

The impact of community engagement initiatives at Soweto science centre of the University of Johannesburg in addressing the subject knowledge deficiency of learners in the Further Education and training band

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Abstract. One of the community initiatives of the University of Johannesburg is championed through tutoring programme for learners in the Further Education and training (FET) band providing contact sessions on Fridays and Saturdays at its Soweto Science Centre. This flagship program is attended weekly by over 1000 Grade 10, 11 and 12 learners coming from schools in and around Soweto Township. Prior to the commencement of coaching of these FET learners, their pre-entry characteristics in terms of topics taught at schools is investigated through carefully structured knowledge, synthesis and application-type questions. The learners' knowledge in topics such as vectors, equations of motion and energy presumably taught at school in grade 10 was assessed by means of a diagnostic test. The results indicate an alarming revelation of the minimal physics content taught at school and the competency of the FET teachers in the Physics content thereof. The revelation is consistent with well-documented subject knowledge deficiencies prevailing amongst Physical Science teachers.

1. Introduction

The shortage of sufficient human and physical resources in the schooling sector puts additional challenges on Higher Education sectors to become proactive in finding appropriate solutions to the demand of qualified Physicist, Mathematicians, Engineers and Science related scientists in other fields necessary for the 21st century technological innovation. In response to the above state of affairs, the Faculty of Science of the University of Johannesburg (UJ) has established the UJ Soweto Science Centre (SSC) in 2010. As a community Engagement initiative, the UJ SSC provides educationally sound coaching in the Sciences (theory and practicals) and English to about 800 Grades 10, 11 and 12 learners from schools in Soweto and surrounding districts. To achieve this, experienced and dedicated lecturers from the Faculty of Science are seconded to teach these learners Mathematics, Physics and Chemistry at the Centre. In respect of Physical Science, learners attend supervised laboratory and tutorial sessions on Friday afternoons and theory lessons on Saturdays at the UJ SSC Centre. These activities are structured in a manner that seeks to bridge the articulation gap that exists between the FET sector and the higher education institutions.

There are many schools in South Africa that are educationally deprived and in this respect and poor educational provisions contribute to low attainments and thereby reveal low expectations from learners [1]. Thus the UJ SSC Centre seeks to address the challenges faced by many disadvantaged schools in and around the Soweto region by providing engaged and focussed learner support in addressing the articulation gaps that exists between the schooling and Higher education sector. The principal activities of the Soweto Science centre are [2]:

- Teaching theory lessons in Mathematics, Physical science, Life Sciences and Environmental Sciences;
- Conducting supervised laboratory and tutorial sessions;
- Teaching English for scientific communications;

- Conducting computer training;
- Participating in and organizing public talks;
- Participating in Science Expo day, National science week, career Guidance day and other science-related activities.

The SSC Centre has similar enrolments as a fully-fledged secondary school as shown by its enrolments for the period 2011-2012 in Table 1 below.

Table 1: Enrolments at SSC for the period 2011-2014

Year	Subject	Grade 10	Grade 11	Grade 12	Total
2011	Mathematics	211	190	231	632
	English	211	190	231	632
	Life Sciences	143	140	135	418
	Physical Sciences	157	150	144	451
2012	Mathematics	169	201	198	568
	English	169	201	198	568
	Life Sciences	169	198	170	537
	Physical Sciences	186	192	191	569
2013	Mathematics	312	277	232	821
	English	312	277	232	821
	Life Sciences	62	57	40	159
	Physical Sciences	250	220	192	662
2014	Mathematics	255	319	196	770
	English	255	319	196	770
	Life Sciences	242	287	175	1704
	Physical Sciences	251	317	194	762

This article focuses on the impact, if any, the SSC has on improving the subject knowledge deficiencies of FET teachers and its knock on effect on the students doing Physical Science in Grades 10, 11 and 12.

2. Methodology and discussion

The work plan of these coaching programmes is to follow the school teaching plans for various topics in Mathematics, Physical Science and Chemistry. Therefore the learners come to the Centre after they were taught the specific sections of the syllabus at school. A survey was conducted to find out the topics in Physics/Chemistry which the school learners find most difficult. The results are represented in figure 1 below:

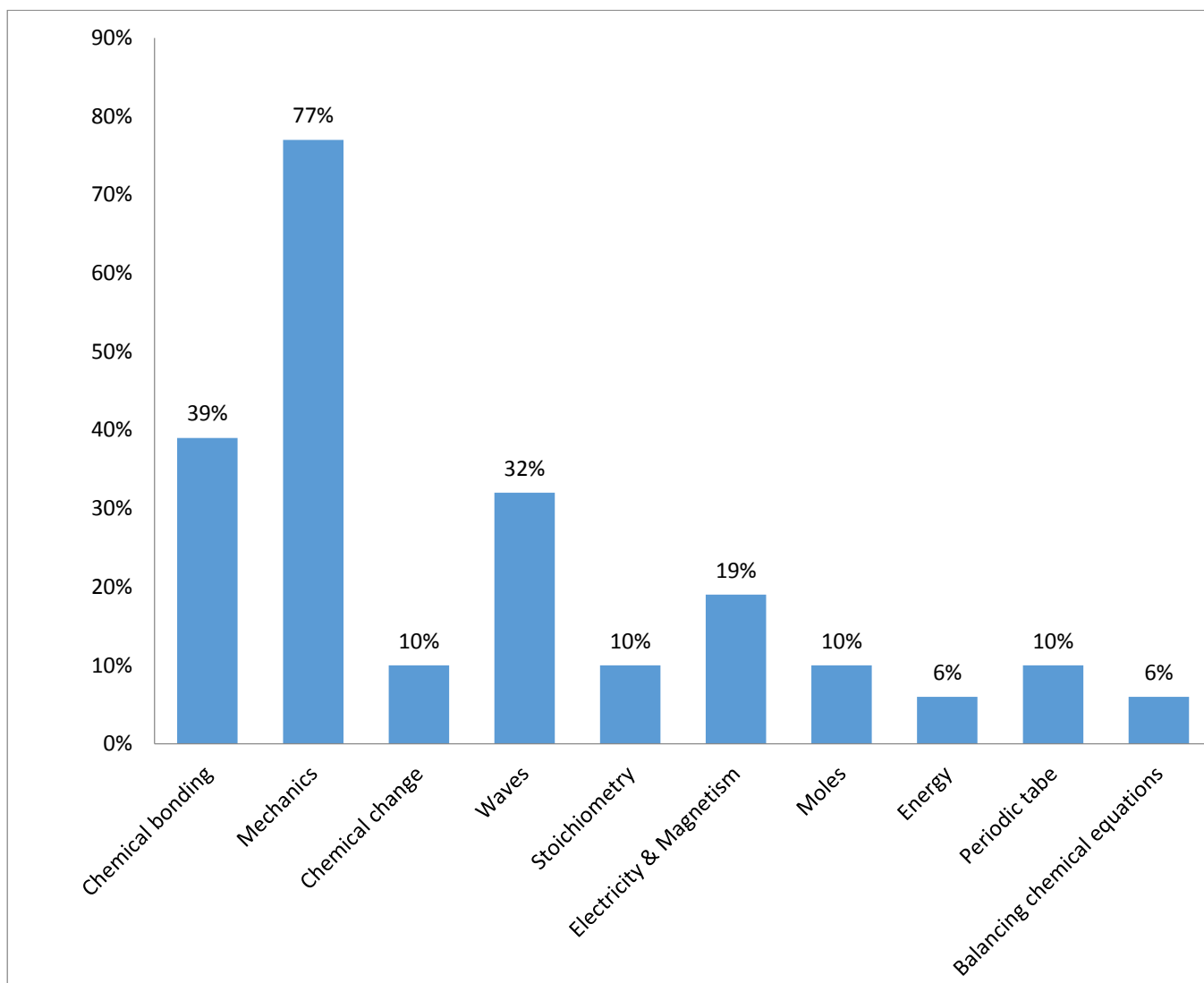


Figure 1: Topics in Physics/Chemistry found difficult at school

At this juncture a pre-test was carried out on the following topics in mechanics: vectors, equations of motion and energy, after establishing that these topics were done at the school for Grade 10 learners as per the school work programme. This was done to investigate how much the students have learnt at school. A questionnaire comprising of 20 Multiple Choice Questions (MCQ) was administered amongst Grade 10 learners after being piloted and refined. Structured questions in the form of knowledge,

synthesis and application –type was set for this purpose. The results of this survey is represented in Table 2 as ‘2012 pre-evaluation’

Table 2: Results of the Pre Evaluation of Grade 10 learners and Post evaluation of Grade 12 learners

Percentages	2012 Pre Evaluation (Number of Learners)	2014 Post Evaluation (Number of Learners)
0 – 10	67	0
11 – 20	2	0
21 – 30	0	1
31 – 40	0	12
41 – 50	0	15
51 – 60	0	25
61 – 70	0	14
71 – 80	0	4
81 – 90	0	0

Intense coaching was done on these topics by experienced lecturers from UJ. The results after such an intervention is represented as “2014 Post evaluation” in Figure 1. 67 out of the total of 69 of the sample had marks in the range 0-10% for the pre-test, while 2 scored in the range from 11-20%. The same questionnaire was administered for both the pre- and post-test. The post-test was conducted for the same students while they were in Grade 12. The results of the post-test was the sum effect of the impact of the Science Centre coaching could have on the school learners. The following graphs show an overview of the impact of the coaching that was produced by the activities of the SSC Centre.

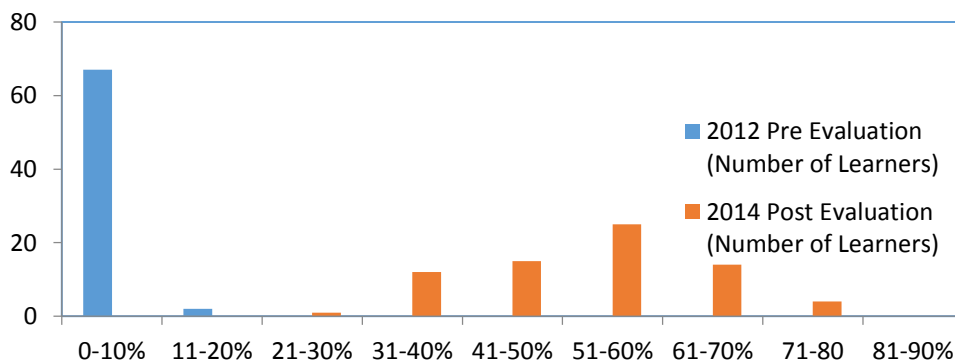


Figure 2: Pre and Post Evaluation Results for Mechanics

As indicated in Figure 3 below, the learners largely expressed positive sentiments in relation to the coaching and mentorship opportunities provided the UJ Soweto Science Centre.

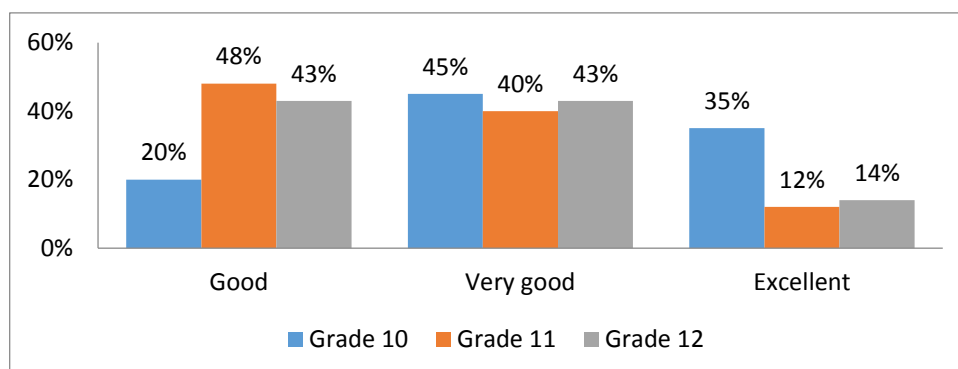


Figure 3: Overall differentiation between the coaching provided by the SSC and the teaching at school

The coaching included both theory and laboratory practical sessions held on Friday afternoons and Saturday mornings, where the practicals were connected to the theory lessons. Such offerings would improve the students' attitude and accomplishments towards Physical Science. On certain days of the programme it was encouraging to see some of the FET teachers were also attending these classes together with their students with the purposes of improving their professional development. Statistics of the SSC matriculation results of learners from the 2013 cohort is shown in Table 3 below:

Table 3: SSC NSC Results 2013

Symbols	Number of students
B	102
D	42
H	14

Of the 188 FET learners that wrote the 2013 National Senior Certificate examination and for whom thorough coaching was provided, 102 obtained B grades and a further 42 learners obtained D grades. The results of the remaining 30 learners are being followed up for. Moreover, the enrichment programme through enhanced coaching leads to improved performance at school thus providing an opportunity to maximise learners' academic experience. Performance of practical work forms an integral part of the key activities involving learners at the UJ Soweto Science Centre. Learners appeared to derive benefits as a result of the opportunities afforded to perform experiments. While the learners appear to lean towards Physics and Chemistry as content areas they like most, Grade 10 learners in particular tend to demonstrate a profound desire for Mathematics and Life Sciences (Figure 4).

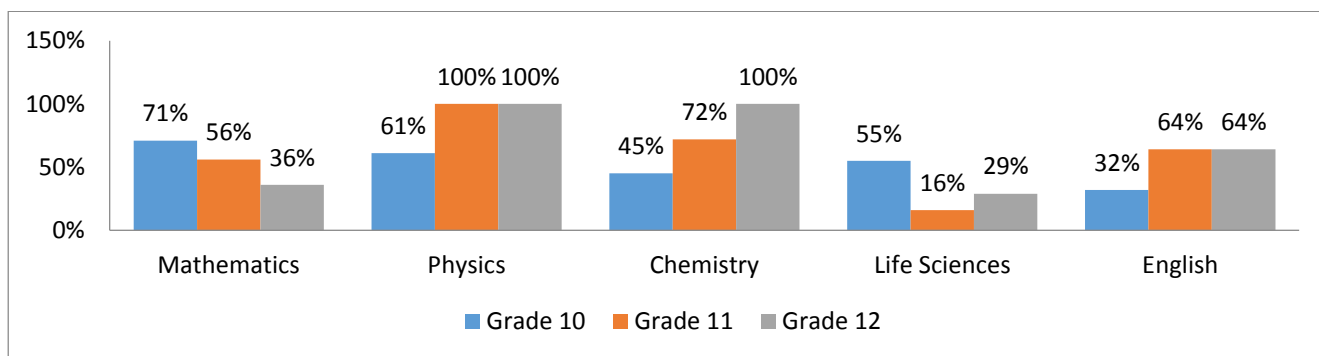


Figure 4: Subjects liked most at the SSC

A substantial number of the learners expressed a pronounced desire to come and study at UJ after Grade 12. There appeared to be an upward trajectory across the grades in terms of the preference for UJ as an academic home for higher education studies.

3. Implications

National Senior Certificate results for learners mentored at the Soweto Science Centre during 2013 indicate significant improvement in terms of the overall performance. This improvement suggests the effectiveness of the intervention provided at the Soweto Science Centre. In this regard, there is a critical need for evidence-based practice which can be defined as an instructional strategy, intervention, or teaching program resulting in consistent positive results [3]. However, intervention strategies have to be subjected to high quality research to be considered evidenced-based practices and the intervention provided by the Soweto Science Centre is no exception. Some of the teaching components with relative effectiveness reported in the literature include domain-specific enquiry, co-operative group-work, enhanced context and direct instruction or active teaching [4].

4. Conclusion

The fact that 144 out of 188 (77%) students have improved their overall performance through subject-enrichment strategy clearly indicates a positive impact which the Science Centre has produced over these FET learners who otherwise would have dropped out of the schooling system. Better equipped human and physical resources have played a role in uplifting the academic career of these school learners. Since vast majority of learners have indicated their desire to come and study at UJ after Grade 12, the SSC activities has proved to be a success story.

References

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