Do Students Have the Relevant ICT Skills They Need to do their Research Projects?

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ABSTRACT
The final year research project is the capstone of undergraduate studies. Finding out the skills students have at final year helps determine how ready they are for their research projects as well as how prepared they are for the job market. In order to ascertain the Information Communication and Technology (ICT) literacy levels of students, a study was carried out using year four (final year) students across several faculties and departments in the University of Botswana using computer self efficacy instrument and Task characteristics. Prior to administering the questionnaire, a pilot test was conducted and reliability and validity tests were done. The data was analysed using SPSS. Chi-square and Cross Tabulation statistics were carried out. The results of the study revealed that students were lacking in skills needed specifically for academic research. Amongst others, the study recommends that the university should provide students with an IT fluency centre for individuals to concentrate on developing their skills. Workshops and demonstrations are recommended in which students can be given individual attention. A broader focus will be to incorporate technology into the curriculum of all courses and to improve the curriculum for the General Education Courses to include the desired skills.

Categories and Subject Descriptors
H.4.1. [Microsoft Office]: Microsoft Word, Microsoft Internet Explorer, Excel, PowerPoint, G3: SPSS

General Terms
Performance, Verification.

Keywords
Computer Skills, ICT; Proficiency; IT Education, Performance Measurement

1. INTRODUCTION
Skills associated with ICTs are increasingly taken for granted at all stages of a student’s university existence [10]. Almost any university expects students to have appropriate computer skills.

In fact, most universities assume that new students are computer-literate when they arrive in contrast to past expectations that all new students would need some basic computer training [8]. The same assumption is in-built into the IS 2010 curriculum for undergraduate programmes in Information Systems (IS).

The revised IS 2010 curriculum recommends dropping the course focusing on personal productivity tools from IS programmes because most high schools are preparing students in this area before they reach a higher education environment [13]. A fundamental question in this study is: do institutions of higher learning adequately prepare students to use these technologies?

In this study, ICT skills for final year research project is defined as skills that students need to develop in order to access the literature in their field and complete research project-related tasks including report writing, analysis of data, report presentation as well as skills in accessing and using the appropriate and available software for these activities.

The term ‘Final Year Research Projects’ in this study refers to undergraduate research done in the final year of study in the university. A typical research project requires word processing of a long document, some form of analysis and a presentation. It sometimes also requires drawing charts, inserting pictures, copying data and graphics across applications, good internet skills and managing citations. Though research itself is already a huge task to perform, students need adequate ICT skills to enable them handle all the activities linked to the research project.

ICT skills are a fundamental requirement for students and workers in the digital age. In schools, universities and in the work place, the question of how to utilise ICTs for learning purposes has become more and more important for anybody engaging in education and training as new technologies are spreading rapidly [16]. Even if a learner is not doing what directly relates to computing, ICT skills are required to do most assignments and projects. In fact, virtually all university courses require basic computer knowledge. Similarly, more and more jobs are demanding that workers become increasingly familiar with using a wide range of computer applications.
2. BACKGROUND

The researchers has been involved for several years in supporting final year undergraduate and graduate students doing research and has noticed, in particular, a lack of basic ICT knowledge as students struggle with most computer applications. Most of the students waste a lot of time on simple ICT tasks, which indicate lack of adequate ICT skills. This lack of skills makes students to spend a lot of valuable time learning ICT skills simultaneously with doing their research projects. Sometimes, due to lack of skills, students use some of the ICT tools in most inefficient ways. A student can for example type the table of contents for a document separately and keep changing the pagination in the table each time corrections are made. This is a clear waste of time and a more efficient use of the application requires that this should be done with the use of the table of content feature in the application. Another common example is how to paginate a document based on different sections, which most students do not know how to do.

From the literature survey, the ICT skills required at undergraduate level can be summarised as those are identified as outlined by [9] as well as two additional competencies. These ICT skills are the ability to: independently operate personal computer systems; use software for preparing and presenting work; use internet and its various features; access and use information from WWW; use an e-learning platform; and perform data analysis using the computer.

Several researches have been carried out in various universities in order to determine the students’ level of ICT literacy. A study of 140 incoming business freshmen in the School of Business at The College of New Jersey was carried out by [15] in 2005 to determine if students had adequate skills to exempt them from introductory computer fundamentals course. The results show that the assumption that incoming freshman business students possess adequate knowledge of both computer concepts and computer literacy skills may not be accurate. The average score of 58 percent on the concepts pre-test and 60 percent on the Excel pre-test respectively suggests that students do not possess the necessary skills to function in an undergraduate School of Business. In the study, 64 percent of the students either failed or scored below 60 percent in one of the two tests. In addition, the percentage that failed both tests were 39 percent, indicating that only about one third of the freshman business students tested could be exempted from the course. They also noted that while some students may eventually pick up some computer skills during the course of their degree program, they would most likely learn them imperfectly and not to the degree that is required.

A similar study was carried out by [8] in 2004 on the computer literacy of university students majoring in computer information systems at Georgia State University. The results of the two-month pilot showed that 28.4% of graduate students majoring in Computer Information Systems (CIS) failed to pass all six exams. For undergraduate students, the results were much worse. Over 50% of CIS undergraduate majors were not able to successfully pass the six computer literacy examinations. Another study carried out in 2007 at Northern Arizona University. A pre-post-test of introduction to computer information systems was conducted to provide information on the level of the computer conceptual knowledge for the college of business students. The study results showed that most students did not possess sufficient proficiency to be exempted from the course. Nineteen of the original eighty students (a little under 24%) achieved a score equal to or greater than 60% on the pre-test. Even those students who achieved a passing score (60%) increased their computer conceptual knowledge by 15% [14]. A more recent study by [5] in 2008 analyses computer self-efficacy for two independent samples of students enrolled in an introduction to information systems course in 1996 and 2006 at the University of Northern Iowa and compared the results of the two years. They discovered that significant and substantial increases in computer experience and use did not translate into significantly higher levels of Computer Self Efficacy for the 2006 students.

A preliminary research from ETS as surveyed by [6] of college students revealed that majority of the students were not ICT literate enough to succeed academically. [12] studied incoming freshmen. The students’ perception of their abilities and the actual test on abilities were performed. Inconsistencies and disconnect were discovered with students actual abilities and their perceptions. Students were not able to perform basic research using technology.

3. RESEARCH METHOD

3.1 Hypothesis of the study

The general question is ‘Do students have the relevant ICT skills they need to do their research projects?’ In order to answer this research question, three null hypotheses were posited.

H1: There is no association between the students’ requirement in literature search and their Internet skills

H2: There is no association between the students’ requirement in report writing and their Microsoft Word® skills

H3: There is no association between the students’ requirement in data analysis and their skills in Microsoft Excel® and SPSS®.

In order to ascertain the literacy levels of students a study was carried out with year four (final year) students of the University of Botswana. The study was carried out between August and October 2009.

3.2 Sample size

The population for the study was also based on the same six faculties. It was estimated that the population size of graduating students in the 2008/2009 academic session will not be more than 2500. A sample size n=229 was the targeted for the study. The selection of respondents was through stratified random sampling. They were selected in a way that the identified departments were represented in the same proportion they exist in the population. Students were then drawn using simple random sample from each stratum. A total of 250 copies of the questionnaire were administered to volunteer students across the departments. One hundred and ninety four (194) usable responses were received. Ten (10) questionnaires were rejected due to incomplete answers to survey questions. Based on the target n=229, it resulted in 85% usable response rate.

3.3 The Instrument

The three related sections in survey instruments for the study were: basic information on demographics of the student, and the use of Computer Self efficacy to determine student’s proficiency level and task characteristics to identify the types of projects and required skills.
3.3.1 Computer self efficacy
Computer self-efficacy (CSE) instrument was used to measure the students’ ability. CSE refers to individuals’ judgment of their capabilities to use computers in diverse situations [1,6]. This study used self-efficacy in the context of computer use to measure the students’ level of competency in order to determine areas of gap in knowledge. Students were asked to rate their level of confidence between 1 and 5.

The self-efficacy comprises the following: online learning (3 items); basics of email, Internet and the WWW (16 items); advanced email; Internet and the WWW (10 items); basic computer operations (9 items), basic Microsoft Word skills (12 items), advanced Microsoft Word skills (14 items), Microsoft Excel skills (5 items) and Microsoft PowerPoint skills (4 items).

3.3.2 Task Characteristics
In the broad TTF perspective, tasks are defined as actions carried out by individuals in turning inputs to outputs in order to satisfy their information needs. However, as discussed by [2], there is a potential for some confusion with this terminology because organisation researchers sometimes define technology as actions used to transform inputs into outputs [4,9]. In order to differentiate technology from task, [2] defined task characteristics of interest as those that might move a user to rely more heavily on certain aspects of IT. However, because of the interest in the impact of IT, TTF researchers have sought to distinguish task from technology. TTF researchers conceptualise task before the application of technology. From a holistic TPTF viewpoint, tasks in this study are defined as actions performed by users in order to complete their final year projects. It could be data analysis, report writing, presentation, etc. In this research, the task is to carry out a final year project based on the requirements of the particular project and the type of research. The components of the task required by a research project can therefore be captured under two broad categories; the first describes the type of research while the second describes the actions by the user.

The types of research include: qualitative, quantitative, experimental, design, etc. The actions by the user include (i) literature search such as searching the Internet and WWW for information, and/or searching OPAC and databases available in the library, (ii) data analysis that involves analysing data using a spreadsheet software, analysing data using SPSS®, drawing charts using a spreadsheet software etc. (iii) report writing which could involve creating headers and footers, endnotes and footnotes, forms (questionnaires), tables and equations, sectionalisng pages, sorting references, creating indexes and table of contents, inserting graphics and pictures, etc. (iv) presentation which involves creating slides.

4. FINDINGS
In order to ascertain if students had the relevant skills they needed to do their research work, a cross tabulation and chi-square tests were conducted on each of the skills students said they required for their research work against the skills they said they possessed using SPSS. This is to confirm if there were any differences in skills based on the research that the students were doing. The results can be divided into literature search skills, report writing skills and data analysis skills.
4.2 Report Writing Skills requirement
Several skills were considered to be required for report writing. They ranged from the need for headers and footers, endnotes and footnotes, forms, tables, equations, pagination, and table of contents etc. The respondents were requested to note which ones are currently related to their projects and each of these was tested with related skills in the computer self-efficacy scale. In the nine skills tested, there was none with any significant difference. No significant differences were found with any of the report writing skills. This showed that there is no difference between those who needed report writing skills in their reports and those who did not have the skills. The association of the need for header or footer in document was \( \chi^2 (4,N=190)=4.267 P>0.05 \); creating a table of contents automatically was \( \chi^2 (4,N=188)=1.832 P>0.05 \); using styles to make my headers uniform was \( \chi^2 (4,N=191)=1.342 P>0.05 \); creating endnotes and footnotes was \( \chi^2 (4,N=191)=3.988 P>0.05 \); managing tables was \( \chi^2 (4,N=191)=1.495 P>0.05 \); inserting symbols or other special characters was \( \chi^2 (4,N=191)=4.826 P>0.05 \); inserting different pagination for sections was \( \chi^2 (4,N=194)=2.304 P>0.05 \); generating an index using the computer was \( \chi^2 (4,N=194)=4.394 P>0.05 \); with creating a chart/graph in Microsoft Excel® was \( \chi^2 (4,N=194)=3.727 P>0.05 \). Table 3 displays the level of confidence of those who said they needed the skills for their research, 46.4-87.3% were equipped with the relevant skills.

<table>
<thead>
<tr>
<th>Skills</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Sum (4-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident in header or footer into a document</td>
<td>11.40%</td>
<td>75.90%</td>
<td>87.30%</td>
</tr>
<tr>
<td>I am confident in managing tables in Microsoft Word®</td>
<td>12.60%</td>
<td>70.30%</td>
<td>82.90%</td>
</tr>
<tr>
<td>I am confident in resizing graphics and objects in Microsoft Word®</td>
<td>20.20%</td>
<td>52.40%</td>
<td>72.60%</td>
</tr>
<tr>
<td>I am confident in creating endnotes and footnotes in Microsoft Word®</td>
<td>24.40%</td>
<td>44.40%</td>
<td>68.80%</td>
</tr>
<tr>
<td>I am confident in inserting symbols or other special characters into Microsoft Word®</td>
<td>26.30%</td>
<td>40.40%</td>
<td>66.70%</td>
</tr>
<tr>
<td>I am confident in inserting different pagination for sections in Microsoft Word®</td>
<td>35.10%</td>
<td>29.70%</td>
<td>64.80%</td>
</tr>
<tr>
<td>I am confident in creating forms in Microsoft Word®</td>
<td>15.70%</td>
<td>43.80%</td>
<td>59.50%</td>
</tr>
<tr>
<td>I am confident in using styles to make my headers uniform in Microsoft Word®</td>
<td>16.40%</td>
<td>42.70%</td>
<td>59.10%</td>
</tr>
<tr>
<td>I am confident in creating a table of contents automatically in Microsoft Word®</td>
<td>21.10%</td>
<td>35.80%</td>
<td>56.90%</td>
</tr>
<tr>
<td>I am confident in generating an index using the computer in Microsoft Word®</td>
<td>19.60%</td>
<td>26.80%</td>
<td>46.40%</td>
</tr>
</tbody>
</table>

4.3 Data analysis skills
Data analysis skills are required in some projects. The students could either be using Microsoft Excel® or SPSS®

4.3.1 Microsoft Excel® skills
The respondents were asked to indicate if Microsoft Excel® skills were related to their research projects. Each of the identified Microsoft Excel® skills was tested with five related skills in the computer self-efficacy scale. A chi-square test was used to compare each dependent variable in the Computer self-efficacy scale with the required skill of data analysis with Microsoft Excel®. This revealed that there was no significant difference in the five variables between those who needed the skill for their research work and those who did not need the skills. The association of the need for performing simple calculations in Microsoft Excel® was \( \chi^2 (4,N=190)=4.629 P>0.05 \); with entering data into Microsoft Excel® was \( \chi^2 (4,N=194)=4.427 P>0.05 \); with doing data analysis in Microsoft Excel® was \( \chi^2 (4,N=188)=1.482 P>0.83 \); with creating a chart/graph in Microsoft Excel® was \( \chi^2 (4, N=194)=4.394 P>0.05 \); and with formatting a chart/graph in Microsoft Excel® was \( \chi^2 (4,N=193)=7.237 P>0.05 \). This showed that there was no significant difference in the skills between the students who had the need for data analysis with Microsoft Excel® for their research and those that did not need it. However, a look at the level of confidence of those who said they needed the skills for their research revealed that 46.1-80% were equipped with the relevant skills. This is shown in Table 4.

<table>
<thead>
<tr>
<th>Skills</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Sum (4-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident in entering data into Microsoft Excel®</td>
<td>18.5%</td>
<td>61.5%</td>
<td>80.00%</td>
</tr>
<tr>
<td>I am confident in formatting a chart/graph in Microsoft Excel®</td>
<td>28.4%</td>
<td>43.3%</td>
<td>71.70%</td>
</tr>
<tr>
<td>I am confident in creating a chart/graph in Microsoft Excel®</td>
<td>23.5%</td>
<td>45.6%</td>
<td>69.10%</td>
</tr>
<tr>
<td>I am confident in performing simple calculations in Microsoft Excel®</td>
<td>15.4%</td>
<td>52.3%</td>
<td>67.70%</td>
</tr>
<tr>
<td>I am confident in doing data analysis in Microsoft Excel®</td>
<td>21.5%</td>
<td>24.6%</td>
<td>46.10%</td>
</tr>
</tbody>
</table>

4.3.2 SPSS® skills
The respondents were requested to indicate if SPSS® skills were related to their research projects and each of these was tested against related skills in the two related skills in the computer self-efficacy scale. A chi-square test was used to compare each dependent variable in the Computer self-efficacy scale with the required skill of data analysis with SPSS®. The result of the test was significant for the two skills tested. A significant difference was found between confidence in coding data in SPSS® \( \chi^2 (4, N=192)=16.070 P<0.05 \) and confidence in analysing data in
spss\(\chi^2(4,N=192)=13.836\ P<0.05\). These showed that there was a difference between those who need the skills to analyse their data in SPSS® and those who did not need it. As shown in Table 5, the level of confidence of those who said they needed the skills for their research revealed that of the 85 (36.3%) who needed the skills, only 24.7 to 27%, a rather low percentage, were equipped with the relevant skills.

Table 5: Cross-tabulation of the need for SPSS® data analysis skills with relevant CSE skills

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Sum (4-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident in analysing my data in SPSS®</td>
<td>11.8%</td>
<td>12.9%</td>
<td>24.70%</td>
</tr>
<tr>
<td>I am confident in coding my data in SPSS®</td>
<td>12.9%</td>
<td>14.1%</td>
<td>27.00%</td>
</tr>
</tbody>
</table>

5. DISCUSSION AND CONCLUSIONS

5.1 Discussion

From the results of the survey, students were lacking in advanced word processing, advanced Internet, data analysis and presentation skills. These are the skills required in a research project. So it can be concluded that students do not have the relevant ICT skills information on the skills they require. This section discusses the answers to the three null hypotheses.

**H1:** There is no association between the students’ requirement in literature search and their Internet skills

The chi-square test between skill of searching the Internet and WWW for information and the three related skills in the computer self-efficacy scale revealed that there was no significant relationship between the three factors. Likewise, the chi-square test between skill in OPAC and online databases for information and the three related skills in the computer self-efficacy scale also revealed that there was no significance between the three factors. This implies that there is probably no difference between the students who need the skills and those who do not need it. The implication is that students will not be able to efficiently find the resources for their research project. Their skills are not related to what is required.

**H2:** There is no association between the students’ requirement in report writing and their Microsoft Word® skills

In terms of report writing and using some of the features in Microsoft Word® such as, endnotes and footnotes, forms, tables, equations, pagination and table of contents, the respondents were requested to note which ones are currently related to their projects. A chi-square test was performed on each of the related skills in the computer self-efficacy scale and there was no significant difference between the variables. This once again implies that there is no relationship between the students report writing requirements and the skills they currently possess. This implies that students’ skills are not at the level of the requirement for their research skills.

**H3:** There is no association between the students’ requirement in data analysis and their skills in Microsoft Excel® and SPSS®

A chi-square test between skills in analysing data using Microsoft Excel® and the related skill in the computer self-efficacy scale revealed that there was no significance between the three factors. A test of creating charts using Excel and the two factors in the computer self-efficacy also revealed that there was no significant difference. This implies that students do not have the required skills for their research project. A test between skill in analysing data using SPSS® and the related skill in the computer self-efficacy scale revealed that there was an association in students who needed the skills and the skills they possess. However, only about 24.7 to 27% were equipped with the relevant skills. This might imply that some of those who need the skills have acquired the skills already before doing their research work.

5.2 Conclusions

From the findings of this study, we conclude that contrary to the expectation/assumption that pre-school to primary and high school exposure to ICT will enhance students’ productivity at the university, was not confirmed in this study. Thus, students use the ICTs for other purposes other than those that can enhance their academic accomplishments. It is therefore recommended that there is need for a deliberate education and counseling for the students. A more focused approach can involve the integration of technology into the curricula of all programmes/departments. In addition, the computer literacy curricula in the University should be improved to include the desired skills in line with University Learning and Teaching Policy to promote in all graduates of the university information and communication technology knowledge and skills. It is recommended that ICT advance literacy skills should be integrated as part of research methods course in departments. The university could consider providing students with an IT fluency centre to enable individuals to concentrate on developing their skills. Development of technology teams of academic staff, IT staff, librarians and students that could help develop and support technology activities for research projects for different disciplines.

6. ACKNOWLEDGMENTS

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7. REFERENCES


