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# Enhancing employability skills of BSc Mathematics and Statistics Open and Distance Learning Graduates in Zimbabwe

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## Abstract:

The researcher has been teaching BSc Mathematics and Statistics (BSMS) students of the Zimbabwe Open University (ZOU) since 2007. Through day-to-day interaction and informal interviews with some students and employers within the city of Gweru, it was noted that most of the students who graduated after studying through open and distance learning (ODL) continued in their former career positions, the majority of them being teachers and few found better employment elsewhere. The majority of the graduates also seemed not to be able to create their own employment. Therefore, this study sought to investigate how employability skills of BSMS ODL graduates could be enhanced. Fifteen former and current students and fifteen employers who were purposively sampled responded to an open-ended email questionnaire. Their views were grouped into themes and qualitatively analysed using content analysis techniques. The respondents mentioned that the BSMS programme needed to have the research project component, that students had to be taught how to be creative, innovative and dedicated to practical work, and that they had to have theoretical as well as hands-on computer knowledge. The respondents also encouraged employers to form partnerships with universities and to engage students on attachment at their companies. In light of the findings and conclusions, the study recommends that the ZOU BSMS programme be biased towards Science, Technology, Engineering and Mathematics (STEM)-related courses and activities which can empower students to be inventors, innovators and problem solvers. It is also recommended that the Government's concept of ZimAsset which is intended for employment creation and economic growth can be realised if ZOU and employers work together towards enhancing employability skills of BSMS graduates.

**Keywords:** employability skills, employment creation, BSc Mathematics and Statistics, ODL graduates, STEM-related courses, ZimAsset.

## INTRODUCTION

The problem of university graduates roaming the streets and failing to acquire relevant and 'satisfying'

employment has been documented (Joshua, Azuh & Olanrewaju, 2015). There could be several reasons why

the graduates fail to get employment or even to create their own. Despite having good academic qualifications graduates should also have some working experience and other qualities required by employers. Employers expect new graduate recruits not to have weaknesses in both theory and practice (Chantara, Kaewkuekool & Koul, 2011). University graduates should have, according to (Weligamage, 2009, p.117), knowledge skills, thinking skills, personal skills, personal attributes and practical skills. They should also have positive attitudes towards learning and work.

According to Lantz, Jr. (2009), the functions of Science, Technology, Engineering and Mathematics (STEM) education are to develop students who are problem solvers, innovators, inventors, self-reliant, logical thinkers and technologically literate. It could be interesting to ask whether Zimbabwe Open University (ZOU)'s BSc Mathematics and Statistics (BSMS) graduates or even those from other Zimbabwean universities have such skills.

According to Chirume (2015, p.237), The BSMS programme at ZOU is a rigorous one with a total of 32 courses (modules) of which 16 are in Mathematics and the other 16 in Statistics. The entry requirements are a minimum of five "O" Level passes of grade C or better inclusive of English Language and Mathematics. Post "O" Level qualifications such as "A" Level, diploma or mathematics-related technical or teaching experience are added advantages. The degree can be attained in a minimum of 4 years and a maximum of 8 years through flexible open and distance learning. A student can graduate after passing at least 14 Mathematics and at least 14 Statistics courses. [Currently there are no courses on offer for Research Methods or Computer Applications or requirements for Attachment during the course of study as is done in other universities].

ZOU was mandated by the government through an act of parliament in March 1999 ([www.zou.ac.zw/aboutus/](http://www.zou.ac.zw/aboutus/)) to offer open and distance learning (ODL) programmes to its students. Most of these students were already working youths or adults but currently ZOU has been enrolling school leavers as well. It has been noticed that BSMS students of ZOU often expressed fear of failing to get satisfactory employment after graduating. Those already working appeared not happy with their salaries but could not get better employment in other sectors. This observation prompted this study to focus on finding ways of enhancing employability skills of BSMS ODL graduates.

### Statement of the Problem

It has been noted that most of the students who graduate after studying through ODL express failure to find better employment elsewhere and continue in their former career positions. The majority of the graduates also seem

not to be able to create their own employment. Such a scenario can cause stress and poor job deliverables in the graduate employees and this does not help to improve the economy of Zimbabwe.

### Purpose of the Study

This study sought to investigate how employability skills of BSMS ODL graduates could be enhanced.

### Objectives of the Study

The objectives of the study were:

- To investigate the views of current and former ZOU students regarding the BSMS programme,
- To explore the views of students and employers on the employability skills of BSMS ODL graduates, and
- To recommend strategies to be used to enhance employability skills of BSMS ODL graduates.

### Definition of Terms

The following are definition of terms as they relate to this study.

**Employability skills:** Weligamage (2009) views employability as having subject content knowledge, personal skills, personal attributes and practical skills that match employer needs. One can also add physical health since some employers would require graduates who are physically strong.

**BSMS ODL graduates:** In this study, BSMS ODL graduates are former students of ZOU who studied and completed the BSMS degree since its inception in 1999 up to the last cohort who graduated in November 2015. The term can be used to refer also to graduates of other institutions provided they have learnt mathematics and statistics courses only through the open and distance and e-learning modes rather than through the conventional modes. In the conventional system the lecturer is the main source of knowledge and lectures to a class of students whereas in the ODL mode, the module is the lecturer but tutors are there to offer guidance and counselling and academic assistance in case the learner fails to interpret information in the module.

**STEM-related courses:** STEM refers to Science, Technology, Engineering and Mathematics. In this study STEM-related courses are those courses within the BSMS programme that may involve partial or full integration with Science, Technology and Engineering. Such courses or modules may include Particle Mechanics, Fluid Mechanics, Mathematical Modelling, Operations Research, Ordinary Differential Equations,

Partial Differential Equations and Numerical Methods. Computer Programming, Research Methods and Communication Skills are not in the BSMS programme but are also STEM-related courses.

**ZimAsset:** ZimAsset refers to Zimbabwe Agenda for Sustainable Socio-Economic Transformation. This was a new policy document or economic blueprint crafted by the Zimbabwe Government whose purpose is, "...to achieve sustainable development and social equity anchored on indigenization, empowerment and employment creation which will be largely propelled by the judicious exploitation of the country's abundant human and natural resources." (Government of Zimbabwe, 2013, p.7). In the ZimAsset document, the key pillars or productive sectors of the economy have been identified as agriculture, mining, manufacturing and tourism (Government of Zimbabwe, 2013, p. 32). Hence universities in Zimbabwe need to equip graduates with entrepreneurial skills related (but not limited) to these key economic pillars.

### Review of Related Literature

There is no doubt that many people regard mathematics as an important and useful tool for solving real life problems. Despite mathematics' utilitarian value, mathematical grades are also used as selection tools for school graduates' future careers (Sfard, 2012), meaning that those who fail to be selected will not be 'empowered' thus causing a 'political' problem (Sfard, 2012). There is a high probability that most university graduates have passed school mathematics but the problem of those graduates failing to secure relevant employment has been documented (Alfred, Simon, Ashiagbor & Baku, 2008; Joshua, Azuh, & Olanrewaju, 2015). In Zimbabwe some university graduates reported selling phone accessories on the streets in order to make ends meet but the police would always close their 'shop' or chase them away because of illegal vending (Dube, 2014). Even those who had a Bachelor of Science Degree in Computers and Mathematics would join temporary teaching in the rural areas but were unsettled because their contracts could be terminated at any time (Dube, 2014). There could be several reasons why the university graduates fail to secure relevant and 'satisfying' employment. Possible reasons include unavailability of the jobs due to closure of industries, too many graduates churned out by universities competing for few available jobs, current job market preferring to recruit cheap labour rather than the academically gifted graduates, lack of capital to start one's own business, inability to create own jobs, most local graduates lacking praxis and experience or just not having employability skills.

The type of curriculum a university has can have a bearing on employability skills of its graduates. Rosa and Orey (2015, p.1) propose a 'three-legged' curriculum based on D'Ambrosio's *Trivium* and composed of *literacy*, *matheracy*, and *technoracy*. They define *literacy* as the

capacity students have to process information present in their daily lives; *matheracy* as the capacity students have to interpret and analyze signs and codes in order to propose models and to find solutions for problems faced daily; and *technoracy* as the capacity students have to both use and combine different instruments in order to help them to solve problems (Rosa & Orey, 2015, p.1). This type of curriculum is believed to help students meet the demands of life at home, at work and in the community. If graduates are able to create, process, and communicate information (literacy), to think analytically using signs, codes and models in everyday life (matheracy) and to integrate the use of technological tools such as computers, software, calculators and digital equipment (technoracy), their employability skills may be enhanced and they can become productive workers (Rosa & Orey, 2015).

Commenting on science, mathematics and ICT (SMICT) education in Sub-Saharan Africa, Ottevanger, Akker and Feiter (2007, p.41) point out that, "Graduating students from SMICT-based programs, including teacher education particularly at the degree level, often have more career opportunities, making teaching frequently a profession 'of last resort' taken up while graduates are looking around for other career opportunities." They also argue that university studies mostly deal with theory and are removed from direct practice and their laboratory experiments may not be related to direct real life situations. Thus graduates enter the labour markets "that increasingly demand modern knowledge and skills, readiness to take initiatives, and ability to solve problems and to innovate products and processes" (Ottevanger, Akker and Feiter, 2007, p. v), characteristics which most graduates do not have.

The Australian Government's Department of Science and Training (2005) have also listed some employability skills. These are self-management, initiative, enterprise, communication, teamwork, planning and organisation, problem solving and technology. These skills need to be developed in university graduates including those of ZOU's BSMS programme. Joshua, Azuh and Olanrewaju (2015) recommend that experienced industrialists should collaborate with Nigerian universities by drawing curricula and teaching some practical courses on part time basis. Nigerian universities could also boost employability profiles of their graduates by sending them on attachment to industries they would collaborate with.

In a study carried out in Ghana to investigate causes of university graduate unemployment, it was found that university programmes were responding poorly to the demands of the job market (Alfred, et al., 2008). It was recommended that there was need, at the government level to put forward a National Manpower Plan, at the universities level to shift orientation from theory type of education to practical type, at the employers and universities level to collaborate and at the graduates'

level to have a new mental orientation linking theory with practical work.

Weligamage (2009) gives the strategies to enhance graduates' employability skills as suggested by the University of Sydney. On knowledge skills they include applying theory to practice in familiar and unfamiliar situations; identifying, accessing, organising and communicating knowledge in both written and oral English; appreciating the requirements and characteristics of scholarship and research and using appropriate technologies in furthering all of the above. On thinking skills, they include exercising critical judgment; being capable of rigorous and independent thinking; becoming realistic self-evaluators; adopting a problem solving approach and being creative and imaginative thinkers. On personal skills they include working with others. On practical skills they include the ability to use information technology for professional and personal development (Weligamage, 2009, p.117).

Another strategy could be to enhance STEM learning in the schools through interdisciplinary research and holding of seminars of concerned stakeholders (Newcombe, Ambady, Eccles, Gomez, Klahr, Linn, Miller & Mix, 2009). Teachers should have positive STEM dispositions and high levels of subject knowledge and technology integration (Knezek, Christensen & Tyler-Wood, 2015) in order to impart knowledge to the learners. If STEM-related issues are addressed at high school level, students can go to universities with positive attitudes to embrace STEM education and STEM assessments and would be better prepared and better equipped for the job market.

According to Government of Zimbabwe's ZimAsset (2013), one of the key strategies that could empower Zimbabwean people and eradicate poverty is to improve entrepreneurial skills for tertiary students and graduates and to put in place special programmes for unemployed graduates. STEM-related courses and activities can help unemployed graduates to be job creators rather than merely job seekers. Within the City of Gweru in the Midlands Province of Zimbabwe would employers and BSMS former and current ZOU students agree with the idea of ZimAsset? What recommendations of enhancing employability skills of BSMS ODL graduates would they give?

## METHODOLOGY

### Population, Sample and Sampling Procedure

The researcher's email (contacts) list had a total of twenty-five employers in Gweru district and twenty-two former and current students of the ZOU BSMS programme. A total of thirty purposively selected respondents comprising fifteen former and current students of the ZOU BSMS programme as well as fifteen

employers in Gweru district all with 'working' email addresses constituted the study sample.

### Data Collection Instrument, Limitations and Advantages

Selected employers and students were asked to respond to an open-ended email questionnaire. Respondents were asked to give their opinions and recommendations on the main research question which was: 'How can employability skills of BSMS ODL graduates be enhanced?' However, e-mail questionnaires have got the limitations that respondents might just copy and paste other people's responses from the internet rather than giving their own personal views (<http://explorable.com/online-surveys>) and the response rate is low so that a 30% rate is normally considered acceptable (The Community, n.d.). Some respondents may fail to understand the message or easily delete it (Gingery, 2011). Many people dislike unsolicited email and findings cannot be generalised to the whole population (Phellas, Bloch & Seale, 2011). However due to the "rising penetration of computers and the increased ability to use computers by many people" (Phellas, Bloch & Seale, 2011, p. 188), the fact that email surveys are fast and cheap, and the idea that ODL cannot be divorced from e-learning, this study considered the advantages to outweigh the disadvantages and opted to use email questionnaires. The disadvantages were also overcome by looking for similar sentiments within the respondents' views and triangulating respondents' data with evidence from authentic sources gleaned from the review of related literature.

### Data Analysis Procedure

In this study, the respondents' views were qualitatively analysed using content analysis. According to Ratcliff (n.d., p. 4), content analysis involves looking at:

... documents, text, or speech to see what themes emerge. What do people talk about the most? See how themes relate to each other. Find latent emphases, political view of newspaper writer, which is implicit or look at surface level - overt emphasis.

Thus respondents' written texts (e-mails) sent to the researcher were critically analysed to see the most popular views and suggestions, what themes emerged and how they were related to one another for both students and employer groups. This analysis procedure was considered to be advantageous in the sense that, according to Busch, De Maret, Flynn, Kellum, Le, Meyers, Saunders, White, and Palmquist (2012), it could allow for both quantitative and qualitative operations

(although quantitative analysis was barely used), it could be used to interpret texts, relationships (similarities or differences) among themes, or could be used for purposes such as the development of expert systems. In this study, “the development of expert systems” could be viewed as new BSMS programme policies that could be developed by the university authorities.

## RESULTS AND DISCUSSION

### Students’ responses

Six of the fifteen former and current students responded to the email questionnaire giving a 40% response rate. Some students gave one-phrase answers such as ‘Employ dedicated tutors with strong academic qualifications’ or ‘Upgrade programme’ or ‘Send students on attachment’ without elaborating while others responded in two or three paragraphs with explanations and examples. The students’ responses were critically analysed to come up with the following themes: Teaching and Consultancy, Redesigning and Upgrading the BSMS Programme, Participation in Research Trips and Seminars and Involvement in Olympiad Competitions.

#### Teaching and Consultancy

Respondents said that during their degree programme, students who were already teachers or who would want to become teachers could be allowed to use acquired knowledge to tutor ‘O’ and ‘A’ Level students as part of their training. They could also offer consultancy in disciplines related to mathematics. After graduating, they could create employment by forming private schools and colleges where they could teach mathematics as well as run funded projects. In particular, one respondent echoed this point by saying, “*I suggest graduate students can combine with graduates from other subject areas and form private schools/colleges. They can develop project proposals for such big ideas to attract funding.*” If such suggestions as raised by the student-respondents could be implemented, universities would ensure that their students are not “quater baked” and that there would be no “mismatch between graduate training and the world of work” (Joshua, Azuh & Olanrewaju, 2015, p. 17, 18).

#### *Redesigning and Upgrading the BSMS Programme*

In a previous study students commented on the ZOU BSMS programme and said it “... is useful, applicable in a variety of contexts and increases promotion chances and employability status of the graduates.” (Chirume, 2015, p. 244). However, in this study the respondents recommended that the programme should be upgraded to an Honours status rich in Research Project and Computer Applications components. They also recommended that students enrolled in the programme should use computer software used in industry, business and academia.

#### Participation in Research Trips and Seminars

Respondents recommended that students should enhance their practical skills by embarking on research trips to Zimbabwe Statistics Agency (ZimStat) and to non-governmental organisations that use mathematics and statistics. ZOU could also organise research seminars where students could benefit by attending and sharing knowledge and skills with experienced professionals who would be invited to give talks and demonstrations. Echoing similar sentiments, one student pointed out that:

*In place of research trips, regional program coordinators can arrange with the students and devise their own tailor-made research seminars where experienced professionals in various fields of Applied Mathematics and Statistics are invited to impart their practical expertise to the students.*

Participation in research trips and seminars by students and sharing knowledge with experienced professionals could also lead to research collaboration and productivity. In a previous study on research productivity and collaboration such views were pointed out by respondents who said, “Students should also be involved in presentations and publications. They can work together with their lecturers.” (Thondhlana & Chirume, 2015, p. 67).

#### Involvement in Mathematics and Statistics Competitions (Olympiad type)

Current students complained that ZOU was not organising national or even international mathematics and statistics competitions for them. They suggested that by participating in these competitions (like the Olympiad ones), they could have the chance to share ideas and experiences with students from other countries and to network. One day they could find themselves employed in those other countries. This could be a way of collaborating with the (global) community and enabling students to ‘showcase their achievements and demonstrate mathematics projects and activities’ (Goos, Stillman & Vale, 2007).

### Employers’ responses

Employers were represented by their senior managers or Chief Executive Officers (CEO’s). Five of the fifteen selected employer representatives responded to the email giving a response rate of 33.3%. They said the suggestions they gave represented the policies and recommendations of their companies. These views were grouped into the following themes: Teaching and Consultancy, New Teaching Methods, Graduates’ Entrepreneurial Skills, Redesigning Course and Internship, Attachment or Fieldwork.

## Teaching and Consultancy

Employers were of the opinion that BSMS students who were temporary teachers or who would want to join the teaching profession should concurrently pursue the GradCE programme so that after completion they would become qualified teachers. Postolică, Nechita and Lupu (2014, p.232) opine that, "The pre-university teaching career is no longer attractive, nor materially or socially." Therefore, becoming qualified teachers as well as BSMS graduates could enhance the social status and improve income of ZOU graduates. During their training BSMS graduates could also offer consultancy services to some companies.

## New Teaching Methods

In order to enhance employability skills of BSMS graduates, employers' representatives proposed that lecturers should adopt new teaching strategies that lead to students being creative, innovative, critical problem solvers, and faithful team workers. Students also need encouragement and motivation to excel in the programme and lecturers should go the extra mile to ensure that students excel. The employers also pointed out that lecturers or the modules should avoid too much theory and let students 'like' and 'do' practical work. This agrees with the sentiments echoed by students in a previous study who said, "Our tutors do not explain the usefulness, applicability and opportunities offered by this programme" (Chirume, 2015, p.243).

## Graduates' Entrepreneurial Skills

Employers suggested that ZOU should tailor students' training to the needs of commerce and industry. For example, one employer said, "*Students need to be encouraged to think big as they still have the time*" while another one said, "*Praxis is an element absent in most of local graduates. Graduates lack both craft literacy and craft competence. They are not initiative.*" Thus the employers suggested that during their degree programme students should make tangible items that they can sell or use for their benefit or the benefit of the community. They should not shun manual labour but should be productive in aspects of their chosen career. These ideas are in tandem with the concept of education with production which seeks to promote learning with a combination of education and productive work (McGrath, 1993).

### *Redesigning Course*

Suggestions given by employers were similar to those pointed out by student-respondents who gave the recommendation of redesigning and upgrading the BSMS programme. Employers responded that ZOU could incorporate into its BSMS programme computing and information technology. They were of the idea that the

university should also develop in students a strong base of knowledge in mathematics and statistics related areas such as research methods, programming and modelling. Students should be assisted to acquire good writing and communication skills. Employers also pointed out, in line with Dubey and Singh (2014) that university curricula should have interdisciplinary programmes where mathematics students and students from other sciences could participate in collaborative or joint projects. The purpose of the joint projects would be to equip graduates with approaches and practices related to their future careers.

## Internship, Attachment or Fieldwork.

One of the employer representatives responded thus, "... *employers consider not only qualifications but also experience of graduates when recruiting them. Attachment provides experience and employees with a pass in Math as well as experience have more productivity and less margin of error.*" All respondents pointed out the need for university students to go for attachment during their degree programme. The importance of attachment was also recognised by the Ghana Employers Association (Alfred, et al., 2008, p. 11) which recommended that industry and training institutions in partnerships should, "set up committee for the development and implementation of a comprehensive and integrated industrial attachment/internship program for students in training." Even if students are already working for some company they may need to go for attachment to a related company or industry to enhance their experience and learn different ways of doing things. Currently ZOU has been enrolling school leavers in programmes such as BSMS and attachment or field work for these students may enhance their employability skills since they do not have any working experience.

## CONCLUSIONS

This study concludes that:

- The ZOU BSMS programme is too theoretical and has not been updated or reviewed since it started in 1999. A too theoretical programme does not help to enhance employability skills of the graduates.
- ZOU tutors normally tutor students on contents of the modules only and do not relate what they tutor to the career aspirations of the students.
- ZOU BSMS students do not go on assessed attachment or fieldwork to enhance their employability skills.
- ZOU BSMS programme does not have computer applications component and students lack

- computer skills which help to enhance employability skills of the graduates.
- ZOU BSMS programme does not have the research project component and students lack research skills which help to enhance employability skills of the graduates.
- ZOU's Midlands Regional Campus and employers in Gweru are not working in partnership to enhance employability skills of BSMS graduates.

## RECOMMENDATIONS

In light of the findings and conclusions the study recommends that:

- The ZOU BSMS programme should be redesigned and biased towards STEM-related courses and activities which can empower students to be inventors, innovators and problem solvers. Incorporating some aspects of Physical Education and Sport into the BSMS programme would be an added advantage since some employers would require graduates who are physically strong.
- ZOU BSMS tutors should employ new teaching strategies and methodologies that motivate students to want to learn and excel, not to shun work but to create employment and be productive during and after completing their degree programmes.
- ZOU BSMS students should go on assessed attachment at selected industries and organisations. There should be clear guidelines on what they should learn and do during the attachment period.
- ZOU BSMS programme should have the computer applications component through which students would acquire computer skills.
- ZOU BSMS programme should have the research project component through which students would gain research skills.
- There is need to implement the Government's concept of ZimAsset which is intended for employment creation and economic growth. This could be realised by ZOU and employers through partnerships that enhance employability skills of BSMS graduates.

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