31.90%	55.56%	39.67%	34.12%	35.00%	38.25%	51.21%
ID005	51.85%	42.05%	54.22%	37.69%	13.10%	60.00%	51.67%	52.94%	36.67%	29.82%	48.48%
ID006	18.52%	5.13%	38.67%	17.69%	5.71%	31.11%	30.67%	30.20%	8.33%	5.96%	43.03%
ID007	55.56%	0.00%	66.67%	43.59%	21.90%	57.78%	36.67%	37.25%	30.67%	31.58%	53.03%
ID008	66.67%	30.77%	71.11%	51.03%	25.00%	67.56%	62.33%	54.90%	30.00%	35.09%	76.36%
ID009	28.89%	10.77%	27.56%	13.85%	5.00%	29.78%	20.67%	25.88%	14.33%	4.91%	34.24%
ID010	31.11%	7.69%	41.78%	15.13%	1.67%	32.89%	30.67%	23.14%	7.33%	4.91%	37.58%

Fig. 6: Focus Group E-portfolios Job Match

In addition, Figure 7 compares the extracted number of skills found on the CVs with the e-portfolios of each participant. The highest score of skills extracted in CVs was 17 skills out of 139. On the other hand, the e-portfolio extracted 51 skills out of 127. However, all participants' results were higher after using the e-portfolio.
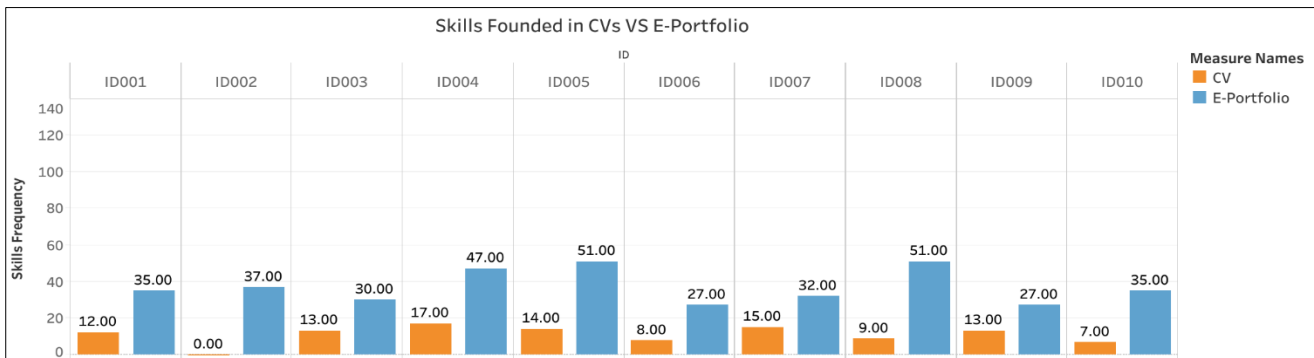

Fig. 7: Number of Skills Extracted from CVs VS E-portfolios

3.1.4 Focus Group Feedback and Recommendations

The main finding of the interview performed by the focus group indicates that most participants liked the e-portfolio idea and were willing to use it in the future, if available. They thought that it could assist job seekers to be properly employed. Additional findings were also observed, such as: (1) all the interviewees raised the issue of the similarity in their backgrounds and difficulties in evaluation without including their specific achievements; (2) they all agreed that the e-portfolio covered more than 90% of the most important knowledge and skills they possess; (3) they were interested in the ability to upload their details and evidence with one click.

3.2 Findings

3.2.1 The E-portfolio Benefits for the Applicants

Does an e-portfolio assist in shortening the gap between the employers' requirements and the graduates' skills? Will the e-portfolio approach be motivating enough for graduates to use? According to the results of this research, the use of an e-portfolio would enable applicants to seek and improve their skill set by understanding career requirements, the needed skills, and their proficiency levels. In addition, the use of an e-portfolio would provide applicants with additional space to present their skills, knowledge, and capabilities in a more visible and standard way. Additionally, the e-portfolio would encourage and motivate graduates and inexperienced job seekers to make more effort in achieving and creating new evidence that can be included in their e-portfolios.

3.2.2 The E-portfolio Benefits for the Job Evaluators

A. Will the e-portfolio be an alternative to the CV? Will employers be in a better position to select a graduate as a candidate after viewing their e-portfolio data? Will the e-portfolio be lengthy and difficult to review? Can the e-portfolio be exported easily to the employers' e-recruitment systems for searching for and filtering candidates?

The ideal answer to all these questions is yes, but according to the interviewed HR/IT managers and the focus group, the e-portfolio is a tool or a method like the other alternatives. If the e-portfolio is used properly by the applicants, then the benefits will be high. The e-portfolio is more standardized than the CV in collecting applicants' detailed information and skills along with the evidence that can be used for evaluations. An e-portfolio could substitute a CV if the purpose is to get a detailed background backed with evidence, not just a summary or a concise overview.

Accurate screening and filtering of applicants during the evaluation process is significant for best candidate selection. This is a time-consuming process. Using ATS would enable employers to easily search and shortlist their candidates according to the required skills in their posted job description. Usually, filtering the applicants using ATS based on CVs would not be the ideal choice where many good candidates would be excluded due to poor design of CV or writing issues. In addition, presenting skill levels backed with evidence will provide evaluators with a more in-depth view which minimizes the need for numerous interviews and examinations.

Finally, the e-portfolio would be easy to share with evaluators via email or an e-recruitment system. After the applicants prepare their e-portfolios and upload all the evidence, the folder will be zipped and shared. The evaluator can then download and extract the e-portfolios with all the evidence in one click.

B. What makes an e-portfolio different from LinkedIn? Will the e-portfolio be preferred on LinkedIn while screening candidates?

Nowadays, LinkedIn is considered the most used platform to find jobs. Updates usually include new features that support many fields. For example, in the profile, the user can add projects, publications experiences, et cetera. Accordingly, LinkedIn might be used as an e-portfolio if all benefits are used. However, the e-portfolio that has been used in this research paper is a simulated tool to evaluate the effectiveness of use as compared to other typical tools. Moreover, it is worth keeping records and downloadable copies of e-portfolios to be exchanged with parties not considering social media as a professional way to apply for jobs, such as governmental sites and some enterprises.

4 Limitations and Recommendations

4.1 Limitations

Interviewees and the focus group confirmed that the e-portfolio was very detailed and took a long time to be prepared or to be reviewed by employers. In addition, using CVs could be preferred by employers for faster screening of candidates by looking for main keywords.

4.2 Recommendations

The main recommendations to be considered for best practice are as follows: (1) it is worth mentioning that an e-

portfolio is flexible and can be updated during the applicant's lifelong learning according to his newly acquired skills and knowledge. (2) Adding some hints or tutorial links would assist the job seeker to create his e-portfolio, and it would help in spreading its usage. (3) To promote and motivate job seekers and employers to use the e-portfolio in a job application, obtaining advice from universities, job coaches, and job search seminars could be valuable.

5 Conclusion

Learning and progressing is a lifetime continuous process. Many important details should be recorded and documented throughout the student's journey. Outlining and summarization would lead to many shortages and missings when presenting the applicant's real knowledge and skills. This research presented the benefits of using an e-portfolio in seeking IT-related jobs. It indicated the employers' willingness to adapt the e-portfolio within the employment process. Moreover, this research proposed an e-portfolio model according to job seekers and employers' recommendations. The e-portfolio consists of components, guidelines, and evidence. As a result, the potential effectiveness of using e-portfolios in applying for IT positions was reported and acknowledged. However, there were some challenges and difficulties during the conduction of this research, such as limited related studies, collecting data, privacy issues, et cetera.

It is recommended, as a start, using the e-portfolio along with the CV for a better presentation of the applicant's skills and knowledge for employment. In the future, after establishing popularity regarding e-portfolio effectiveness, the e-portfolio could then replace the traditional CV.

To support the hypothesis, the e-portfolio in future works needs to be experienced by more applicants and tested by IT departments, since in the actual evaluation, the number of interviewees and the focus group were found to be limited. Moreover, future research should focus more on the recruitment process. Exporting e-portfolio data in e-recruitment systems should involve developing machine learning models and techniques. These will shorten the candidates' selection processes, enhance the e-portfolio functionality, facilitate extracting potential candidates from the e-portfolio repository, and limit the lengthy interviews and examinations. Some firms might put the e-portfolio to use now, so researchers could collaborate with these firms to conduct better results.

Conflict of Interest

The authors declare that there is no conflict regarding the publication of this paper.

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