Assessment of the implementation of the Pioneer Secondary School Science Teachers Education Programme in the three Primary Teachers Colleges in Zimbabwe

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***Abstract*: The research was concerned with assessment of the Secondary Science Teacher Programme that was introduced in the three Primary Teachers Colleges namely Masvingo, Mkoba and Joshua Mqabuko Polytechnic. Interviews were held with Administration personnel in the three colleges to find out how administration dealt with financing and staffing of the programme. Focus group discussions were held with members of the lecturing staff running the Secondary Science Teacher Programme in the three colleges, to find out the support that they got from administration to run the program, how the program was structured and implemented. A questionnaire was administered to students of the pioneer group who completed the course to find their opinions on the course. Findings were that the three colleges received money from the government to buy science equipment, books and consumables to run the course. All the three colleges used lecturers already in college to kick-start the programme. Learning space was also shared between the Primary and Secondary programs. Generally, lecturers running the programs were qualified to teach at that level. Programs that were running in the three colleges were comparable in terms of content but differences' were seen in assessment and lack of practical activities in the colleges. Recommendations were that the University of Zimbabwe could revisit assessment in the Handbook guidelines while colleges could revisit their criteria of selecting students and structure of the course in terms of subject combinations. It was recommended that the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development could help colleges by sourcing for equipment and resources from a central point. The Ministry could also provide colleges with learning space and more lecturers to run the programme.**

I. BACKGROUND TO THE STUDY

The quality of teachers has been viewed as the major influence on students learning in the field of Science (Darling-Harmond, 2000; Hattle , 2009 in Luft, etal, 2020). Science is the term for school subjects that deal with natural phenomena and the scientific exploration of them. Science in school draws on astronomy, physics, chemistry, geology, geography, and biology.

Plunkett & Dyson,(2011) observe that meeting the demand of highly qualified Science teachers can be challenging. Science and technology are seen as the keys to socio-economic development in an increasingly interconnected world and it is therefore important for developing countries that include Zimbabwe to embrace science since it is a vital tool to accelerate the country's socio-economic development (Majo, 2016). Kaptain and Timurlenk (2012) argue that Scientific knowledge is the common heritage of humankind which should be provided to bring about acceptable quality of life for the majority of the people. They however observe that there is a challenge of insufficient number of Science teachers. Chitate, (2016) says while Zimbabwe embarked on a drive to increase the numbers of learners taking Science subjects at secondary schools, there was the serious shortage of qualified science teachers.

Mpofu et.al (2012) have an opinion that the Millennium Development Goal (MDG) of Education for All (EFA) may not be achieved due to some challenges in the education sector that include the severe shortage of science teachers especially in developing countries and Zimbabwe not being an exception. Avolos, (1995) noted that, in countries aiming at growth in industrial output, although science education is considered an important factor, its quality is often viewed as far from satisfactory.

Kaptain & Tumurlenk, (2012) indicate that very few learners take up science subjects at school if there is no policy that these subjects are compulsory. This kind of scenario leads to fewer applications for science courses and the supply of science qualified personnel is reduced resulting in skills shortages in most sectors including teacher production.

In the research by Kaptain and Timurlenk (2012), it was revealed that 44% of the science teachers had qualifications in Biology, 25% in Chemistry and 19% in Physics and the remainder were generalists teachers. This suggests that some learners were being taught by teachers with no relevant science qualifications.

In his address in Matebeleland, Minister Dokora, (2014), indicated that Zimbabwe was in short supply of 1500 Science and Mathematics teachers. He said this shortage undermined the Government's desire of having more learners studying these subjects which the Government had identified as

strategic in the development of the country. The Minister mourned the lack of Science teachers that had led to the production of learners with no science skills.

On the same token, the Minister of Higher and Tertiary Education, Innovation, Science and Technology Development Professor. Murwira, indicated that the country had serious shortage of secondary science teachers following a brain drain to neighbouring countries. During the graduation ceremony at Mkoba Teachers College, the Minister told the gathering that his Ministry had identified three Primary Teachers Colleges which were to be given additional mandates to train secondary science teachers to alleviate the critical shortage.

At the launch of training of Science teachers at Mkoba Teachers College in July 2018, the then Permanent Secretary of Higher and Tertiary Education, Science and Technology Development, Dr. Sibanda (Ministry of Higher and Tertiary Eduction, Science and Technology Development, 2018), indicated that the supply conduit of qualified Ó level graduates with requisite Science and Mathematics subjects was stifled by shortage of qualified Science and Mathematics teachers at secondary school level. In an effort to increase the production of science and mathematics teachers, the Ministry had decided to increase secondary teachers colleges that train such teachers from three to six. During the same event, the Minister of Higher and Tertiary Education, Science and Technology Development Professor Murwira told the gathering that his Ministry had put in place intervention strategies to address the critical shortage of Science and Mathematics Teachers in the country. The strategy put in place gave three Primary Teachers Colleges namely, Masvingo Teachers College, Joshua Mqabuko Nkomo Polytechnic and Mkoba Teachers College additional mandates to train Secondary Science teachers.

Ekes, (2001), in Mertogu & Sayan, (2020), observe that in many countries of the world, Science Course is taught as an essential course. As being an essential course in the programs, it has a big importance of teaching of science education. Countries emphasise science education not only to educate young generations in accordance with the requirements of the century and to raise scientists but to get them to gain daily life skills, to improve their ways of thinking, and to develop their problem-solving skills.

1.2 Problem Statement

The emergence of rapid growth in scientific knowledge and the ever increasing pace of technological change in society in general and at work place in particular has presented Science education with challenges (Machingambi , Oyedele, Chikwature, & Oyedele, 2018). The brain drain to regional and international destinations for supposedly greener pastures was a huge blow to Zimbabwe's science teaching. Nationally, the available number of science teachers dropped tremendously and science subjects could not be offered at some schools (Pedzisai, et al., 2012).

The period 2000-2010 witnessed Zimbabwean schools being hard hit by shortages of trained science teachers due to low enrolments at teacher training colleges, brain drain, and economic challenges faced by the country (Chetsanga, 2000). Mhishi, Bhukuvhani, & Sana (2012), observed that conventional science teacher education delivery system could not totally cater for the local demand for science educators.

Having observed these challenges, the Ministry of Higher and Tertiary Education, Science and Technology Development decided to increase the number of Secondary Teachers Colleges from three to six by giving three Primary Teachers Colleges additional mandates to train Secondary Science teachers starting May 2018. The research's intent was to find out how the program for the pioneer group was implemented in the three colleges.

1.3 Research Questions

1. How was the program financed?
2. What physical and human resources were available to start the program?
3. How were the syllabi implemented in the three colleges?

1.4 Assumptions

It was assumed that

(a) Students were to answer questionnaires honestly.
(b) Participants in the interview and focus group discussions were going to provide accurate and honest information.
(c) Reliable data collected was to adequately answer the research questions.

1.5 Significance of The Study

The research will help the Department of Teacher Education (DTE) to help Colleges craft syllabi that are in tandem with world trends in both teaching and assessment. The research will help the Department reflect on the autonomy of colleges versus best practices.

The research will also help colleges to reflect and take a deeper look at their current practices in comparison to other colleges. It is hoped this reflection would result in a better product.

Students in the three colleges would benefit from reflections by DTE and colleges as they will be trained in line with the minimum bodies of knowledge and practices the colleges are likely to come up with.

1.6 Delimitation

The research was limited to the three Primary Teachers Colleges that were given the mandate to train Secondary Science Teachers.

II. LITERATURE REVIEW

2.1 Curriculum Assessment

Assessment is a broad term defined as a process for obtaining information that is used for making decisions about students; curricula, programs, and-schools; and educational policy (American Federation of Teachers, National Council on Measurement in Education, and national Education Association, 1990, Anthony & Susan, 2005) in Qu & Zhang, (2013). Ghaicha, (2016) views assessment in Education as a vital component of evaluation that is critical for educational institutions. It is an integral part of instruction that determines whether or not the goals of education have been met (Lucas 2008). Wagner,et.al (2011) have a view that assessments are carried out in order to ascertain whether desired and planned educational goals are achieved and the results can then be used to modify curricula or refashion numerous other aspects of the educational system. Besides the above, the assessment results in some cases could be used for accountability purposes such as making resources allocation and for public awareness of educational issues. At institutional level, assessment allows departments or division heads to evaluate the effectiveness of the entire programs and determine what and how well the students have learnt.

Curriculum assessment is a process of gathering and analysing information from multiple sources in order to improve student learning in sustainable ways (Wolf, Hill, & Evers, 2006 p2). They further assert that if curriculum assessment is done properly, it actually helps to seed a culture of engagement, an ethos of conscious and intentional reflection and transformation.

Assessment for a syllabus can be viewed as involving measurement, reporting and interpretation of student learning and development an analysis that embraces both formative and summative (Curaj, Pricopie, & Scot, 2015)

Assessment does not only inform instructional decisions made on a day-to -day basis but also assists in diagnosing strengths and weaknesses of students that are related to classroom instruction (Tosuncouglu, 2018) Feedback obtained from assessment while essential to students is also helpful to teachers as it informs them to shape their teaching practices.

Nitko, 2004; Reynolds, Livingston, and Wilson, 2006, cited by (Stognieva & Popov, 2021) say assessment in Higher Education allows instructors to make judgements about individuals' progress or efficiency of programs regarding student learning, the curriculum and instruction. Results of assessment are then used to enhance the quality of educational provision.

Amua-Sekyi (2016) citing (Biggs, 2003; p.141) says assessment is also used in 'selecting, controlling or motivating students, and to satisfy public expectations as to standards and accountability'. At exit point, assessment works as an essential assurance to a number of stakeholders as it informs them that the students have attained various knowledge and skills and that they are ready for employment or further study.

2.2 Curriculum Development

The curriculum that was used for the Secondary Science program was developed by the individual colleges and submitted to the University of Zimbabwe Department of Teacher Education (DTE) for approval. The current arrangement is that all teachers colleges fall under the University of Zimbabwe. Teachers colleges are autonomous and therefore they develop their curricula and submit to DTE as the quality control institution for approval (Department of Teacher Education, 2015). Quality assurance is critical in curriculum development for the accredited institutions to ensure autonomy, academic freedom, quality efficiency of educational processes (Geda, 2015, Maniku 2008) cited by (Kigozi, 2020). Kigozi, (2020) further notes that quality assurance is conducted at programme and institutional level, which both are subjected to internal and external evaluation.

Moyana, (2016) says quality assurance is often variously defined as any systematic process of checking to see whether a product or service being developed is meeting specified requirements.

Jamaica Tertiary Education Commission, (2020) suggests that the quality assurance process should check whether teacher education programmes provide instructors, curricula reflecting theory and practice, assessment methods and supporting resources to facilitate student teachers' acquiring experience with teaching and learning approaches and assessment methods that ensure competence to operate effectively in the classroom after graduation and certification.

While Teachers Colleges develop their curricula, DTE provides associate colleges with guidelines in syllabi development as tabulated in the Handbook.

2.3 Effect of Lecturers' Qualification on Student Performance

Research revealed that students taught by teachers with higher qualifications and more experience performed better than those taught by teachers with lower qualifications. It was also noted that students performed better in physics when taught by professional teachers (Owolabi, 2012). Heinesen(2010) appears to be in agreement with Owalabi by observing that the teachers' ability and competence prove significant in improving students' performance. In support of the assertions above, Zuzoysky (2019) says several studies show a positive relationship between teachers' qualifications and their Impact on student achievement. Abe (2014) revealed that, teacher's characteristics such as certification status and degree in area of specialisation are very significant and positively correlated with students learning outcomes in science and mathematics.

2.4 Role of Science Equipment

Mertoglu and Sayan, (2020) cite Karamustafaoğlu, (2006) who sees the use of equipment in education as having an important role in the success of the program by preparing an effective classroom environment and helping students to achieve the objectives specified in the program. All tools, equipment and resources used in the development of students'

knowledge, skills, attitudes and values are called teaching materials.

Millar,(2004) suggests that since the subject matter of science is the material world, it seems natural, and rather obvious, that learning science should involve seeing, handling and manipulating real objects and materials. Practical work therefore becomes an essential component of science teaching and learning, both for the aim of developing students' scientific knowledge and that of developing students' knowledge about science.

Edessa, (2016) in reference to Ethiopian Higher Education observes that the process of teaching biology needs consistency and innovation of instructional materials and resources to execute pertinent practical activities to produce professional workers after graduation. This was after a research carried out on university biology trainee teachers reflected that the graduates had poor access to instructional materials and resources.

Abbasi and Mir, (2012) imply that physical resources and staff competence are important in determining the performance of students. Incorporating inquiry-type activities in school science is inhibited by limitations in resources including access to appropriate technology tools (Hofstein & Lunetta, 2004). Due to the importance of science education,George, (2017) suggests that countries especially developing countries should invest in these subjects in order to improve appreciation of these subjects.

A research by Ruparanganda, (2019) on Biology teaching in Zimbabwe reflected a gloomy picture. In that research teachers in most secondary schools indicated that there was generally lack of laboratory equipment and chemicals suggesting that learners did not have an opportunity of hands on approach when learning the subject. In the same research, Ruparanganda revealed that the older teachers said they were not able to use advanced educational technologies in their teaching because they were not exposed to the gadgets during their training while the younger teachers expressed concern over the lack of electronic boards in their classrooms.

2.5 Entry Requirements

Sorge, et.al., (2019) citing Grossmanet.al. (2019) suggest that teachers need to have the relevant subject matter knowledge. This means that pre-service trainees should have passed the subjects they intend to teach prior to embarking on teacher training. It is possible to define some general guidelines on what is desirable for initial teacher education to include a strong subject-matter knowledge (Musset, 2010). In order to enter teachers colleges, applicants need to have educational attainment at least equivalent to that of a high school diploma (Kwak, 2019).

Yusuf (2011), Adeosun, (2012), Darling-Hammond (2000) cited by Ijioma, Afurobi, Izuagba and Ifegbo, (2014) strongly support the model of initial teacher preparation where the student teacher's special subject area is relevant to the school curriculum. The implication is that the student teacher is enrolled on the basis of the subject she/he will teach after completing the course.

Staffolani and Bratti (2002) cited by Martha (2005) found that high school grade point average is consistently the best predictor of college grade of students. And also the similar study by Anderson, Benjamin and Fuss (1994) on the determinants of success in university found out that students who performed better in high school also perform better in college and the researcher suggested that high school grades were predictors of academic performance at college without doubt (Yigermal, 2017 p7). This is considered to be a suggestion that students enrolled on the strength of subjects done and passed at secondary school would enable the students to perform well due to the subject background knowledge they have.

In the research they carried out with students in Physics and Computers at Bindura University of Science Education, Zezekwa and Mudavanhu, (2011) revealed that students who had enrolled without background in the subjects they studied at A Level performed poorly. This suggests that it is necessary to consider relevant subject qualification when enrolling students onto the course to ensure that they advance knowledge in the particular subject at tertiary level rather than beginning to learn it from start. Even if the student marginally passes the subject at exit the teaching after graduating is likely to be less effective due to lack of confidence in delivery of the content.

III. METHODOLOGY

The research focused on assessing the Secondary Science Teachers programmes in the three Primary Teachers Colleges, (Masvingo Teachers College, Mkoba Teachers College and Joshua Mqabuko Polytechnic College) after the mandates of the three colleges were extended in 2018 to include the training of the secondary science teachers. A mixed research approach that used both quantitative and qualitative data was used. Using both the qualitative and quantitative approaches has the potential to offset shortcomings of one method, thus offering more validity and reliability (Nur-E , 2019). Qualitative research aims at gathering an in depth understanding of human behaviour and the reasons that govern such behaviour. According to Trochim (2006) qualitative research aims to get a better understanding through first-hand experience, truthful reporting and quotations of actual conversations. It aims to understand how the participants derive meaning from their surrounding and how their meaning influences their behaviour ((DeWalt & DeWalt, 2002). On the other hand quantitative research is suitable when answering the research questions that seek to investigate the questions how many, how much and to what extent (Md Shidar, 2017).

Population

Population is said to refer to an aggregate of individuals that are of interest and remain the focus of the investigation (Gard , 2016). Creswell (2012) suggests that in a school set up, all

administrators, all teachers and all learners would form the population of the study. In this case all the administrators in the three colleges formed the population, all subjects lecturers and all Science Pioneer Program students were included in the population under investigation. The prrgram of study is regulated by the same university therefore the syllabi is not very different although each institution has the autonomy to produce its syllabuses which are approved by the University of Zimbabwe as the awarding body. The college administration was selected as the board that runs the afairs of the institution while subject lecturers were expected to have first hand information on how the program had progessed in the three institutions. The students being the main beneficiaries of the program were very critical in judging the success or failure of the teaching and learning episode.

Sammple

Once this target population has been identified, the researcher needs to assess whether it is possible to study all the individuals for an outcome but usually, all cannot be included, so a study population is sampled (Garg, 2016).

Purposeful sampling is a technique widely used in qualitative research for the identification and selection of information-rich cases for the most effective use of limited resource (Patton, 2016). Palinkas, et al., (2015) suggest that purposeful sampling involves identifying and selecting individuals who are especially knowledgeable and have experience with a phenomenon of interest. Besides knowledge and experience, Bernard (2002) says importance of availability and willingness to participate and explicitly communicate experiences and opinions in a reflective manner is crucial.

For this study, the researchers selected College administrators who were responsible for the allocation of both material and human resources while lecturers for every subject were involved. It was the desire of the researchers to include students from the three colleges for its sample, but due to the COVID 19 pandemic, in one college the students were not available during the time of carrying out the study. The two colleges whose students answered the questionnaire gave an overwhelming response as reflected in the results.

To assess the programmes, in- person Focus Group Discussions (FGD) (Vaughan, 2017) were held with administration personnel and lecturers in the three colleges. FGD with administrators looked at how the programme was financed, how colleges were able to provide teaching space, equipment, staff and recruitment of students for the programme. FDG with lecturers looked at support they got from administration, model of programme they used, qualifications of students that were recruited and opinions on running the programme with the first cohort of students.

Document analysis was done on the syllabi to check if the programmes met the minimum body of knowledge for the programmes on offer. Common topics were identified and any differences in syllabus content noted. Document analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic (Bowen, 2009). Corbin and Straus, (2008), cited by Bowen, (2009), define document analysis as a systematic quality research procedure for reviewing documents where the researcher examines and interprets data in order to gain understanding and eventually develop empirical knowledge

Secer and Erisen, (2020) suggest that document analysis is applied on documents obtained from the relevant institution in order to determine weaknesses and strengths of the program.

A checklist of equipment and textbooks in each of the subjects offered was done. The aim was to check on adequacy of the equipment to kick-start the programme. Other items checked were teaching and learning software that were in place, available textbooks and teaching and learning materials (e.g. chemicals for experiments).

A questionnaire was used on the first cohort of students. The questionnaire looked at time, content, depth of coverage, availability of the Internet, availability of teaching and learning equipment and resources for both their Main Subjects and Professional Studies Syllabus B. The questionnaire looked at support students received from lectures on setting Continuous Assessment of Learning Areas (CALA) and community involvement. The questionnaire also asked about the support they got during their teaching practice on staff development and community involvement. The final section of the questionnaire requested students to indicate any other comments they had about the programme.

IV. RESULTS

4.1 Financing of The Programme

Interviews were held with Administrators that included the Principal, Vice Principal and Accountant at each institution. One question particularly asked Administration on how the programme was financed. All colleges indicated that the major source of finance was the Zimbabwe Development Education Fund (ZIMDEF). The funding came in three tranches of ZWL 500 000, ZWL 500 000 and ZWL 5 000 000 to each of the three colleges. Administrators appreciated this funding, which was used to procure teaching and learning equipment and consumables. All the colleges used the money to buy science equipment, science chemicals for experiments, textbooks and equipment for Geography, Biology, Mathematics and Agriculture. Tuition fees from students supplemented the ZIMDEF finances.

However, Administrators noted challenges in utilising the ZIMDEF funds. All colleges indicated that it was very difficult to purchase science equipment and materials in Zimbabwe using the local currency. Problems noted included lack of suppliers for science equipment and materials and a volatile economic climate. On lack of reputable suppliers, administrators noted that the few that were available failed to deliver after tender evaluation because of price volatility. In most cases tenderers would quote a price using the existing prices but when it came to supplying, in most cases the

suppliers found out that the prices of goods would have gone up, and hence their failure to supply. Colleges had no option but to go back to tender again. This, however, meant that they could not buy the originally intended equipment, as the money would have been eroded. Colleges ended up buying fewer items than originally intended and in some instances buying completely different items.

Colleges also noted that ZIMDEF acquittals required receipt values of equipment of materials procured and yet buying of the items also involved a 2% transfer tax which ZIMDEF did not want to acknowledge. Colleges suggested that if possible ZIMDEF could acknowledge the 2% tax and allow colleges to acquit taking into account the tax. Another suggestion given was that colleges would indicate their requirements and then these could be bought from a central point as was done with laptops (bought at Ministerial level). That was viewed as having the advantage that colleges could be able to get equipment and materials that are not locally available, just as the laptops. The other advantage would be that colleges could benefit from economies of scale.

4.2. Staffing

Administrators were asked on where they got staff to start the Science Teacher Education Programme. Masvingo Teachers College and Mkoba Teachers College indicated that they used the lecturers that were already in college. They looked at the staff meant for the Primary Teacher Education programme who had the requisite qualifications and seconded these to the Secondary Science programme. Joshua Mqabuko Nkomo Polytechnic made use of visiting lecturers from Hillside Teachers college before they got the secondary complement. The government, through the Public Service Commission, later increased the staff complement of these colleges in recognition of the Secondary Science Programme. Colleges were then able to recruit staff for this programme.

Although seconding lecturers to the Secondary Science programme worked, it meant lecturers were over-stretched in the three colleges. Lecturers made extreme sacrifices, and as one college put it – It would be advisable to give lecturers who kick started the programme some recognition through monetary incentives for the extreme sacrifices that they made to kick start the programme. To illustrate how lecturers in the three colleges are over-stretched one particular participant noted that in established colleges such as Hillside and Belvedere Technical Teachers Colleges subject areas had a minimum of four lecturers per subject, yet in the case of the three colleges an establishment of only two lecturers per subject was made. This means lecturers are still over-worked. (listen audio: in Appendix).

Qualifications of lecturers manning the programme in the three colleges was also looked at. Teacher qualification and subject major were found to be high positive predictors of student performance in science (Antony & Elangkumaran, 2020). Research has also revealed that students taught by teachers with higher qualifications and more experience performed better than those taught by teachers with lower qualifications. It was also shown that students performed better in physics when taught by professional teachers (Owolabi, 2012). Heinesen (2012) appears to be in agreement with Owalabi by observing that the teachers' ability and competence prove significant in improving students' performance. In support of the assertions above, Zuzoysky (2019) says several studies show a positive relationship between teachers' qualifications and their Impact on student achievement. Abe (2014) revealed that teacher's characteristics such as certification status and degree in area of specialization are very significant and positively correlated with students learning outcomes in science and mathematics.

Below is a summary of the lecturers per college and qualifications for each subject area. Of the three colleges, only Masvingo Teachers College offered Agriculture and comparison on lecturer qualifications were not done in this subject.

Table 1

Qualifications		Masvingo	JMN	Mkoba
Applied Maths	Masters	2	1	1
	First Degree	1	2	
Biology	Masters	3	1	2
	First Degree		2	
Chemistry	Masters	1		2
	First Degree	2	2	
Physics	Masters	1		2
	First Degree	1	2	
Pure Mathematics	Masters	3	1	2
	First Degree		1	
Geography	Masters	2		2
	First Degree			

4.3.1 Applied Mathematics

At Masvingo Teachers College, three lecturers manned the subject area. Two of these had a Masters degree while one had a first degree. It can be deduced that lecturers manning Applied Mathematics at Masvingo Teachers College had the requisite qualifications. If the above literature is anything to go by, then students at Masvingo Teachers College could be expected to receive expert coaching in Applied Mathematics and subsequently excel in their studies. The same can be said of Mkoba Teachers College. However, Mkoba Teachers College, had one member manning Applied Mathematics. This could seriously affect the knowledge students are likely to get, as one member cannot be an expert in both Mechanics and Statistics. At JMN, there were three lecturers operating in Applied Mathematics with one having a Masters degree while the other two had first degrees.

In terms of number of lecturers operating in the subject area, Masvingo Teachers College and JMN had adequate manpower, while Mkoba Teachers College was seriously constrained. Mkoba Teachers College was expected to

urgently address man-power in the subject area by recruiting more lecturers.

4.3.2 Pure Mathematics

In Pure Mathematics, the three colleges each had two lecturers operating in the subject area. At Masvingo Teachers College one had a Masters degree while the other had a first degree. At JMN and Mkoba Teachers College, both lecturers in Pure Mathematics had a Masters degree. Pure Mathematics in the three colleges had adequately qualified lecturers to take care of the subject area and it was expected that students in the three colleges were to perform well in the subject area as it has been shown that teacher qualifications is a positive indicator for student performance (Antony & Elangkumaran, 2020; Owolabi, 2012; Abe, 2014). However, there is need to increase the members of staff in the three colleges operating in the subject area, especially when enrolments increase.

4.3.3. Biology

In Biology, Masvingo Teachers College had three lecturers with a Masters degree, JMN had three lecturers, one with a Masters degree and the other two with a first degree. Mkoba Teachers College had two lecturers both with a Masters degree. The subject area of Biology had sufficiently qualified members of staff in the three colleges. Mkoba Teachers College could consider increasing man-power in the subject area.

4.3.4 Chemistry

Chemistry is taught by one lecturer with a Masters degree and two with first degrees at Masvingo Teachers College and at JMN, while at Mkoba Teachers College Chemistry was taught by two lecturers both with Masters degrees. Chemistry had the requisite man-power in the three colleges.

4.3.5 Physics

Physics is also adequately manned in the three colleges as there was one lecturer with a Masters degree and one with first degree at Masvingo Teachers College, two lecturers with Masters degree at Mkoba Teachers College and two lecturers with first degrees at JMN. JMN could do better by recruiting some lecturers with Masters degrees.

4.3.6 Geography

Geography is only offered at two colleges that is Masvingo and Mkoba Teachers Colleges In both colleges the subject area had two lecturers each who held Masters degrees. The subject area had highly qualified personnel operating in the subject.

4.4 Entry Qualifications and Subject Choice

4.4.1Masvingo Teachers College

Subject combinations for the two colleges' double majors were looked at. According to Ndikokubwayo, Byusa, and Ukobizaba, (2022) subjects with a low link resulted in poor student performance.

Masvingo Teachers College recruited students with a science subject regardless of its depth at O level. They went as far as taking students with Integrated Science which does not cover great depth at O level. They also gave preference to candidates that had attempted A level. The college also recruited candidates with Geography, Mathematics and Agriculture. A double major at Masvingo Teachers College could be made from the following combinations: Pure and Applied Mathematics, Geography and Agriculture, and, Chemistry and a science subject. What this meant in practice is that if the student Xchose Mathematics, the student would then do both Pure and Applied mathematics, which are subjects with a very high match and students were likely to perform well in such a combination (Ndikokubwayo, Byusa, & Ukobizaba, 2022). If a student chose Geography then that student would also have to do Agriculture. Similarly, if a student wanted a science subject then the student had to do a combination of Chemistry with either Physics or Biology. Chemistry anchored the science subjects. It was observed that Masvingo Teachers College deliberately chose subjects with a high match to be done and this could result in better student performance as these combinations complement each other.

JMN had similar entry requirements and subject combinations with Masvingo Teachers College.

Mkoba Teachers College recruited students with passes in Geography, Mathematics, Chemistry, Physics, Biology, Combined Science and Physical Science. Mkoba Teachers College did not take a student for science on the strength of a pass at O level in Integrated Science. In terms of entry requirements, Mkoba Teachers College demanded a well-grounded student at O level before enrolling on the course. For the double major, a student could choose any two of Pure Mathematics, Biology, Chemistry, Geography, Applied Mathematics and Physics. Although it was good that students made a choice of subjects that they wanted to learn, the choice could also result in poor subject choices such as Biology and Applied Mathematics which have very low link. Also, doing Applied Mathematics without a grounding in Pure mathematics could be an uphill task.

It was noted that Masvingo and JMN Teachers Colleges could think of recruiting students with a better grounding in the science subjects at O level, while Mkoba Teachers College could have a rethink of its subject combinations. It would be better for Mkoba Teachers College to have some restrictions on the open choice.

4.5. Teaching /Learning Space

The three colleges were asked how they dealt with the teaching/learning space for the science programme. All three colleges indicated that they shared the rooms meant for the Primary Teacher Programme with the secondary programme. The three colleges were given the mandate to start on the secondary teacher programme on the strength of the science laboratories the three colleges had. Mkoba Teachers College and Masvingo Teachers College had refurbished their laboratories for the Primary Teachers Programme when the

natural sciences were re-introduced as main subjects in primary teachers colleges, while Joshua Mqabuko Nkomo Polytechnic had new laboratories. All three colleges had Biology, Chemistry and Physics laboratories. (see Appendix C -photos JMN Mkoba and MASVINGO).

The laboratories were equipped with teaching / learning resources sourced using the ZIMDEF funds. All three colleges had laboratories with wash centres in the Chemistry and Biology laboratories. For Mkoba Teachers College, the Chemistry and Biology laboratories each had two working extractions fans at the time of visit and three fume cupboards. Joshua Mqabuko had one extraction fan fitted in each of the Chemistry and Biology laboratories, but these were not functional at the time of visit. Masvingo teachers College did not have extraction fans fitted (see appendix). Mkoba Teachers college also had an analytical balance room in the Biology laboratory. The other two colleges did not have an analytical balance room. An analytical balance room is used to measure ingredients when carrying out experiments that require a high degree of accuracy.

For lectures in Theory of Education and Professional Studies Syllabi, Mkoba Teachers college used a 200 seater classroom fitted with two smart boards and projector. The room can be divided into two rooms easily using fitted sliding dividers. For Masvingo and Joshua Mqabuko Polytechnic, the secondary programme students used the same classrooms and lecture theatres used by the Primary Teachers Programme students. Time-tabling was done in such a way to avoid clashes of lessons. The three colleges seemed to be getting by with the current arrangement. Mkoba Teachers College hoped to have separate laboratories, lecture rooms and theatres for the secondary science programme by building a science centre.

4.6 Syll Abi.- Main Subjects

A document analysis of the Main Subject Syllabi in the main subjects of Applied Mathematics, Biology, Chemistry, Pure mathematics, Physics and Geography were made. Aspects looked at were content and assessment. The syllabus is an important curriculum document that shows the intended curriculum and informs the depth and scope of coverage of the learning content. Agriculture was not looked at as it was only done at Masvingo Teachers College. The researchers used expert advice from subject specialists to identify the common topics covered in the three colleges. The analysis' emphasis was on differences in the assessment procedures as seen in the various syllabi.

4.6.1. Applied Mathematics.

The three colleges covered mostly the same topics in both Mechanics and Statistics. Topics covered in Mechanics included Kinematics, Newton's laws of motion, Projectiles and Momentum and Impulse. In Statistics, the common topics covered were Probability concepts, Sampling Distributions and Estimation Theory, Bivariate Analysis and Hypothesis Testing. The topics covered in the syllabus are adequate as the minimum body of knowledge at this level, as these were all approved by the Department of Teacher Education of the University of Zimbabwe, which is the accrediting institution and which awards Diplomas to the students. However, it was noted that only Mkoba Teachers College and Joshua Mqabuko Nkomo Polytechnic covered Motion in a Circle and Simple Harmonic Motion. Analysis of Variance was only covered by Joshua Mqabuko Nkomo Polytechnic. In this regard, students from Mkoba Teachers College and Joshua Mqabuko Nkomo Polytechnic were better grounded in Mechanics and Statistics than their counterparts from Masvingo Teachers College.

Assessment plays a pivotal role in curriculum implementation (Afsahi, 2016) An analysis was made on the assessment criteria adopted by each of the three colleges in both coursework and examinations. The three colleges are Associate Colleges of the University of Zimbabwe. The scheme of Association requires that the candidates be assessed using Coursework (30%) and Examination (70%)- Handbook for Quality Assurance in Associate Teachers Colleges (2015).

Masvingo Teachers College assessed its candidates using three tests (combining both Mechanics and Statistics) for coursework and a one-three-hour paper comprising of Mechanics and Statistics) for the Examinations.

Joshua Mqabuko Nkomo Polytechnic assessed candidates using one Distance Education assignment and four tests (combining Mechanics and Statistics) and a one-three-hour examination paper. It should be noted that for JMN, the Mechanics and Statistics is only a component of the Mathematics syllabus which also includes Pure Mathematics (contributing 35% to the final mark), Core Mathematics and Mathematics Education (contributing 30% to the final mark). The Statistics and Mechanics Component contributes 30% to the final mark in Mathematics.

Mkoba Teachers College assessed candidates with six tests (three in Mechanics and three in Statistics) and two-three-hour papers in Mechanics and Statistics separately.

Candidates at Mkoba Teachers College cover more scope and depth in Mechanics and Statistics than their counterparts at the other two colleges. Mkoba Teachers College emphasizes both mechanics and statistics, whereas a candidate at Masvingo or Joshua Mqabuko Polytechnic Colleges could easily complete the course even if one of the areas was overlooked. JMN's situation could be worse because the final paper included Core Mathematics (O-level standard questions) and Mathematics Education (both of which contributed to the final mark). JMN could think about breaking down the Mathematics curriculum into three parts: Pure Mathematics, Mechanics and Statistics, and Mathematics Education. This would give all areas depth and scope, as well as a true reflection of students' performance in each of the three areas.

4.6.2 Pure Mathematics.

The three colleges syllabi have Polynomials, Roots of Equations, indices and logarithms, Sequences and series, Coordinate Geometry, Trigonometry, Differentiation and Integration, Limits (including Epsilon-Delta Definition),

matrices, 3D Vectors, Method of Proof, Logic Mathematics, Sets and Relations and, Operations and structure in common. Only JMN also includes conic sections. In terms of content coverage in Pure Mathematics, the three colleges covered the minimum body of knowledge in Pure Mathematics.

Assessment in coursework at Mkoba Teachers College consisted of six tests, while the examination was a one three-hour paper. At JMN, coursework consisted of four tests and one three-hour examination paper. Masvingo Teachers College assessed students through three tests in coursework and one three-hour examination paper. While assessment in the examination was the same for the three colleges, a cause for concern would be in coursework assessment where differences in assessment were observed. It could have been better to have the same number of assessment pieces in the three colleges as this could ensure similar scope and depth of content coverage in the three colleges. The Department of Teacher Education of the University of Zimbabwe could come up with similar assessment procedures for the three colleges as it the one approving the various syllabi. This could ensure colleges produced teachers of the same quality. The researchers are aware of each colleges autonomy, but great differences could be a serious cause for concern especially for the same qualification.

4.6.3 Biology.

The three colleges reflect almost the same topics in the syllabi. Topics that are in common are Plant and Animal Nutrition, Respiration, Transport in Plants and Animals, Regulation and Control in Plants and Animals, Genetics, Ecology, Evolution, Health and Diseases and Human Impact on the Environment.

Of the three colleges, Mkoba Teachers College and Joshua Mqabuko Nkomo Polytechnic Colleges have Mathematics in Biology listed in their syllabi. Joshua Mqabuko Nkomo Polytechnic College is the only one that lists Information Communication Technology in Biology. This means that candidates at Joshua Mqabuko Polytechnic College cover more content than their counterparts, while candidates at Masvingo Teachers College cover less content as they don't have both Mathematics in Biology and Information Communication in Biology.

Coursework assessment for Masvingo Teachers College consist of one Distance Education assignment, two theory written assignments, two practical assignments and two theory tests. For the examinations, the college has a one-three- hour theory paper. For a practical subject, only two practical assessment pieces in the absence of a practical examination might be inadequate. Candidates could be given a balance between theory and practical assessment in a practical subject. Masvingo Teachers College could consider including a Practical examination and a Mini Project in their of assessment.

At Joshua Mqabuko Nkomo Polytechnic College, assessment comprises of one distance Education assignment, Five Theory Assignments, Five theory Tests, Five Practical Tests and one Mini Project. The examination is a one-three-hour theory paper. It can be observed that in terms of coursework, JMN produces a well- balanced candidate in theory and practical assessments. The inclusion of a mini project is a welcome development especially in light of Education 5.0. JMN could consider including a practical paper in the final examinations.

At Mkoba Teachers College, coursework assessment comprises of four Theory Assignments, four Theory Tests and Eight Practical Tests. Examinations comprise of two papers: a one-three-hour theory paper and a four-hour practical paper. A candidate from Mkoba Teachers College is well-grounded in both theory and practical experience as seen from the syllabus document. Mkoba Teachers College could consider including a Mini Project in their assessment.

4.6.4 Chemistry

The three colleges have listed Chemical Bonding, Chemical Energetic, Reaction Kinematics, Electrochemistry, Chemical and Ionic Equilibria, Organic Chemistry, Industrial Chemistry, transition elements, Environment and NANO Chemistry, and, Modern Physics for Chemistry in their syllabi. Differences were noted in Mathematics in Chemistry, Inorganic Chemistry and Computational Chemistry which were listed by JMN and Mkoba Teachers College but not by Masvingo Teachers College. Biological Molecules was listed in the Masvingo and Mkoba Teachers College syllabi but not in the JMN syllabus. Indigenous Knowledge System in Chemistry was found in the Mkoba Teachers College Syllabus only while Information Communication Technology was listed in the JMN Syllabus only. Ideally, all the three colleges could cover the same topics if they are to produce the same type of teacher. As things stand, some students are disadvantaged in terms of content coverage by the college that they attended. Colleges should consider including those topics that are currently not in their respective syllabi.

Assessment at Mkoba Teachers College consists of Four Theory Assignments, Four Theory Tests and Eight Practical Assignments. The Examination consisted of two papers: a three-hour theory paper and a four-hour practical paper. Mkoba Teachers college is the only one doing a practical examination. Mkoba Teachers College might consider having a Mini Project as part of their assessment.

Assessment at JMN in coursework consists of one Distance Education assignment, five assignments, five Practical Assignments, five Theory Tests, and a Mini Project. Examination consists of a one-three-hour theory paper. The college does not have a practical examination. JMN might consider having a practical examination as part of the examination assessment.

Masvingo Teachers College assessment in coursework comprised of one distance education assignment, two theory assignments, two theory tests and two practical tests. The examination consisted of a one three-hour theory paper. Masvingo Teachers College might consider having a practical

examination and a mini project as part of the assessment procedures. It is also again observed that a student from Mkoba Teachers College is better grounded in both theory and practical experiences. A practical subject definitely requires grounding in the practical aspects of the subject.

4.6.5 Physics

The three colleges had pre-requisite Mathematics, Mechanics, Waves and Optics, thermodynamics, Electromagnetism and modern Physics listed in their syllabi. Only JMN further listed Research Methods in Physics and Information Communication Technology in Physics. The other two colleges did not have these topics. It would be prudent for Masvingo and Mkoba Teachers Colleges to seriously consider including these two topics that are critical in the learning of Physics in the present age.

Differences were noted in the assessment in both coursework and examinations. Masvingo Teachers College assessed students in coursework by one distance Education assignment, two theory tests, two theory assignments, two practical tests and two theory tests. The examination at Masvingo Teachers College consisted of a one three-hour theory paper, without the practical examination.

Mkoba Teachers College assessed students using four theory assignments, four tests and eight practical assignments in the coursework. Mkoba Teachers College again was the only college using a one three-hour theory examination and a four-hour practical examination. Both Masvingo and Mkoba Teachers Colleges specifically stated that they used third year work to assess students.

JMN used five assignments, five tests, one distance education assignment, five practical assignments and a mini project for coursework assessment. However, JMN used some first year assignments, tests and practical assignment in their final assessment. This is in violation of the understanding that final assessment is done using third year work. JMN uses a one-three hour theory examination in assessing students.

It was noted that there is need for practical examinations in the colleges not offering these as these are critical for a practical subject. Teachers are expected to carry experiments with learners in school when they complete the course so it is only prudent that they be exposed to as much practical experience as possible, including under examination conditions.

4.6.6 Geography.

Geography was offered at Mkoba Teachers College and Masvingo Teachers College only. JMN did not offer Geography. An analysis of topics covered by both colleges showed a perfect match, although the Masvingo Teachers College syllabus title was Geography and Environmental Issues while that of Mkoba Teachers College was simply Geography. Topics covered in common were Evolution of Geography Thought, Geomorphology, Cartographic Techniques, Population Geography, Cartograms and Thematic Mapping, Climatology, Statistical Mathematics in Geography, Regional Planning and Development, Economic Geography, Environmental Geography, Geo Information and Remote Sensing, Disaster Management, Hydrology, Settlement Geography, Urban Geography and, Soil and Biogeography. From the syllabus documents, students at both colleges are covering the same content and this is desirable for students doing similar courses.

Assessment procedures in coursework at Masvingo Teachers College consisted of two assignments done in the second residential course and two tests done in the third year. Examinations consisted of two papers: one three-hour paper covering Evolution of Geography Thought and Physical Geography and another three-hour paper covering Human Geography and Environment Issues. At Mkoba Teachers College, coursework comprised of Three assignments and three tests done in the third year. Examinations consisted of two papers: a three-hour paper on Physical geography and a three- hour paper on Human Geography.

Both colleges seem to adequately assess students, although Masvingo Teachers College could reflect on using second residential assignments for final assessment and possibly increasing assessment items in coursework.

4.7 Syllabi- Professional Studies.

4.7.1 Mathematics.

Analysis of the Professional Studies Syllabus B syllabi of the three colleges was made. Findings were that the three colleges had the following topics in common: Methods of Teaching Mathematics, Scheming and Lesson Planning, and, Assessment and Evaluation. It was noted that the Topic Theories and Principles of Teaching and Learning Mathematics was listed in the Mkoba Teachers College and JMN syllabi but not in the Masvingo Teachers College Syllabus. Research in Mathematics was listed in the JMN syllabus and not in the other two, while Trends in Mathematics Education was listed only in the Mkoba Teachers College Syllabus.

Masvingo Teachers College could consider including Theories and Principles of Learning Mathematics, Research in Mathematics and trends in Mathematics Education in their syllabi. Mkoba Teachers College could also consider the inclusion of Research in Mathematics in their syllabus, while JMN could also include Trends in Mathematics Education.

Variations were seen in assessment of the Mathematics Professional studies Syllabi in the three colleges. Mkoba Teachers College and Masvingo Teachers College used coursework, while JMN used a combination of coursework and examinations. Mkoba Teachers College assessed students with three assignments done in the third year, while Masvingo Teachers College used one assignment and two tests, with one of the tests referred to as final test in the third year. At JMN, the Mathematics Professional Studies Syllabus is not a standalone, but part of the Mathematics Syllabus. Assessment of the Professional Studies component consisted of

coursework and examination. The coursework consisted of one assignment in Mathematics Education, one assignment in Core Mathematics, Two tests in Core Mathematics and Two tests in Mathematics Education. The examination consisted of a three-hour paper. It should be noted that the Professional Studies component at JMN contributed 30% to the final mark in Mathematics.

4.7.2 Science

A comparison of the syllabi in Professional Studies Syllabus B in the three colleges indicated the following topics that were common: Theories and Principles of Teaching and Learning Science, Syllabus Interpretation, Scheming, Planning, Assessment and Evaluation, Methods of Teaching Science, and laboratory Management. Mkoba Teachers College further listed Combined Science enrichment and Community Involvement, while Masvingo Teachers College listed Educational Technology. Both Mkoba Teachers College and Masvingo Teachers Colleges also listed Trends in Science Education. Topics listed by the three colleges are relevant in producing a Secondary Science teacher. Colleges could consider adding those topics that were not in their various syllabi.

Assessment in Professional Studies Syllabus B in Science was by coursework at Mkoba Teachers College and JMN, while Masvingo Teachers College had a combination of coursework and examinations. Mkoba Teachers College used three assignments, JMN used three assignments (one in each year), four tests (two each for first and third years), mini-project and a final test in the third year. Masvingo Teachers College used one distance education assignment and two assignments in the third year for coursework and a three-hour examination paper comprising Section A – Methods of teaching Science, Section B- Teaching of Biology, Section C – Teaching of Chemistry and section D- Teaching of Physics.

Assessment in Professional Studies B in Science at Masvingo Teachers College is very comprehensive as it covers all the science subjects. All the major subjects offered at Secondary school level are adequately assessed by Masvingo Teachers College- Biology, Chemistry and Physics are covered in the assessment procedures. Mkoba Teachers College's three assignments could be limited in assessing the three science subjects offered in schools. JMN has a relatively comprehensive assessment procedure, however, the college uses first year assessment for final assessment, which is against the spirit of final assessment being dependent on terminal performance. Mkoba Teachers College and JMN might deliberately consider assessment procedures that adequately cover all the science subjects offered at secondary school level.

4.8 Students Responses

Due to the disruption of learning caused by the Covid -19 Pandemic, while the program started at the same time, the completion dates differed and as such students for Masvingo Teachers College who completed earlier than their counterparts could not be accessed since they had already collected their results by the time the institutions were visited.

4.8.1 Mkoba Teachers College

4.8.1.1 Summary of responses

OVERALL MAIN SUBJECT											
	SD	%	D	%	N	%	**A**	**%**	SA	%	Total
Time was adequate			8	4.7	6	3.5	109	64.1	47	27.6	170
Content coverage was adequate	1	0.6	1	0.6	18	10.6	106	62.4	44	25.9	170
Depth of content was pitched at first year degree level.			2	1.2	14	8.2	109	64.1	45	26.5	170
Textbooks in the library were adequate			19	11.2	22	12.9	82	48.2	47	27.6	170
The college provided e-Learning resources	1	0.6	10	5.9	27	15.9	86	50.6	46	27.1	170
The college provided adequate equipment	1	0.6	7	4.1	24	14.1	113	66.5	25	14.7	170
The College provided adequate materials			7	4.1	30	17.6	96	56.5	37	21.8	170
The college provided efficient Internet (3 none response)			2	1.2	11	6.6	87	52.1	67	40.1	167

Overall in Main Subject, students at Mkoba Teachers College were of the opinion that the time was adequate for the course (97,7%), content coverage was adequate (88,3%), content was pitched at first year degree level (90,6%) and that textbooks for the course were adequate (75,8%). The students also opined that the college provided adequate e-Learning resources, adequate materials (78,3%) and that the college provided efficient Internet services (92,2%). From the students' perspective, Mkoba Teachers College was able to provide adequately for the students learning needs in main subject.

4.8.1.2 Comments from Students.

1. College provided me with an opportunity to boost my confidence	6
2. The course was very fruitful and productive	14
3. Wishing for further studies	
4. e-Learning to be provided for students	2

5. Teaching practise assessment was very good	7
6. Teaching practise important to the profession	3
7. A lot of information on self hygiene given during covid-19 era	2
8. Course duration was long	2
9. Conducive learning environment provided	3
10. College to organise field trips in Geography	3
11. Challenges met along the way	
12. Covered the syllabus well	3
13. The course was thorough	
14. The course was long. Make use of e-Learning to shorten course	
15. There is need to empower students with skills in CALA	
16. Provide equipment for learning	2
17. Course fairly resourced	
18. Some TP documents were not very useful	
19. Books in library were very useful	
20. Improve on practicals' for sciences	
21. College to take care of the physically challenged in facilities	
22. Need to improve on ICT studies	
23. TP external assessment was not fair	
24. Need for materials in Geography	2

4.8.2 Joshua Mqabuko Nkomo Polytechnic

4.8.2.1 Summary of Students Responses

	SD	%	D	%	N	%	A	%	SA	%	Total
Time was adequate	0	0	7	7.4	7	7.4	60	63.8	20	21.3	94
Content coverage was adequate	2	2.1	5	5.2	19	19.8	53	55.2	17	17.7	96
Depth of content was pitched at first year degree level.	0	0.0	3	3.1	12	12.5	62	64.6	19	19.8	96
Textbooks in the library were adequate	5	5.1	15	15.3	18	18.4	42	42.9	18	18.4	98
The college provided e-Learning resources	13	13.4	25	25.8	33	34.0	24	24.7	2	2.1	97
The college provided adequate equipment	8	8.3	24	25.0	21	21.9	39	40.6	4	4.2	96
The College provided adequate materials	8	8.2	23	23.5	26	26.5	37	37.8	4	4.1	98
The college provided efficient Internet (3 none response)	32	32.7	30	30.6	20	20.4	13	13.3	3	3.1	98

Students at JMN opined that time for the course was adequate (85,1%), content coverage was adequate 972,9%), the depth of coverage was pitched at first year degree level (84,4%) and that the college provided adequate textbooks (61,3). Opinions on whether the college provided adequate e-Learning resources, students were divided with 39,2% saying college did not provide adequate e-learning resources, 34% offering no opinion and only 26,8% thinking that the college provided adequate e-Learning resources. The same trend was observed on whether college provided adequate materials with 31,8% thinking that college did not provide adequate materials, 26,5% offering no opinion and 41,9% believing that college provided adequate materials. On provision of the Internet by the college, the majority (63,3%) believed that the college did not provide adequate Internet for them, 20,4% not offering an opinion and only 16,4% thinking that college provided adequate internet connectivity. Internet connectivity was also observed to cover only the administration by the researchers at the time of the visit.

4.8.2.2 Comments from Students

1. There is need for more equipment	2
2. Teaching Practise schools should have adequate materials for experiments.	
3. Colleges and schools should source science equipment and materials.	
4.There is need for more teachers of physics.	
5. Laboratories should be adequately equipped and experiments held regularly	
6. Course equipped me with relevant life skills	3
7. there is need for practical experiments.	
8. We had very good lecturers.	

Masvingo Teachers College did not have results as the data was collected when the students had left college. Professional studies syllabus B was also not summarized for JMN as the students failed to differentiate between PSB and PSD. Data from Mkoba Teachers College was summarized but had no comparison so was left out.

V. DISCUSSIONS

All three colleges stated that the program was adequately funded by the Ministry through ZIMDEF funds, which were distributed in three tranches. In addition to Ministry funding, the institutions used local fees to run the Secondary Science course. However, there was an outcry that funds provided for equipment were not always used up in a timely manner due to the lack of equipment in the country as suppliers demanded foreign currency, resulting in price changes. As a result of that challenge, all three colleges eventually did not procure such critical equipment. The institutions suggested that in the future, the Ministry could procure the much needed equipment at the Ministry level and distribute it to the user colleges. The lecturers who staffed the Secondary Science program in the three colleges had prerequisite qualifications ranging from first degrees to Masters degrees in the various subjects available. However, there was a challenge in that the institutions were unable to retain the Masters holders for long because they were quickly snatched up by universities. In fact, as soon as a person's curriculum vitae indicates that they have taught at a tertiary institution, they are quickly accepted into

universities. Chemistry and Physics were the hardest hit subjects.

Because none of the three colleges had a full lecturer staff complement for the Secondary Science program, the colleges relied on staff from the Primary complement to ensure program implementation. Unfortunately, the arrangement resulted in staff overwork because lecturers had to conduct lectures for both programs. When colleges had more groups on campus for both the Primary and Secondary programs, the situation became more taxing for the lecturers.

It was discovered that the three colleges had different entry requirements, particularly for the natural sciences. While natural sciences are thought to be more viable for economic development, implying that Chemistry and Physics are important, colleges sought applicants with Integrated Science. Mnguni (2021), outlines natural science subjects as biology, chemistry, physics, geography, and environmental sciences. Recruiting students with Integrated Science may result in the student teachers struggling in understating the concepts of the natural sciences thereby producing underqualified teachers. Mizzi, (2013) says teachers teaching outside their area of specialism face considerable challenges in lesson preparation and science teaching. This could be as a result of recruiting science student teachers with weak subject background from their secondary education. Teachers are expected to have a clear understanding of the structure and nature of the discipline and challenges could occur for those teaching outside their area of expertise (Mizzi, 2013). The effects of such teachers while in the field would result in learners dropping the subjects when in high school due to lack of motivation from underperforming teachers.

All the three institutions indicated that they used the teaching and learning accommodation originally meant for the Primary Teacher program. While the administration in the three colleges indicated that they had managed to come up with timetables to accommodate all the groups that would be on campus, they could not guarantee use of the laboratories during the students free time as they were always occupied. Also to be noted is that both the Primary and Secondary programs run two courses each that would always want to utilise the same learning bases i.e. main subjects lectures and professional studies syllabus B courses. Lunneta, Hofstein, & Clough, (2007p399), citing Tobin (1990) observed that Laboratory activities appeal as a way of allowing students to learn with understanding and, at the same time, engage in the process of constructing knowledge by doing science as that provided opportunities to students to reflect on findings, clarify understandings and misunderstandings with peers.

The content for the syllabi for the three colleges in the majority of cases was the same suggesting that there is generally consensus in determining the knowledge and skills to be developed in student teachers (Holland, et al., 2019). ZIMCHE((2017) declared that purposes of Minimum Bodies of Knowledge for a degree programme has to give the degree holder basic skills to function successfully in the workplace while Phuthi(2022) suggests that a particular degree qualification from any institution must equip the holders to perform certain basic functions and display specific capabilities expected of the purpose of that degree. A few topics appeared on some institutions while others did not include them.

The syllabi implementation procedures differed in the three colleges for the natural science subjects. Masvingo Teachers College and JMN Polytechnic expose the students to the three main subjects in their first year namely Biology, Chemistry and Physics and specialise in two in their final year while at Mkoba Teachers College the students who decide to do science specialise in the two subjects they would have passed at O level from first year. The observation made suggest that the students who would have specialised from entry into college are likely to be better equipped in content as compared to those who embark on Teaching Practice with general knowledge of the three subjects some of whom would not have done the subject at O Level. From the discussions with the lecturers in the two colleges, enrolling students with Integrated Science at O Level was due to unavailability of candidates with natural science subjects at O Level.

Syllabi assessment methods were found to differ in the three colleges in the number of assessment items as well as the timing of assessment. Mkoba Teachers College in Geography examines students in three assignments, three tests and two examination papers in the final year, while Masvingo Teachers College for the same area says the coursework is based on two second residential assignments and two tests in the third year and two examination papers. It is however not clear what is meant by second residential as the three-year program has no second residential phase but the third year. Joshua Mqabuko Nkomo Polytechnic for the natural sciences, assesses its students in five (5) assignments, five tests, one distance education assignment, five experimental practical work, a mini project and one theory examination. The assignments and tests are said to be done one per each term suggesting that some of the work is done before the final year. Actually, in the discussion with the lecturers there was an indication that some work is done during the first year before students go for Teaching Practice. Ideally, students should have been assessed prior to going for Teaching Practice using first year work, and if that is the case with JMN, this may suggest that they use the same work twice to examine the students i.e. before they proceed to Teaching Practice and at the exit of the course. Mkoba Teachers College is the only college that examines its students in practical work for the natural science subjects.

VI. RECOMMENDATIONS

1. The Ministry could assist the institutions to procure equipment and software required by the colleges since all the three institutions indicated failure to procure these due to the demand of foreign currency by suppliers.

2. There is need for making movement from schools to colleges more attractive for lecturers in order retain staff.
3. Learning space is required as a matter of urgency as sharing of facilities has revealed that students for both courses are disadvantaged.
4. Colleges could revisit their recruitment of students for the natural sciences as well as the specialisation to ensure the graduates are well grounded with the content.
5. Final assessment needs a review by all the colleges.
6. Full staff compliment for the Secondary Science program is urgently required if the program progresses well.
7. All colleges should have practical examinations for the sciences as this is critical in the training of teachers. The teachers are expected to do practical work with learners upon qualification.
8. There is need for further research on depth of coverage in both coursework and examinations to ascertain if colleges are covering the same skills and knowledge in their courses.

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Acronyms

JMN- Joshua Mqabuko Polytechnic
DTE- Department of Teacher Education
FGD- Focus Group Discussion
EFA- Education for All
MDG- Millennium Development Goals
ZIMDEF- Zimbabwe Development Fund

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APPENDIX A SYLLABUS COMPARISON

https://docs.google.com/spreadsheets/d/1da9AnXD4aYrKZ6JyIHxLnjmt_UbEfM3aew7qOGCo0aE/edit#gid=1206749534

APPENDIX B -STUDENTS RESPONSES

https://docs.google.com/spreadsheets/d/1kJHHHsHAMf1UHS1QO9PsqiX4bHgSSK90T1oGf6sKqkc/edit#gid=940068547

APPENDIX C – Equipment

JMN

https://drive.google.com/drive/folders/1-6tchR2F6IDOhVhootE9ERlLGXsov4wL?usp=sharing,

MASVINGO

https://drive.google.com/drive/folders/1j5Q3Ql9U2MclU2YWE3p4f5J-JGx40a1K

MKOBA

https://drive.google.com/drive/u/0/folders/1u0y5bGoUqLR_INboUkV-s21StCmJIprm

APPENDIX D –AUDIOS

MASVINGO

https://drive.google.com/file/d/1xQGC_GCYY6lDAg5hMzv8slu8Z2qTGjCC/view?usp=sharing

MKOBA

https://drive.google.com/drive/u/0/my-drive

JMN

https://drive.google.com/drive/u/0/my-drive

SCIENCE APPARATUS AND TEXTBOOKS

https://docs.google.com/spreadsheets/d/1J5I5T05yiTLdpBbryrfRB62Hl72XAUWWyIb8TU3zUGs/edit#gid=1473012807

AUTHORITY

dAll official communications should be addressed to: "The Secretary for Higher & Tertiary Education
Telephones: 795891-5, 796441-9, 730055-9
Fax Numbers: 792109, 728730, 703957 E-mail: lhesecretary@mbet.ac.ZY
Telegraphic address: "EDUCATION"

ZIMBABWE

10 December 2021

Dear Dr. Dube

Reference:

MINISTRY OF HIGHER AND TERTIARY
EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT
P. BAG CY 7732
CAUSEWAY

Ref: P/Dr Dube
EC. No. 0016565 E

RE: AUTHORITY TO CARRY OUT RESEARCH: DR. DUBE FLORENCE: MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT

Reference is made to your letter in which you requested for permission to carry out a Research on "Assessment of the implementation of the Pioneer Secondary School Scie Teachers Education Programme in the three Primary Teacher's Colleges in Zimbabwe'

Accordingly, please be advised that the Head of Ministry has granted you permission to carry out the research.

It is hoped that your research will benefit the Ministry and it would be appreciated if you could supply the office of the Permanent Secretary with a final copy of your study, as the findings would be relevant to the Ministry's strategic planning process.

D. Mintiyatu

FOR: SECRETARY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT

D. Mintiyatu

cc: File