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# Deployment of Computer Science Curriculum: Does That Translate Into Entrepreneurial Skills? Mediating From ICT Role

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**Abstract**

This research explored at the relationship between curricular development and entrepreneurial abilities, using ICT knowledge as a mediator. In this research, a quantitative analysis style was exploited to make course of study with the various aspects of objectives, contents, teaching tactics, feedback, and assessment. At the OUT Universities regional centers in Tanzania, 66 respondents from graduate students and employers completed two sets of questionnaires, one for the graduate's survey and the other for employers. The findings demonstrate that all aspects of curriculum development (i) have no bearing on entrepreneurial abilities (ii) Educational Environment have influence in Development of Entrepreneurial Skills and Competencies and (iii) have a favorable impact on ICT knowledge. Additionally, all aspects of curriculum development including objectives, contents, teaching methods, and feedback and assessment were found to be favorably connected in the indirect way for the entire development process. Finally, the discussion, conclusions, and practical implications of this study are presented in detail.

**Keywords:** assessing learning, entrepreneurship, curriculum, education, ICT

## 1. Introduction

Higher learning institutions' (HLIs') main goal is to create lifelong learners for the social good. Universities serve as the foundation for a nation's development and growth in the modern, technologically and economically globalized world. According to (Fejes et al., 2019; Wang, 2021), this is done by offering courses that emphasize advanced technological knowledge and entrepreneurial skills (ES).

Higher education institutions (HLIs) should demonstrate how they address the social and economic needs of society, including improving graduate employability, promoting social mobility and wider access to higher education, supporting the local and national economic growth in the short and long term, but also encourage the creation of new companies and the innovation of existing companies. However, to maintain excellent standards and remain competitive on global education marketplaces, HLIs like The Open University of Tanzania (OUT) must constantly adapt to new challenges.

Therefore, a comprehensive higher education must fully equip students to comprehend technology and its effects on society. The ability to critically evaluate technical promises which will enable one to make better decisions that have the potential with big impact on the world. Tanzania as a nation that has decided to develop through the industrialization route has a critical need for higher education that produces IT and innovation experts that are essential to our economy. According to the Development Vision 2025, Tanzania ought to have built a robust, diverse, resilient, and competitive economy that can successfully meet development challenges and that can also easily and confidently adapt to shifting market and technological conditions in the regional and global economy. The research done echoing the Market Survey and collected responses from stakeholder also investigated the need for courses related to Sustainable Entrepreneurship and Innovation in the employment sector. The Tracer Study and Market Survey Report revealed deficiencies in inadequate skills for self-employment, inadequate IT skills, innovation to graduates, inadequate practical orientation of the courses, insufficient time devoted to field practical training, and poor communication skills. However, the fact of a large pool of form six leavers and Diploma of Information Technology graduates and related fields in Tanzanian's institutions who are interested to pursue IT related degree programs, owing to the increase in their demand in the labour market as indicated in National Information and Communication Technologies Policy (2016) of Tanzania. It is for these reasons the study poses the mediating role of ICT for deployments of science curriculum as a remedy for entrepreneur skills.

In order to determine the impact on employability, this study reports on the intervention effects of ICT knowledge on curriculum development (CD) and entrepreneurship skills (ES). Curriculum development is a prerequisite for entrepreneurial skills and is divided into four dimensions (i) objectives, (ii) content and material, (iii) teaching methods and (iv) evaluation as well feedback. Universities are dedicated to developing curriculum that cultivates entrepreneurial skills in their students (Arranz et al., 2017; Padilla-Meléndez et al., 2014). Nowadays, integrated curriculum development across disciplines is regarded as the driving force behind the creation of employment opportunities, particularly for young people in various nations (Jie and Harms, 2017). In addition, Tanzania is well aware of the difficulties posed by youth unemployment and the need for universities to adjust and incorporate entrepreneurial curriculum development into cross-disciplinary instruction (Sentosa et al., 2017).

Through ICT, various economic sectors, including education, have changed their processes, and ICT information has changed the methods of teaching, learning and communication (Badawi et al., 2019). In Western countries, the inclusion of information and communication technology (ICT) skills in entrepreneurship education is considered evidence of successful entrepreneurs (Portuguez Castro and Gómez Zermeño, 2020), and ICT innovations and knowledge promote the development of entrepreneurship skills in universities (Badawi). et al., 2019). Information and communication technology can be used to develop entrepreneurial skills and help teachers effectively implement the curriculum (e.g., objectives, content and materials, teaching strategies and feedback and evaluation) (Bacigalupo et al., 2016).

Based on the previous discussion, it is assumed that ICT competence and curriculum development (CD) are prerequisites for entrepreneurship. The topic was the important role of entrepreneurship education in the development of entrepreneurial skills (ES) for the benefit of the economy from many studies (Jardim et al., 2022) (Jardim and Franco, 2019; Jones et al., 2018). Entrepreneurial skills help students develop critical thinking, problem solving, risk-taking and innovation. They also require students to put theory into practice and use it actively and creatively. In addition, entrepreneurial instruction helps students learn new concepts and technology practices in the classroom (Jones et al., 2019). However, there were very few studies that looked into the connection between ICT knowledge and entrepreneurial skills, and that's the foci for this study.

Based on the results, some proposals and conclusions are drawn up for administrative authorities and universities on how they can plan the development of entrepreneurial skills of students. Therefore, the aim of the study was to answer the following questions.

1. RQ: How to develop an ICT Curriculum which can Increase Students' Entrepreneurial Skills?

2. RQ: How to produce IT and innovation experts who can identify, analyze and evaluate opportunities for new business start-ups and growth in already established companies?

## 2. Study Philosophy on Entrepreneurial Skills and Curriculum Development

This finding looks into two questions presented above, beginning with "How to develop an ICT Curriculum which can Increase Students' Entrepreneurial Skills?" In responding to the first question the study laid down the philosophical concept within the question. Competence is defined as the ability to apply a set of knowledge, attitudes, and skills in a specific situation to succeed (Jardim and Franco, 2019). This concept emphasizes that competent individuals in a particular field possess analytical, creative and practical know-how beyond in-depth knowledge of performance environments. In addition, they show special skills to successfully apply their knowledge in specific situations. Entrepreneurial skills, on the other hand, are understood as knowledge, attitudes and skills that enable the development of original and valuable projects, products or services based on the needs of the company (Olutuase et al., 2020). In this context, know-how enables the implementation of practical ideas to solve problems and satisfy customer segments.

Designing, testing, and scaling up a successful business model therefore requires a complex set of skills. Among these competencies, we can identify in the literature several models of transversal competencies or life skills that enable success in personal, family and social life.(Jagodič and Dermol, 2015; Jardim, 2013; Kucel et al., 2016) .We also know that certain academic achievements lead to success in college life (Jardim, 2013; Parreira et al., 2018). As an envisioned model for promoting a society based on an entrepreneurial culture (Buli and Yesuf, 2015), some national and international educational institutions have defined a capacity model of citizenship and participation that allows everyone to intervene and become an entrepreneur. He points out that we must think with a spirit.

## 3. Curriculum Development

The Curriculum development includes objectives, content, teaching strategies, and feedback and assessment to meet the needs of all students. Curriculum goals are the expected educational, social, economic, or composite

outcomes, and content is the thematic area covered by the course. Teaching strategy refers to the delivery of course content to facilitate understanding of core concepts and learning according to course objectives. Feedback and assessment are important for measuring the success of curriculum development (Ahmed et al., 2017) Feedback and assessment generally measure progress (formative assessment) and achievement (summative assessment). The curriculum development is adjusted according to the type of course, especially entrepreneurial skills. The success of entrepreneurial skills depends on several factors, but in Planned Behavior Theory (TPB), high-quality education with successful curriculum development is considered to be the most important (Kazakeviciute et al., 2016). Students can learn entrepreneurial skills by integrating the benefits of a curriculum that has been effectively developed at the university. Previous studies have also discussed aspects of curriculum development (objectives, instructional strategies, content and materials, and feedback assessment), arguing that these contribute to students' entrepreneurial skills (Arranz et al., 2017; Popescu and Research, 2014). Therefore, curriculum development is becoming increasingly important for entrepreneurial skills development in college students, and this study focuses on curriculum development.

## 4. Research Methods

The second question under these findings asks, "How to produce IT and innovation experts that can identify, analyze and evaluate opportunities for the start-up of new businesses and growth in already established businesses?": expanding access to all levels of education, improving the author then identifies and responds to the question by taking a large pool of form six leavers and Diploma of Information Technology graduates and related fields existing as a base of study to analyses how they fit well in an already existing ICT programmes to find how well that could clearly show what skills the market needs.

The research used market survey which was conducted using a qualitative approach to collect the key information from the graduates and employers was taken. Primary data was collected from graduates and potential employers using questionnaires. There were two sets of questionnaires, one for the graduates' survey and the other for employers' survey. Questionnaires were used as a data collection tool because they are easy to complete, familiar to alumni and employers, relatively inexpensive to reach large samples of specific populations, and easy to manage. A total of 23 BSc in ICT graduates and 43 employers who were randomly selected participated in this study.

### *4.1 Major Finding of the Graduates' Survey*

#### 4.1.1 Sex of the Graduates

A total of 23 (41%) out of 56 graduates participated in the graduate survey. As shown in Figure 1, the male graduates who participated in the study were 19(82.6%) and female graduates were 4(17.4%). The results reflect the actual admission trend of students into the BSc Informatics programme. Admission data for the BSc. Informatics show that more than 80% of students admitted into the programme are male.

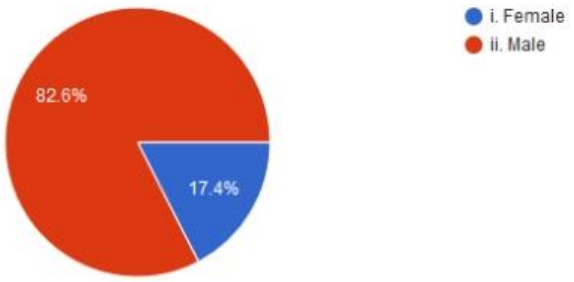


Figure 1. Sex of respondents

#### 4.1.2 Graduation Year

Graduates involved in this study had graduated from Open University of Tanzania (OUT) with a Bachelor of Science degree in ICT between the year 2011 and the year 2019 as shown in Table 1.

Table 1. Yearly Distribution of Graduates

| Graduation Year | Frequency | Percentage |
|---|---|---|
| 2011-2013 | 13 | 56.5 |
| 2014-2016 | 5 | 21.75 |
| 2017-2019 | 5 | 21.75 |
| | 23 | 100 |

The results show that most 13(56.5%) respondents who participated in this study graduated between 2011 and 2013. These graduates are expected to provide more useful information to the study as they are in the labor market for so long.

*4.2 Factors for the Decision to Enroll in the Programme*

Figure 2 clearly shows that area of specialization is the main (39.1%) factor that influenced most students to choose BSc. ICT. The influences of other factors are as shown in the same Figure 2. The results indicate that the students had their mission to pursue in joining the programme.

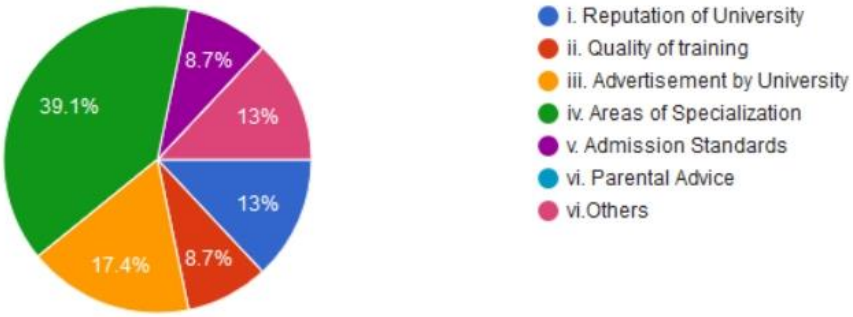


Figure 2. Factors that Influenced Graduates to join BSc in ICT Programme

*4.3 Assessment of Study Conditions and Provisions*

Graduates were requested to provide their assessment of the programme study provisions and conditions at the Open University of Tanzania (OUT). The study conditions and provisions were specifically assessed on the academic environment, infrastructure provision and social environment.

4.3.1 Academic Environment

In assessing the academic environment, graduates rated ten (10) items from very good to very poor. The items were the structure of the programme, duration of the programme, teaching quality of lecturers, academic advice offered, chances to participate in research projects, grading system of examinations, training on innovation and entrepreneurship, the effectiveness of practical works provided, the effectiveness of assessment method used and instructors. Competence. The results of the study are as indicated in Table 3.

Table 3. Responses on Academic Environment based on Three-Fold Classification of Responses

| | **Poor to Very Poor (%)** | **Satisfactory (%)** | **Good to Very Good (%)** |
|---|---|---|---|
| Programme Structure | 8.70 | 43.48 | 47.83 |
| Programme Duration | 4.35 | 43.48 | 52.17 |
| Teaching Quality | 13.04 | 43.48 | 43.48 |

| | | | |
|---|---|---|---|
| Academic Advice offered | 21.74 | 30.43 | 47.83 |
| Research Projects Opportunities | 30.43 | 30.43 | 39.13 |
| Examination Grading System | 0.00 | 39.13 | 60.87 |
| Training on innovation and entrepreneurship | 39.13 | 39.13 | 21.74 |
| Effectiveness of practical works provided | 34.78 | 39.13 | 26.09 |
| Effectiveness of assessment method used | 17.39 | 47.83 | 34.78 |
| Competence of instructors | 13.04 | 43.48 | 43.48 |

Results of the study show that the academic environment at OUT is generally rated as good. However, graduates raised concerns in areas such as training on innovation and entrepreneurship, the effectiveness of practical works provided, and opportunities provided for research projects.

*4.4 Infrastructure Provision*

As regards the assessment of infrastructure provision, graduates were asked to rate eleven (11) items from very poor to very good. Results indicate that infrastructure provision at OUT is generally good but major concerns were raised on the quality of availability of relevant books in the library, chance to influence university policies, availability of relevant books in bookshops, and availability of technical equipment. Table 4 shows details of the survey results.

Table 4. Responses on Infrastructure Provision Based on a Three-Fold Classification of Responses

| | **Poor to Very Poor (%)** | **Satisfactory (%)** | **Good to Very Good (%)** |
|---|---|---|---|
| Chance to influence university policies | 34.78 | 34.78 | 30.43 |
| Technical Equipment Availability | 30.43 | 39.13 | 30.43 |
| Quality of Computer laboratories | 21.74 | 34.78 | 43.48 |
| Quality of Teaching and Learning Materials | 17.39 | 43.48 | 39.13 |
| Availability of relevant books in Library | 43.48 | 30.43 | 26.09 |
| Availability of relevant books in Bookshops | 26.09 | 43.48 | 30.43 |
| Affordability of relevant books in Bookshops | 30.43 | 47.83 | 21.74 |
| Buildings Quality | 13.04 | 47.83 | 39.13 |
| Classrooms Quality | 8.70 | 52.17 | 39.13 |
| Quality for Staff Offices | 8.70 | 52.17 | 39.13 |
| Quality of Accommodation facilities | 21.74 | 39.13 | 39.13 |

*4.5 Social Environment*

The immediate physical and social setting were referred to as Social environment to in which students experience while studying at the university. The study results indicate that the social environment for the students at OUT is very good. It is encouraging that the key aspect of the social environment for university students such as collaboration with their fellow students and students' relationship with teaching staff were rated very high. However, there are some areas such as health care services and recreation facilities which need improvements. Table 5 shows details of the survey results.

Table 5. Graduates' Responses on Social Environment based on Two-fold Classification

| | Poor to Very Poor (%) | Satisfactory (%) | Good to Very Good (%) |
|---|---|---|---|
| Student Administration | 0.00 | 52.17 | 47.83 |
| Collaboration with Fellow Students | 4.35 | 30.43 | 65.22 |
| Catering Services | 4.35 | 56.52 | 39.13 |
| Student Organization | 4.35 | 52.17 | 43.48 |
| Counseling Services | 13.04 | 43.48 | 43.48 |
| Health Care Services | 13.04 | 39.13 | 47.83 |
| Recreation Facilities | 13.04 | 56.52 | 30.43 |
| Relationship with Teaching Staff | 4.35 | 30.43 | 65.22 |
| Availability of Worshipping Areas | 13.04 | 21.74 | 65.22 |

*4.6 Themes and Courses Relevance*

Computer science research involves the systematic study of methodological processes (such as algorithms) that support the acquisition, presentation, processing, storage, mediation, and access of information. In achieving the programme learning outcome, the BSc in ICT is built of eleven (11) themes namely Enterprise Information Systems, Programming, Software and Hardware Systems, Information Technology, System Analysis and Databases, Artificial Intelligence, Computer Networks, Research Projects and Field Practical Training, Mathematics, Information Science and Entrepreneurship and Business Management. In this study, graduates were requested to rate the relevance of programme themes and their underlying courses from highly relevant to highly irrelevant. The results of the ratings are as described below.

4.6.1 Enterprise Information Systems

The theme of Enterprise Information Systems consisted of two (2) courses which were Organizational Behavior and Managing Information and Communication Systems. Results, as shown in Table 6, indicate that both courses are relevant to the programme.

Table 6. Graduates' Responses on Enterprise Information Systems theme based on Two-fold Classification

| | Irrelevant to Highly irrelevant (%) | Relevant to Highly relevant (%) |
|---|---|---|
| Organisation Behaviour | 17.39 | 82.61 |
| Information System Management | 8.70 | 91.30 |

*4.7 Programming*

The programming theme comprised seven (7) courses. The courses were Web Contents Design and Management, Internet Programming and Web Server Management, Data Structure and Algorithms, Object-Oriented Concepts, Fundamentals of Computer Programing, Programming in Java and Introduction to XML and related technologies. The outcome of the ratings is as indicated in Table 7. Graduate considered all seven (7) courses as relevant to the programming theme. In addition to that, all courses except the courses Introduction to XML and Related Technologies and Internet Programming and Web Server Management were rated relevant to the theme by more than 90%.

Table 7. Graduates' Responses on Programming theme based on Two-fold Classification

| | Irrelevant to Highly irrelevant (%) | Relevant to Highly relevant (%) |
|---|---|---|
| Web content design and Management | 8.70 | 91.30 |
| Internet Programming and Web Server Management | 13.04 | 86.96 |
| Data structure and Algorithms | 4.35 | 95.65 |
| Object-Oriented Concepts | 8.70 | 91.30 |
| Fundamental of Computer Programming | 8.70 | 91.30 |
| Programming in Java | 8.70 | 91.30 |
| Introduction to XML and related technologies. | 13.04 | 86.96 |

*4.8 Software and Hardware Systems*

The theme for Software and Hardware Systems was made up of four courses namely Computer Architecture and Operating Systems, Basics in Digital Circuitry, Geo-Informatics and Distributed Systems. Graduates' responses depict that all the courses are relevant to the theme. Table 8 shows the results.

Table 8. Graduates' Responses on the Software and hardware Systems theme based on Two-fold Classification

| | Irrelevant to Highly irrelevant (%) | Relevant to Highly relevant (%) |
|---|---|---|
| Architecture and Operating Systems | 4.35 | 95.65 |
| Basics in Digital Circuitry | 13.04 | 86.96 |
| Geo Informatics | 17.39 | 82.61 |
| Distributed Systems | 4.35 | 95.65 |

*4.9 Information Technology*

Introduction to Microcomputer and Applications, Computer Modelling and Simulation, Computer Graphics and Image Processing, Social and Cultural Impact of ICT and Information Technology Security were courses that form the Information Technology theme. Graduates reacted so positively to the course Introduction to Microcomputer and Applications with 100% rated as highly relevant to the Information Technology theme. Table 9 depicts the results.

Table 9. Graduates' Responses on the Information Technology theme based on Two-fold Classification

| | Irrelevant to Highly irrelevant (%) | Relevant to Highly relevant (%) |
|---|---|---|
| Introduction to Microcomputer and Applications | 0.00 | 100.00 |
| Computer Modelling and Simulation | 13.04 | 86.96 |
| Information Technology Security | 4.35 | 95.65 |
| Social and Cultural Impact of ICT | 8.70 | 91.30 |
| Computer Graphics and Image Processing | 17.39 | 82.61 |

*4.10 System Analysis and Databases*

The courses that made the System Analysis and Databases theme are Introduction to System Analysis and Design, Software Engineering and Project Management, Database Concepts, Database Implementation and Management and Human-Computer Interaction. The outcomes of the ratings indicate that all courses are highly relevant to the theme as all of them were rated above 90%.

Table 10. Graduates' Responses on the System Analysis and Database theme based on Two-fold Classification

| | **Irrelevant to Highly irrelevant (%)** | **Relevant to Highly relevant (%)** |
|---|---|---|
| Introduction to System Analysis and Design | 0.00 | 100.00 |
| Software Engineering and Project Management | 8.70 | 91.30 |
| Database Concepts | 4.35 | 95.65 |
| Database Implementation and Management | 4.35 | 95.65 |
| Human Computer Interaction | 8.70 | 91.30 |

4.10.1 Artificial Intelligence

The Artificial Intelligence theme comprised four (4) courses. The course was an introduction to artificial intelligence, decision support systems, knowledge-based systems, and expert Systems. Graduates regarded all four (4) courses as relevant to the theme. Nevertheless, there is a discrepancy in the results as shown in Table 10. While the course Artificial Intelligence was rated highly relevant (95.5%), the courses, Knowledge-Based System, Decision Support Systems and Expert Systems were rated quite low with 50.26%, 51.56% and 50.90% respectively. From the graduates' point of view, these courses were rated low because their contents are almost similar. The curriculum reviewers should explore the contents of these courses for the possibility of merging them.

Table 11. Graduates' Responses on the Artificial Intelligence theme based on Two-fold Classification

| | **Irrelevant to Highly irrelevant (%)** | **Relevant to Highly relevant (%)** |
|---|---|---|
| Introduction to Artificial Intelligence | 4.35 | 95.65 |
| Decision Support Systems | 49.74 | 50.26 |
| Knowledge Based Systems | 48.44 | 51.56 |
| Expert Systems | 49.10 | 50.90 |

*4.11 Computer Networks*

Computer Networks theme comprised of two (2) courses namely Network Design and Administration and Management of Communication and Computer Networks. Both courses were considered by graduates as highly relevant to the theme at more than 95%. Table 12 represents the results.

Table 12. Graduates' Responses on the Computer Networks theme based on Two-fold Classification

| | **Irrelevant to Highly irrelevant (%)** | **Relevant to Highly relevant (%)** |
|---|---|---|
| Network Design and Administration | 4.35 | 95.65 |
| Management of Communication and Computer Networks. | 0.00 | 100.00 |

*4.12 Mathematics*

Courses that formed the mathematics theme were Numerical Analysis I, Numerical Analysis II, Linear Algebra I, Foundation of Analysis, Discrete Mathematics, Linear Programming, Mathematical Logic and Formal Semantics,

Introductory Statistics and Advanced Mathematical Statistics. As regards the rating outcomes, all courses were rated relevant to the theme as indicated in Table 13. However, graduates were concerned with the course Advanced Mathematical Statistics as its relevance was rated low (39%). Further, only the course Operational Research was rated highly relevant at 95%.

Table 13. Graduates' Responses on the Mathematics theme based on Two-fold Classification

| | **Irrelevant to Highly irrelevant (%)** | **Relevant to Highly relevant (%)** |
|---|---|---|
| Numerical Analysis I | 17.39 | 82.61 |
| Numerical Analysis II | 17.39 | 82.61 |
| Linear Algebra I | 13.04 | 86.96 |
| Foundation of Analysis | 13.04 | 86.96 |
| Discrete Mathematics | 17.39 | 82.61 |
| Operational Research | 4.35 | 95.65 |
| Mathematical Logic and Formal Semantics | 13.04 | 86.96 |
| Introductory Statistics | 13.04 | 86.96 |
| Advanced Mathematical Statistics | 60.87 | 39.13 |

*4.13 Information Science*

In respect to the ratings of courses in the Information Science theme, all courses were rated as relevant to the Information Science theme. The rated courses were Knowledge Management, Information Storage and Retrieval, Records and Archive Management, Information Architecture and Organization of Information. The two courses namely Information Architecture and Information Storage and Retrieval were rated highly relevant to the theme at 95%. Table 14 summarizes the results

Table 14. Graduates' Responses on the Information Science theme based on Two-fold Classification

| | **Irrelevant to Highly irrelevant (%)** | **Relevant to Highly relevant (%)** |
|---|---|---|
| Knowledge Management | 21.74 | 78.26 |
| Information Storage and Retrieval | 4.35 | 95.65 |
| Records and Archive Management | 17.39 | 82.61 |
| Information Architecture | 4.35 | 95.65 |
| Organization of Information | 17.39 | 82.61 |

*4.14 Research Projects and Field Practical Training*

Courses in the Research Projects and Field Practical Training theme were all rated highly relevant by the graduates. All courses were rated relevant to the theme by 100%. The results as depicted in Table 15 clearly show that graduates regard hands-on skills as a very key attribute of the BSc Informatics graduate.

Table 15. Graduates' Responses on the System Analysis and Database theme based on Two-fold Classification

| | Irrelevant to Highly irrelevant (%) | Relevant to Highly relevant (%) |
|---|---|---|
| Research Methods in Computing and Information Management | 0.00 | 100.00 |
| Research Project | 0.00 | 100.00 |
| Field Practical Training I | 0.00 | 100.00 |
| Field Practical Training II | 0.00 | 100.00 |

*4.15 Entrepreneurship, Innovation and Business Management*

Unfortunately, the theme Entrepreneurship, Innovation and Business Management have only one course i.e., Policy, Legal and Ethical Issues in ICT. The response of graduates on this course regarding its relevance to the theme was positive. The course is highly relevant to the theme as shown in Table 16.

Table 16. Graduates' Responses on Entrepreneurship, Innovation and Business Management theme based on Two-fold Classification

| | Irrelevant to Highly irrelevant (%) | Relevant to Highly relevant (%) |
|---|---|---|
| Policy, Legal and Ethical Issues in ICT. | 8.70 | 91.30 |

*4.16 Graduate Employability*

It is the expectation of every graduate to have the means of living after completing studies at the university. The graduates may be employed or employ themselves. As the mismatch between the skills of graduates and the skills required in the labour market widens, it is very important to address the problem in the curriculum review exercise. Graduates were requested to respond to various questions concerning graduate employability. The graduates' responses are presented and discussed in the following sections.

4.16.1 Programme Expectations

Graduates were asked to rate how the programme has met their expectations from a very high extent to not at all. The results as shown in Figure 3 indicate that the programme met the expectation of more than 65% of the graduates, about 31% of the graduates were satisfied to some extent and it did not meet the expectations of about 4% of the graduate. However, there are some issues to be addressed as about 35% of the graduates claimed to be somehow unsatisfied.

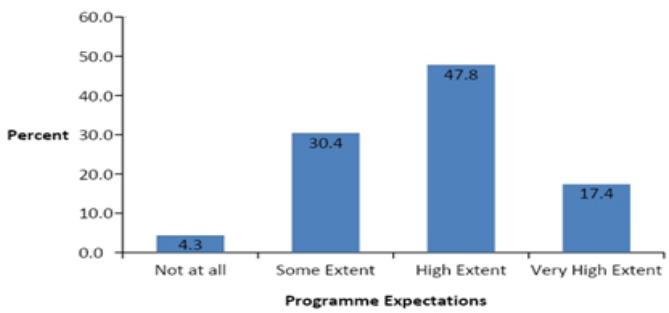


Figure 3. Graduates' Responses on Programme expectations

*4.17 Type of Organization*

Results indicate that more than 61% of the graduates have been employed by the government or government organizations. While 18% of the graduates are working in private companies and 17% of graduates are self-employed. Few (4%) graduates have been employed by non-government organizations. The results show obviously that most the graduates rely on the government for their employment. Figure 4 summarizes the results.

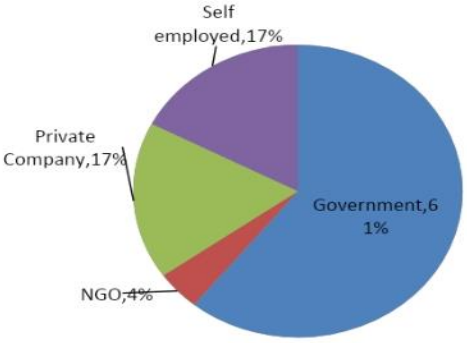


Figure 4. Graduates' Responses on the type of organization

*4.18 Seeking for Employment*

As Figure 5 indicates, more than half (56.5%) of the graduates started looking for employment one (1) to two (2) years after graduation while 21.7% looked for employment before graduation. Another 4.3% said they did not look for employment and the remaining 17.4% looked for employment more than two (2) years after employment. Generally, the results show that more than 95% of the graduates have no other alternative besides waiting for employment. This situation, therefore, calls for immediate actions to incorporate entrepreneurship and innovation skills into the curriculum to prepare graduates for self-employment and be job creators for others.

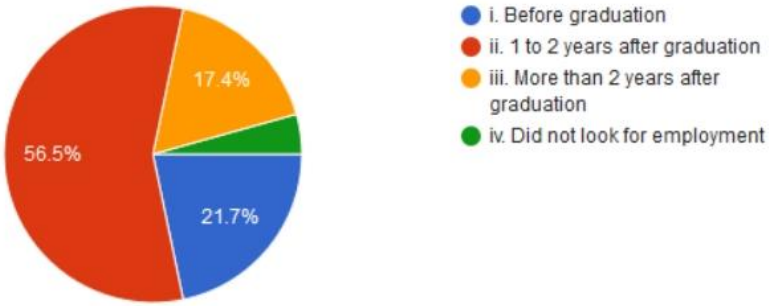


Figure 5. Graduates' Responses on Seeking for Employment

*4.19 Application for the First Employment*

Graduates were asked to indicate how they obtained their first employment. As in Figure 6, the majority (65.2%) of graduates obtained their first employment by applying for advertised vacant positions, 17.4% through personal connections, 8.7% through department staff 4.3% through contacts established during FPT and 4.3% through parents/relatives help. It is unfortunate that no graduate who neither set up his/her own business or being approached by the employers. This indicates that BSc in ICT graduates do not possess the desired quality to attract a rare situation of being approached by employers or possessing the competence of setting up their own business. In that regard, it is so important to develop a competence-based curriculum that considers issues of entrepreneurship and innovation.

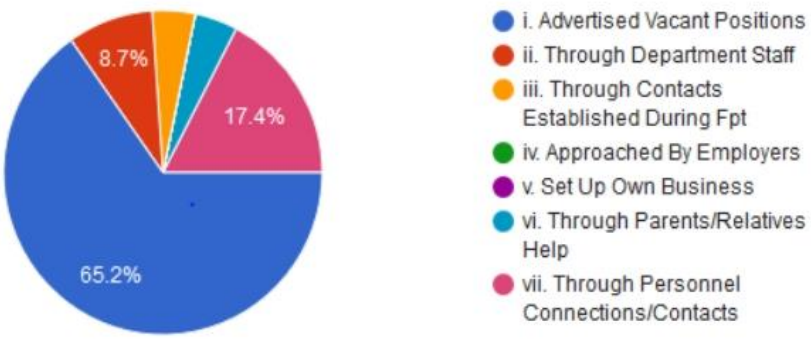


Figure 6. Graduates' Responses on the Application for the First Employment

*4.20 Factors for Employment*

Graduates were asked to rate how some factors have contributed to them being employed as Figure 7 indicates the results. Performance at the interview was the major (34.8%) factor for their employability. Other greatly contributing factors include the main focus of the subject area (21.7%), previous work experience (17.4%) and the special projects (13%). The results also show that the least contributing factor for the graduates' employability is the grades at the university (3.4%). This result provides further evidence that the competence of the graduates is the major contributing factor to their employability. Hence, the competence-based curriculum that equips graduates with entrepreneurial and innovative skills for employability and self-employment is inevitable if SUA intends to produce market-oriented graduates.

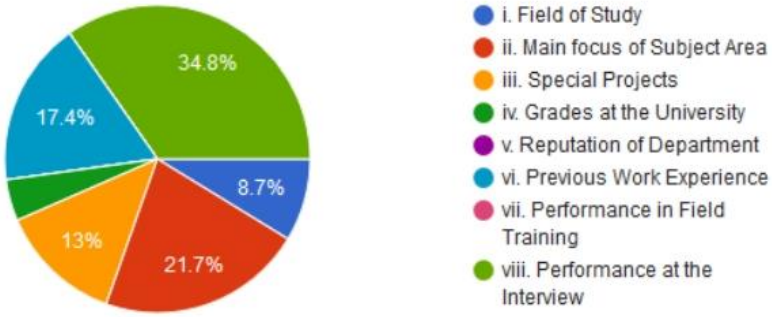


Figure 7. Graduates' Responses on the Factors for Employment

*4.21 Theme Knowledge Usage*

Graduates were also asked to specify the extent to which the knowledge acquired at SUA is used in their carrier path. Generally, all knowledge areas are used as Table 17 depicts except for Artificial Intelligence, Geoinformatics and Graphics Design. The extent of knowledge usage is almost the same (less than 80%) in all knowledge areas which indicates the lack of specialization in the BSc. Informatics programme. Further, the extent of knowledge usage from field practical training is moderate (69%). Hence, the conduct of field practical training needs to be revised to ensure that students immensely benefit from the field works.

Table 17. Themes Knowledge Usage based on Two-fold Classification

| | Not at All to Low Extent (%) | Some Extent to High Extent (%) |
|---|---|---|
| System Analysis and Design | 34.78 | 65.22 |
| Databases | 21.74 | 78.26 |
| Mathematics | 43.48 | 56.52 |
| Computer Programming | 21.74 | 78.26 |
| Computer Networking | 30.43 | 69.57 |
| Information Security | 21.74 | 78.26 |
| Artificial Intelligence | 86.96 | 13.04 |
| Operating System | 21.74 | 78.26 |
| Geo Informatics | 65.22 | 34.78 |
| Project Management | 21.74 | 78.26 |
| Information Science | 34.78 | 65.22 |
| Software Development | 26.09 | 73.91 |
| Graphics Design | 56.52 | 43.48 |
| Special Projects | 26.09 | 73.91 |
| Website Development | 26.09 | 73.91 |
| Field Practical Training | 30.43 | 69.57 |

*4.22 Addition of Relevant Courses*

Graduates were also requested to suggest courses to be added to the curriculum based on the advancement of Information Technology and their industrial working experience. As shown in Figure 8, most (35%) of graduates proposed courses on Entrepreneurship and Innovation to be included in the curriculum, 22% of graduates suggested the addition of data science courses and 18% of graduates recommended that the curriculum should include courses on Android and Mobile Applications. While few (4%) advised that the curriculum should contain courses on wireless technology, machine learning and computer repair and maintenance. It is evident that skills in entrepreneurship and innovation are highly important for our students to cope with the rapid advancement of technology and the changing demands of the labour market.

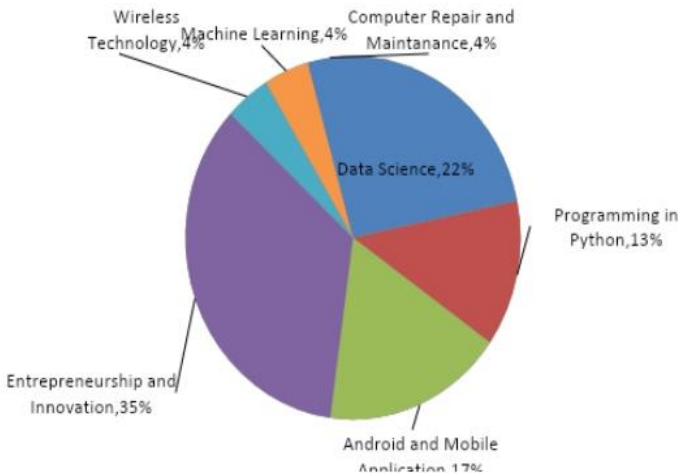


Figure 8. Graduates' Responses on Addition of Relevant Courses

*4.23 Effective Mode of Delivery*

When asked about the effective mode of delivery of the programme, most graduates suggested problem-based learning (43.48%) and project-based learning (52.17%). Few graduates (4.35%) recommended student centred learning. Generally, most graduates (95.65%) suggested a delivery mode that will impart to students' real-world skills and competencies. Figure 9 depicts the results.

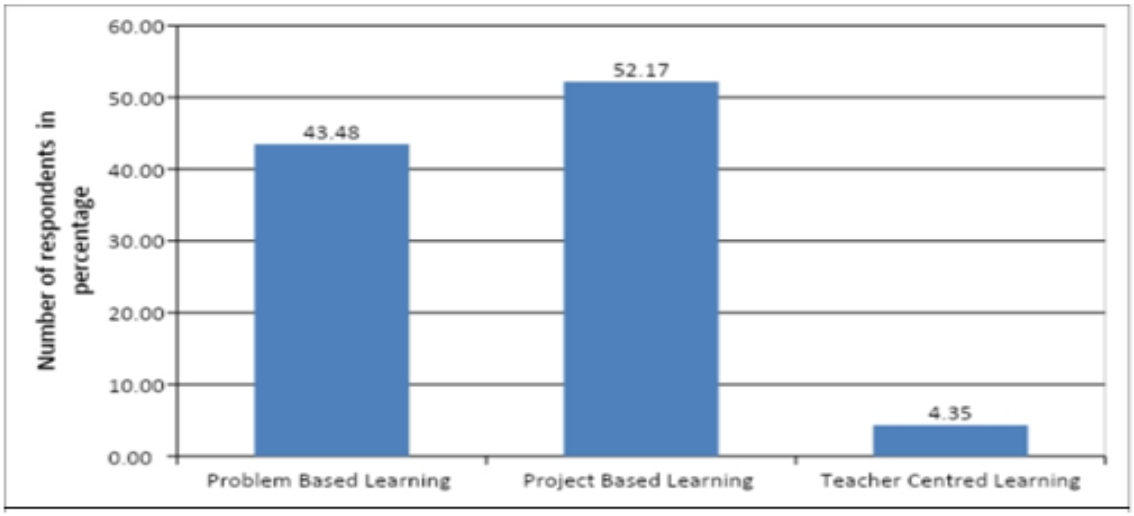


Figure 9. Graduates' Responses on Effective Delivery Mode

## *5.* Major Finding of the Employers' Survey

*5.1 Type of Respondents' Organization*

The majority of respondents were private companies consisting 41.9% of the responses which was followed closely by government institutions (including ministries, municipals, and authorities) at 32.6%. The ICT services firms and training institutions consisted of 14% and 11.6% of respondents respectively. The study deliberately involved more private companies because private companies put more emphasis on the practical competencies of the graduate they want to recruit. Figure 10 illustrates the results.

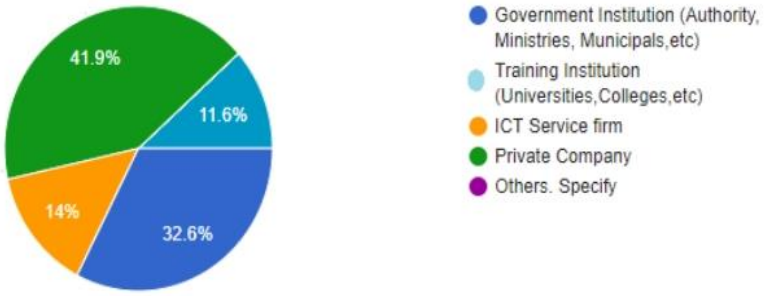


Figure 10. Type of Respondents' Organization

*5.2 Number of ICT Employees in the Organizations*

60.5% of the respondents have less than ten (10) ICT employees in their ICT services departments while 14% of the companies have more than fifty (50) ICT employees in their organizations. This is simply because companies with less than 10 ICT staff are either non-ICT based companies or small ICT services firms so they don't have many IT employees. On the contrary, companies with the higher number of ICT employees are either ICT based companies or huge and widely distributed companies. Figure 11 detailed the results.

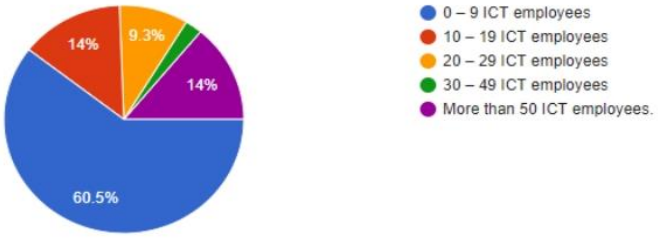


Figure 11. Number of ICT employees in the organizations

*5.3 ICT Employees Graduated From OUT*

The majority, 81.39% of the organization had OUT BSc in Informatics graduates as their permanent employed staff in their ICT departments or as internships trainees. Few, 18.61 of organizations do not have OUT graduates at any level however they do have similar ICT graduates from other universities, and they were willing to share their experiences regarding what they see from them. As most organizations involved in this study employed OUT BSc. Informatics graduates, their inputs in this study will be pertinent and will be very useful in developing a curriculum that produces IT graduates that meet the demands of the labour market.

*5.4 Procedures Used to Recruit ICT Graduates*

According to our survey, most, 92% of the government institutions depend on public sector recruitment services and 8% have the autonomy to recruit directly. The private companies conducted their recruitments through advertising the vacancies 42.5%, references through internships and field practical training 37.5%, direct applications from the applicants 15% and 6% comes from other sources like the recommendation of personal contacts and the likes. All respondents indicated that graduates must pass the interview before being employed.

*5.5 Important Criteria Considered in Recruiting ICT Graduates*

Most employers considered work experience (31%), practical abilities (28%) and innovation skills (26%) as the three most important criteria in the selection of new recruitments. Other criteria were specialization (9%) and academic performance (6%). According to the survey's results, no employer considered University's reputation as the criterion for recruitment. Most employers especially in private sectors and ICT services firms claimed that GPA may be a good indicator of someone's ability but is not an effective factor towards determining someone's practical and creative ability. This indicates that most ICT graduates need to demonstrate practical ability rather than just good grades to be in a position for consideration in a competitive job market. Further, ICT business start-ups consider the practical ability and innovative skills as the best tools required for the success of any ICT firm. Figure 12 provides more details.


Figure 12. Important Criteria Considered in Recruiting ICT Graduates

*5.6 Employers Expectation From the Fresh ICT Graduates*

The study results indicated that most (66.7%) employers expect ICT graduates to have at least satisfactory

knowledge and practical ability in the main areas (subfields) of ICT. However, these graduates have to undergo comprehensive training before assuming their responsibilities. Other (31%) employers believe that there is no need of training newly employed ICT graduates, but they will have to work under the guidance of seniors. While only a few (2.14%) expect ICT graduate to carry out their tasks without any support. Figure 13 below shows the results.


Figure 13. Employers Expectation from the Fresh ICT Graduates

*5.7 Competences of ICT Graduates When Employed*

There are many job titles in the ICT sector with a variety of areas of interest and many levels of expertise. The study results revealed that companies seeking to recruit ICT professionals face difficulties in finding skilled practitioners because of competence mismatches. In the recruitment process, employers found that most ICT graduates are quite competent in graphics design (28%), network administration (25%) and website development (22%). Very few ICT graduates are competent in computer programming (6%) and the development of innovative ICT solutions. The competence mismatches necessitate companies to provide comprehensive training to the newly employed ICT graduates.

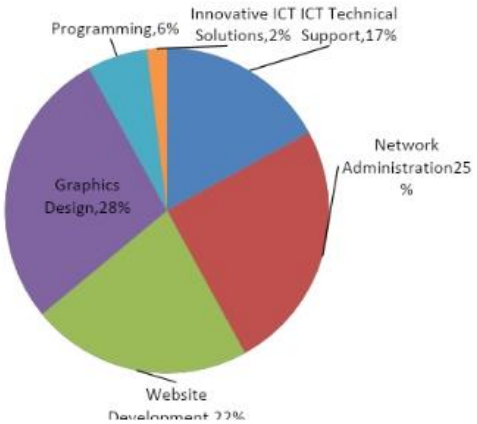


Figure 14. Competences of ICT Graduates When Employed

*5.8 Graduates' ICT Competencies Required by Employers*

Most (40%) employers preferred ICT graduates with programming skills. Since most organizations are in high demand of ICT innovative solutions for improving working performance and business efficiency. Other competencies required by employers are website development and management (19%), ICT support (16%), network design and administration (16%), IT security (7%) and graphics design (2%). Figure 14 illustrate the results.

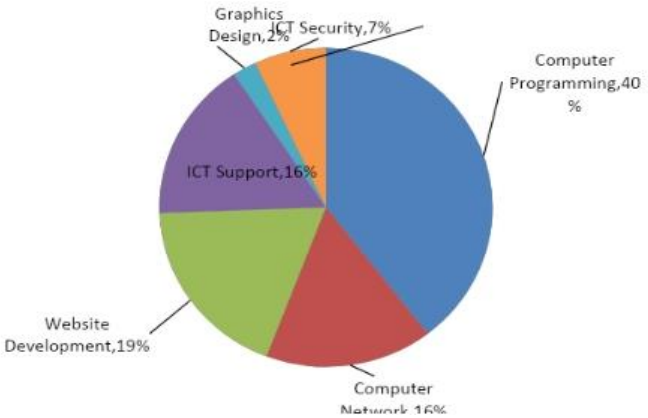


Figure 15. Graduates' ICT competencies required by Employers

*5.9 Appropriate Mode of the Programme Delivery*

All employers (100%) who participated in this study proposed the teaching approach that makes ICT graduates acquire the necessary knowledge, skills and competencies that are required in the labor market. The approach of implementing competence-based learning can take any path based on the availability of resources. However, most (53%) employers suggested the problem-based approach as it focuses on the student's use of knowledge, skills, and abilities to produce effective solutions to real-life problems. Some employers (32%) proposed the project-based learning which requires students to work on the long task as a project and create a useful product. Other (15%) employers recommended an internship-based approach where students spend a significant amount of time (maybe six or nine months) working in the actual working environment and provide innovative solutions to problems existing at the working place.

## 6. Discussion

The current study initially looked at the relationship between entrepreneurial competencies and the curriculum content, curricular materials, teaching methodologies, assessment, and feedback. The findings validated our mediation on the function of ICT and showed that the content of ICT curricula had a favorable relationship with entrepreneurial competencies. These findings were backed by information gathered from various sources. The outcomes supported earlier study findings that entrepreneurial competencies were influenced by curricular content (Gieure et al., 2019; Shirokova et al., 2017) In order to determine if university-based educational approaches have an impact on entrepreneurial competencies, (Lee et al., 2018), studied 927 university students. The findings, however, showed that there was no significant correlation between ICT curriculum content, instructional methodologies, assessment, and feedback.

Second, using a two-fold classification system, the current study evaluated the direct impact of the campus learning environment on graduates' responses to the social environment on their entrepreneurial competencies. The findings demonstrated how crucial a role the learning environment plays in helping students build their entrepreneurial skills and competences. These results are consistent with earlier study on the impact of the educational environment on the acquisition of entrepreneurial skills and competencies in students (Iqbal et al., 2022), this study found that most students (>50%) had a modest level of entrepreneurial competency.

The results of this study can be interpreted as follow: Teaching, feedback and assessment strategies need urgent change because of their influential role in the development of entrepreneurial skills. Entrepreneurial skills should be incorporated into the curriculum content, teaching materials, teaching strategies, feedback and assessment, as they are tied up to the on campus learning environment. However, it has been observed that the learning environment on campus plays an important role in the formation of entrepreneurial skills.

*6.1 Conclusions and Recommendations*

This research was conducted with focus on OUT as part of the development of BSc in ICT curriculum. The findings of this study are based on quantitative data collected from twenty-three (23) students graduating from the BSc in ICT from 2012 to 2019 and forty-three (43) employers. The study outcomes represent the genuine and key observations on the conduct of the academic study in OUT head quarter and its existing regional centers, in general, the OUT should take appropriate measures to address genuine matters of concern raised by the graduates and employers. As to ensure that our graduates make a significant contribution to the national development, OUT must

prepare its graduates as per the employment needs as well as making them capable enough to create new employment.

BSc in ICT is expected to be running for upcoming years at OUT and hence during survey many organizations were involved in this study as the employed BSc in ICT graduates. However, the programme has not been running well at OUT besides the rapid changes in the IT sector. Thus, producing graduates with skills will mismatch with those requirements in the labour market. Study results show also that majority of graduates who graduated from OUT were employed in the government, and few were employed in the private sector, NGOs or established their own firms. This trend is because most employers in the private sector prefer to recruit innovative employees, with good work experience and good practical skills. As the private sector is increasingly becoming the main employer.

Study investigation realized that many graduates were recruited due to their excellent performance in the interview and not by good grades that appear on their certificates. It was also found that the graduates are lacking skills due to inadequate practical opportunities. Even the employers expect little from the fresh ICT graduates and are obliged to provide them with comprehensive training to be productive. In addition to that, most employers are in high demand of ICT innovative solutions for solving their business problems. It was therefore recommended to change the teaching approach from conventional teaching methodology and adopt those which put more emphasis on practical training such as problem-based learning and project-based learning. This will increase graduates' competence to suit the market needs.

The research undertaken in this study can assist the Computer Science curriculum developers to critique the proposed outcomes, their imaginative and prescient for enactment, and functions of the written curriculum, in addition to the techniques which these computer science curriculums are created. The guidelines derived from this research can assist designers to cognizance on hands-on layout initiatives that cope with a confined set of key reforms-aligned mastering goals, contextualized in proper work-stimulated practices which are attractive to learners with a wide variety of interests in future. Altogether, these findings give a modest presentation however they do have vital limitations insights for designers developing curricula with workplace connections that can make science engaging and relevant to all learners.

Lastly, the study results revealed that many graduates obtained their job by applying for advertised vacant posts. Very few obtained their job through the departmental staff, none obtained by being approached by employers and none set up their own business. This situation stands as a wake-up call for the OUT to establish IT incubators for supporting the development of start-ups. The OUT staff and other stakeholders will provide technical and administrative support services and hence assist significant graduates in securing jobs or establishing their own businesses.

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