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A Toolbox for Science and Mathematics Educators' Professional Guidance at Bindura University of Science Education

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Abstract:

In Zimbabwe there is a great demand for science specialists and science teachers since the scientific development of the country has to be fostered. However, the enrolment of students in the conventional courses of science and science teachers' careers at Bindura University of Science Education is very poor. Then, a group of lecturers is doing a research work related to vocational education, particularly to the professional guidance towards those careers. In this paper it is presented an action plan that contains actions to be developed by the university and the schools, involving the community and the learners' relatives. Furthermore, it is expected that the actions strengthen the relationship among the university, the schools, the learners' relatives and the community. Since the beginning of this research different methods and techniques are being used like surveys, interviews, observation, analysis and synthesis, induction and deduction, historical and logical, among others.

Keywords: Vocational Education, Professional Guidance, Science and Mathematics Teacher Formation, Higher Education

1. Introduction

Across the African countries quality education has been greatly challenged by critical shortages of teachers due to HIV/AIDS attrition and out of service teacher migration (UNESCO, 2008). Over the past two decades Zimbabwe has experienced the highest science teacher exodus due to persistent economic hardships. A survey undertaken by the Progressive Teachers' Union of Zimbabwe (PTUZ) approximated that 5000 teachers had left their jobs in 2005 and the numbers leaving the teaching profession had accelerated in the first months of 2006. The teacher turnover rate increased tremendously up to the year 2009 creating a demand difficult to supply through conventional teacher training means only.

Bindura University of Science Education (BUSE) launched an institutionally born intervention project named Virtual and Open Distance Learning (VODL) in Mashonaland central. The project initiated as an attempt to curb the demand of science teachers and in pursuance of the University mandate. BUSE is the sole institution in Zimbabwe whose name carries its mandate. The Bindura University of Science Education Act was gazetted in 2000. Since then, the University enjoyed a steady increase in the science student teacher enrolment up to 2006. There after the science teacher student enrolment has drastically gone down to near unsustainable levels in 2009. This scenario has threatened the University's fulfilment of its mandate.

Science teacher formation is of relevant importance, but, unfortunately, few numbers of students, all over the world, like to go to universities and get prepared for being teachers of Mathematics, Physics, Biology, Geography and Chemistry, for example. The situation in the conventional courses in these careers at Bindura University of Science Education is similar. The science teacher student enrolment has drastically gone down in 2009, as it was already noted. On the other hand, at schools there is shortage of teachers and some of them, already working, have left their jobs. At Bindura University some actions are done trying to solve these difficulty, but actually there is not a strategy designed with the purpose of motivating students at schools to enrol the conventional courses to be the future teachers of science, who will prepare the new generations for the development of this region in Zimbabwe. Pure science students' enrolment at Bindura University careers is also very poor.

It is in this context that these authors have realized that it was necessary to develop a research project which purpose is to propose a group of actions to motivate students towards the Mathematics and science careers at Bindura University of Science Education, as well as, the pure science careers, trying to guarantee their enrolment.

2. Materials And Methods

At Bindura University of Science Education, as a result of the shortage of teachers already explained, these researchers began searching on the issue of professional guidance. In the analysis of the results of different research works developed by different

specialists, by the study of the literature and by the diagnostic analysis done for the beginning of this investigation, applying an interview (See Appendix), it could be known that learners lack orientation towards their future occupation and / or profession and mainly related to the careers of science education, and schools, families and communities are not involved in this process. All this is manifested on the shortage of learners wanting and registering on those careers at Bindura University of Science Education.

The interview was applied at the university and at different schools to in-service and pre-service teachers and some members of the schools staff. The questions of the interview were related to the fact if they like to be teachers and why; which the characteristics they think a teacher should have; what they know about those careers, the sciences they prefer and would like to teach if they were teachers, the way they would like to be oriented about those careers, how they know about what they want to study and who participate in the process of vocational education/ guidance, particularly in the pedagogical professional guidance.

3. Results

The main weaknesses found were: lack of knowledge on the students' and teachers' part, poor delimitation and structuring of vocational/professional guidance scenarios that do not consider the integration of educational influences, the teaching of vocational / professional guidance is not based on curriculum guidelines that allow their proper development, absence of a nucleus that brings together the various activities of vocational/ professional guidance and the need of identifying professional guidance with the potentialities that for this work the university, the school, the students' families and the communities have (following the integrative tendency).

All this has permitted these researchers to determine the contradiction between the professional guidance in the instructional process of the schools and the inconsistencies in their organization and development, fact that limits the enrolment of the learners in the careers for being science teachers.

This way, the scientific problem to solve is the following: The insufficiencies in the professional guidance of the learners towards the careers of science and science teachers, limit their enrolment at Bindura University of Science Education.

In this investigation the concept of PEDAGOGICAL PROFESSIONAL GUIDANCE below guides its development:

"It is the process of helping relationships, upon a system of educational, psychological and pedagogical influences, where the school, the learners' families and the community get integrated to achieve the pedagogical self-determination of the learners." (Hernandez, O., 2012)

3.1. Actions

These authors have elaborated a group of actions, mainly practical ones, which involve the university, the schools, the students' families and the communities, in order to motivate students, to ignite students' passion for Science and Mathematics, to make them love Mathematics and science subjects:

3.2. Actions At The University

- Diagnose the causes of the shortage of enrolment of learners in those careers (needs analysis). Apply a survey/ interview at the university and at different schools to in-service and pre-service teachers, schools staff, etc.
- Include in the curriculum of each career, in the subjects **Management of Science Education** and **Pedagogics** the topic on vocational education.
- Elaborate a booklet containing information about the university and the science and science teachers' careers, as well as, their outstanding lecturers (to be distributed at schools).
 - Characterization of the Bindura University
 - Characterization of the Faculty of Science Education
 - Characterization of the Faculty of Science
 - Characterization of each career
 - .Object of study
 - .Curriculum
 - .Teaching practice/laboratory work/ field work
 - .Research activities
 - .Possible area of work
 - .Upgrading possibilities
- Film short videos presenting outstanding lecturers talking about their pedagogical experiences and their love for teaching (to be watched at schools)
- Film videos presenting laboratory and classroom activities, as well as, field work activities.
- Design a space/place in the website of the Faculty and / or university where information about the university, its careers and lecturers can be placed (news on what is being done in this area, curiosities related to the contents of the specialties, outstanding personalities representing the specialties; anecdotes related to the work of scientists and/ or teachers, examples of exercises that may call learners' attention, publish the booklet with the characterization of the careers, etc.)
- To coordinate with broadcasts, TV and other media in the country to have a little time/ space to talk/ write or inform about the teaching experiences of outstanding lecturers and teachers, expressing their love for teaching, characteristics of the careers, etc.

- Prepare short courses on vocational education and particularly on professional guidance for school teachers
- Donate to schools printed bibliography on the topic and elaborate other types of materials for the teachers, pupils and parents to consult them at libraries in schools
- Promote book presentation at schools; the topics should be related to this issue
- Make expositions of equipments and show their functioning to pupils from different schools
- Promote research works on this topic

3.3. *Actions That The University Should Coordinate With The Schools To Be Done At Schools*

- Determine/ propose a day each month that will be devoted to science issues (Science Day).
- Organize/ promote contests on sciences.
- Prepare activities in which the learners can see movies related to the lives of scientists or science teachers (giving them a purpose for watching).
- Organize groups of students interested in sciences and/ or pedagogical issues to develop activities out of the lesson time related to this issue, so that they can deepen on their knowledge, develop certain skills and get more motivated.
- Ask parents to attend seminars where they can be told about the science and science careers. The university lecturers should develop these activities and/ or prepare teachers from the schools.
- Invite parents who are teachers or lecturers to go to schools and talk about their experiences in their pedagogical profession; this can be done also with professionals on sciences, mainly with females.
- Select advanced pupils who like a given science to be assistant students working in different activities with the teacher/ lecturer in the lesson or in simulations.
- Ask pupils to prepare bulletin boards in the classroom and/ or school where they can paste information on: biographies on scientists and teachers of science from their schools, anecdotes and interesting scientific information, issues related to environment and sciences, health and sciences, disasters and sciences, sports and sciences, the pupils having the best results in science subjects, etc., with this an interdisciplinary work is also done.

4. Discussion

When implemented, it is expected that the development of these actions will increase the students' knowledge of the contents of the pedagogical and pure science careers. Moreover, their interest for them will be greater (greater intrinsic motivation) and they will give these careers more importance (greater extrinsic motivation). As a consequence, after studying their majors, they will have a better performance; they will feel satisfaction, trust, and wellbeing in the workplace because all this has been the result of their career aspirations.

The actions will help to motivate students, both intrinsically and extrinsically, towards the conscious and responsible election of the pedagogical and pure science careers of great demand in the territory, departing from the organization and development of the process. If this is achieved, then one can talk of the pedagogical self-determination of the students.

5. Conclusion

The integration of the school, the students' relatives, the community and the university, with their necessary interrelationships, in the process of professional guidance and, particularly, in the process of pedagogical professional guidance is of great importance. This new model, with the partnership of the university, the schools, the students' families and their communities for career decision making, should overcome the traditional way of developing this process at school and at homes. This old model, somehow, denies the formative potentialities of the university that forms the teacher, of the school that is forming the students every day, the families who share their lives with the students and the communities where the school is, where the university is placed and the community where the students live.

The group of actions is flexible; it can be applied in different contexts for stimulating student's career aspirations and career choices. Most of the actions are not so difficult to be applied by the university, the schools, the teachers, and the communities; that is why, these researchers are giving their first steps in their implementation.

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7. Appendix

Interview To Determine The Pedagogical Interests Of The Students

Dear students,

These lecturers are carrying out a research project in order to propose some actions to help solving the limitations in the students' enrolment in the different pedagogical and pure science careers at Bindura University of Science Education. We would be grateful if you answer the questions we are going to formulate you.

Thanks for your help.

The researchers

Questions

- Would you like to be a teacher? Why?
- Which are the characteristics that you think a teacher should have?
- What do you know about this career?
- From the subjects you have received, which one do you prefer / like the most?
- Would you like to be informed about the different pedagogical careers?
- How do you think this orientation can be done?
- Who do you think can help you in knowing about this career? How?
- Do you know if any of the courses taught at the university include in their course outlines the study of vocational education?

Note: These questions were adapted according to the persons interviewed, that is, some questions were specific for the university staff.