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An evaluation of the Science Learner Assisted Program (SLAP) at the University of Limpopo Science Centre, South Africa

Potgieter MJ¹, Potgieter A², Ramaila PR³, Wildschut L⁴

¹Department of Biodiversity, ²Science Centre, University of Limpopo, Private Bag X1106, Sovenga, 0727, South Africa; ³Centre for Research on Evaluation, Science and Technology, University of Stellenbosch, South Africa

martin.potgieter@ul.ac.za

Abstract. This paper is an evaluation of the Science Learner Assisted Programme (SLAP) at the University of Limpopo Science Centre. The evaluation is intended to be useful for improving the programme and informing social action aimed at amending educational problems (related to science education faced by schools in the Limpopo Province (South Africa)). The purpose of the evaluation was to evaluate the design of SLAP and how it was being delivered to the target group (Grade 10-12 learners). Data was collected during August to October 2016. Data were collected via documentation review, semi-structured interviews, questionnaires and observations. Forty five learners completed the questionnaires. Qualitative and quantitative data analysis techniques were employed during data analysis process. In terms of programme design, the evaluation found that SLAP is aligned to the goals of the University of Limpopo Science Centre. With regard to programme delivery, the evaluation found that the programs major activity is performing of experiments. Methods of engaging learners include class discussions, presentations and group discussions. The methods proved to be effective as the level of participation was high during lessons. Affordability of lessons, performance of experiments and information sharing were mentioned as aspects of implementation facilitating the success of the programme, while overcrowding, small labs, insufficient resources and learners being unprepared for lessons were reported as impeding the success of service delivery. Teachers reported that the programme was of great assistance to them as they learn to simplify topics and improve their methods of engaging learners in class.

Keywords. Curriculum support; practical and theoretical science lessons; museums; rural learners

Introduction

Science centres are popular destinations for many people throughout the world. Rennie and McClafferty [1] asserted that science centres are stimulating, visually exciting, noisy, active environments. Danilov [2] distinguished their focus from museums by mentioning that (1) museums emphasises cultural heritage through objects of intrinsic value, and (2) the science and technology centres aims to both enlighten and entertain through contemporary, participatory exhibits and programmes.

However, the role of science centres goes beyond that of entertainment and science exhibits. Science centres play a significant role in educating societies and communities about the role of science and technology in their daily lives. In many countries, they serve as information centres for STEM learning and development. Also, Bandelli and Konijn [3] pointed out that science centres, as interfaces between science and society, are informal educational institutions for life-long learning. One should also keep in mind that, depending on their scope and target groups, science centres offer a wide range of activities such as exhibits, experiments, school programmes, outreach programmes, career guidance and debates. However, their role differs from country to country and even within countries.

The University of Limpopo Science Centre (South Africa) is the Limpopo province's premier science centre and outreach facility that support maths, science and technology education and awareness. One of the programs offered by the centre is the Science Learner Assisted Programme (SLAP). This programme is an in-reach programme (facilitating on campus interventions) designed to alleviate challenges faced by rural schools in the Limpopo Province mainly in the science subjects of Physical and Life Sciences. During their visit to the centre, Grade 10-12 learners are exposed to a laboratory setting and perform subject related experiments to increase their understanding and prepare for final examinations. This is important, as most rural schools have a problem with space and have no laboratories. Furthermore, the programme empowers STEM graduates by equipping them with work related skills and experience. These STEM graduates fulfil very important roles working as facilitators for these lessons. The programmes' objectives are to (1) improve learners' understanding of physical and life science topics and experiments, (2) provide STEM graduates an opportunity to acquire work related skills and experience.

Research and evaluation on the science centres in South Africa and the question of how staff members of these centres interpret their mission statements to plan programmes and activities to reach their target populations [4] are unfortunately lacking. Only around 50% of centres undertake customer surveys, fewer than 30% undertake internal reviews and only one has sought independent assessment [5]. Joubert [4] noted that most research in science centres focuses on the learning potential of informal learning on visitors of science centres and museums, but not on goals, perceptions and ideas of the people actually working in the centres. The aforementioned limitations and challenges highlight the necessity to evaluate programmes offered at science centres. Another important issue is that evaluation of the impact of the science centres and museums is a growing field of study, because of trends such as increasing competition and financial pressure, demands for greater public accountability and transparency, and government policies that require public institutions to demonstrate their achievements in a variety of areas [6]. This indicates the need to evaluate science centre programmes in South Africa.

Thus an investigation was initiated in 2016 to evaluate the SLAP programme at the Science Centre of the University of Limpopo. The purpose was to evaluate the design and how the programme was being delivered to the target group. The evaluation sought to answer five key questions: (1) To what extent is SLAP aligned to the broader vision, and goals of the science centre? (2) How is the programme aligned to the National Curriculum? (3) How is SLAP being implemented? (4) To what extent are the resources and materials relevant and appropriate for the programme delivery? (5) To what extent is SLAP serving the intended beneficiaries?

Theoretical framework

Theory of Change

Rossi et al. [7] pointed out that only a well-defined and well-justified program layout permits identification of critical program functions and what is supposed to happen as a result.

Information obtained during engagements with Science Centre management showed that there were certain assumptions underlying the programme. Therefore, an initial evaluation was conducted to clarify the aims of the programme. It focused mainly on understanding the problems addressed by the programme, the needs of the target group, the context in which it operates and the conceptualisation and design of the programme [8]. This led to the development of a theory of change, which gave the evaluator a clear picture of what the programme intended to achieve. CARE [9] defines a Theory of Change as: “*A theory of change clearly articulates the intended activity (the ‘if’ part), and the expected change it will bring about (the ‘then’ part). Articulating a theory of change offers a clearer picture of the intended result from an action, and explains how programme activities and results are connected with each other and contribute to achieving results at different levels. In other words, a well-articulated theory of change is attestable hypothesis of how the planned activities will contribute to achieving the desired results for the programme*”.

Since the Science Centre has never developed a theory of change for any of its programmes, a simplified theory of change was constructed that could be easily interpreted and understood by management and all stakeholders involved in the programme. The aim was to have a clear and coherent “Theory of Change” that is shared and accepted by the programme staff [10]. This was essential since a complex and sophisticated format of a theory of change will not assist management in understanding the assumptions and the expectations that make up a program theory [7].

Assumptions underlying the SLAP Theory of Change include (1) Additional lessons will improve learners’ understanding of Physical Science and Life Sciences topics, (2) Experiments will enable learners to integrate theoretical part with practice, and (3) STEM graduates acquire skills and experience by facilitating the programme. Thus, if SLAP provide learners with Physical Science and Life Sciences tutorial guides, conduct additional Physical and Life Science lessons, and provide learners with an opportunity to perform Physical Science experiments, then SLAP will enhance learners’ understanding in science subjects and improve their academic performance through additional lessons aligned to the National Curriculum and provide STEM graduates with an opportunity to facilitate Physical Science and Life Science lessons.

Materials and methods

Evaluation design and approach

Process evaluations are typically associated with qualitative designs [11]. As such, spectrums of qualitative techniques [12] were used to evaluate the SLAP program. The University of Limpopo Science Centre has never carried out a formal evaluation for the Science Learner Assisted Program. Therefore, it was necessary to evaluate the programme from its design to the implementation phase. The evaluation was a **process evaluation** as it intended to verify what the programme is and whether it is delivered as intended to the target recipients [13]. This process evaluation was formative in nature aimed at providing useful feedback for programme improvement to the science centre management and programme staff. The evaluation was also **clarificatory evaluation** as it focused on developing a clear and coherent programme description that is shared and accepted by programme staff [10]. A **theory-based evaluation** was also helpful in extrapolating understanding of the programme, therefore, to make explicit, the implicit theory of the programme being evaluated [8].

Evaluation approach and process

Engagements were made with stakeholders and documents were reviewed to obtain critical information about the organisation and the programme. The information was crucial in assisting to describe the programme. The study then focused the evaluation design which was helpful in determining data collection methods. Conclusions were drawn and justified through data analysis, which led to the generation of findings.

Data collection methods

Various qualitative methods were used to collect and cross check data during the evaluation. Qualitative methods were used because: (1) the evaluation involved people, (2) it was conducted in the natural setting of the participants [14], and (3) in-depth analysis of the programme from the design phase to implementation required engagements with the stakeholders and programme implementers, and to understand the programme as seen through the eyes of the beneficiaries. Qualitative methods enabled the study to obtain rich detailed information from the participants and allowed for bracketing and triangulation.

Document review

During the evaluation, secondary data was collected by reviewing various documents of the University of Limpopo Science Centre. This included the 2015 Strategic Planning Documents which also includes a Risk Register, Future Developmental Programmes and Capital Projects; 2014 and 2015 Annual Reports; Activity Booklet; and online information provided on the Centre's website. The purpose of document review was to: (1) gather information about the University of Limpopo Science Centre and its programmes, and; (2) to understand the context in which the SLAP program operates and how it is aligned to the vision and goals of the Centre. Data collected through document reviews contributed to the evaluation by highlighting important aspects which the evaluation should focus on.

Interviews

Semi-structured interviews were conducted during the evaluation. Interviews were conducted based on the assumption that participants' perspectives were meaningful, comprehensible, explicit and that their perspectives affect the success of the programme [15] being evaluated. Two sets of interviews were conducted with teachers and facilitators. Semi-structured interview guides with open-ended questions covering a wide range of topics were designed for the teachers and the facilitators. An informed consent form addressing ethical issues regarding the evaluation was also developed for both the teachers and facilitators. Before the interviews commenced, the evaluator explained the evaluation procedures and ethical issues such as anonymity and confidentiality to the respondents [16]. The informed consent forms were then signed by both the evaluator and the respondents. The respondents were interviewed separately to protect their identity, privacy and maintain confidentiality.

Semi-structured interviews with teachers

Semi-structured face-to-face interviews were conducted with teachers from different schools. These were teachers who accompanied learners to the University of Limpopo Science Centre. The teachers were involved in teaching STEM subjects from different grades. Most teachers were familiar with the programme as they visit the Centre yearly for experiments. Before teachers were interviewed, they were given time to observe lessons.

During the interviewing process, informed consent forms were signed by both the evaluator and the teachers. A copy of the signed informed consent form was handed to each

teacher after the interview. Responses were recorded using voice recorder software and the evaluator also took notes. Data gathered from the respondents provided meaningful insights on challenging topics in Physical Science and Life Sciences, factors hindering mastery of subjects, how the programme related to the needs of learners, how the programme assisted educators, important topics covered during the lessons which learners should master and suggestions for programme improvement.

Semi-structured interviews with facilitators

Three facilitators were interviewed during the evaluation. The facilitators were responsible for day-to-day implementation of the programme activities. The same approach used during interviews with teachers was also employed during the interviews with the facilitators. A semi-structured interview guide with open-ended questions was used to collect data as already mentioned. Before interviews commenced with each facilitator, an informed consent form explaining ethical issues was signed by both the evaluator and facilitator. A copy of the signed form was then handed to each facilitator at the end of the interview.

The face-to-face interviews allowed in-depth discussions between respondents and the evaluator. Crucial information about major programme activities, training facilitators received, aspects of implementation facilitating programme success, aspects of implementation acting as stumbling blocks to programme success, how the programme address the needs of the target group, relevancy and sufficiency of material and resources used in the programme, and suggestions for programme improvement was obtained during the interviews.

Questionnaire

(i) Selection of respondents

Seventy learners from seven schools completed the questionnaires. Learners were selected from different grades (10-12) with the assistance of teachers. Variables such as gender, grade and ability to respond to questions were considered during the selection.

Administering questionnaires

Questionnaires were administered to Grade 10-12 learners. This data collection method was appropriate and convenient for learners due to time constraints. Two sets of questionnaires were completed by learners:

Pre-lesson questionnaire: Learners completed pre-lesson questionnaires before lessons commenced. The questionnaire required the learners to provide the following demographical information: gender, age group, grade, name of school their school, and information on main problems in Physical Science and Life Sciences at their schools, whether they perform experiments at their schools and the important Physical Science and Life Sciences topics they wanted the lessons to cover.

Post-lesson questionnaire: Post-lesson questionnaires allowed the learners to provide information on topics or experiments offered in the lessons, topics or experiments offered in the lessons which were important to their studies, topics or experiments offered in the lessons which were least important to their studies, rate facilitator competencies, opportunities provided by the programme and relevancy of experiments, rate the length of the programme, and to rank the programme in terms of its value.

Observation

Observation is one of the most used data collection methods in evaluation research. A structured observation guide to collect data on how lessons begin, methods of engaging learners,

equipment used during lessons, classroom setting and activities was designed. The guide allowed for gathering data by watching behaviour, events or noting physical characteristics in their natural setting [17]. Activities, behaviour and physical aspects were documented without having to depend upon participant's willingness and ability to respond to questions [18].

Data Analysis

During data analysis, both qualitative and quantitative data was analysed together. The data was unpacked, reduced, sorted and organised into categories [19]. ATLAS.ti, a computer assisted qualitative data analysis software, was utilized to display verbatim quotes, narratives and perspectives from semi-structured interviews data. The software was further used for analysing observational data (photos).

Results

Demographic information of participants

Descriptive characteristics of learners

Forty-five learners from seven schools were able to complete evaluation questionnaires. Botsholla Secondary School, Kgakala Secondary School, Morebeng Secondary School, My Darling Secondary School and Nthabiseng Secondary School had seven learners each, while Izikhali Zembundo Secondary School and Ramobu High School had five learners each participating.

Gender-wise, 25 respondents were female and 20 were male. Learners' gender was also stratified according to age groups (13-15, 16-17, 18-20, >20). There were 1 male and 2 female learners in the 13-15 age groups, 4 males and 10 females in the 16-17 age group, 14 males and 13 female learners were between 18-20 years, and only 1 male learner was older than 20 years.

All genders were represented in each grade. In Grade 10, 7 female and 3 male learners responded to the questionnaires. In Grade 11, 8 female and 7 male learners also completed the questionnaires, and in Grade 12 ten learners in each gender completed the questionnaires.

Descriptive characteristics of teachers

Five male and female teachers participated in the evaluation. One teacher teaches Grade 10, while 11 and five teachers teach Grade 10, 11 and 12, respectively. One teacher instructs both Physical Science and Life Sciences, one teacher teaches Physical Science only, while four teachers teach Physical Science and Mathematics.

Programme design

Findings presented in this section focuses on the alignment of the programme with the vision and goals of the Science Centre, alignment of the programme to the national curriculum, and programme description.

Alignment of SLAP to the vision and goals of the Science Centre

Secondary data obtained from the 2015 Strategic Planning Document, 2014 Annual Report, and 2015 Annual Report demonstrated that the programme is aligned to the following two goals of the UL Science Centre: (1) Contribute to the enhancement of learner participation and performance in STEM subjects and careers and; (2) Enhance quality STEM education. The evidence of alignment to the goals were further substantiated by online information which states that (i) The Science Centre aims to promote Science and Technology awareness and instil the love of Science subjects in the community, and (ii) The Science Learner Assisted Program provide schools with an opportunity to perform experiments of their choice.

The vision statement of the Centre is about uplifting communities in the Limpopo province by introducing them to Science, Technology and Innovation. It does not mention schools but instead focus on communities. Therefore, one has to assume that the term “communities” on the vision also includes schools.

Alignment of the programme to the National Curriculum and Assessment Policy

Data obtained during engagements with management and programme staff revealed that the programme is aligned to the National Curriculum and Assessment Policy(NCS) statement for Physical and Life Sciences. Important insights to prove its alignment to the National Curriculum were provided by teachers. Teachers mentioned that the experiments performed during lessons are prescribed by the National Curriculum as indicated by the following quotes.

“...it is aligned to the curriculum because they are doing the prescribed one. The one that we are supposed to do even at school...the facilitators here are doing something that [what] we should have done at school.” (Teacher 1).

“...the facilitators did their research, I like it or maybe they are used to because every day, they interacting with the learners, and they are working with the same content, and most of the experiments they choose are those prescribed, because we have prescribed formal and informal experiments...because the marks thereof contribute to the learner’s school based assessments” (Teacher 3).

Programme description

Information obtained from observation and meetings with management indicated that the Science Learner Assisted Program is one of the Centre’s core programmes. However, there is little information about the programme in the Centre’s strategic documents, annual reports and the website. Furthermore, documents reviewed indicated that the Science Learner Assisted Program does not have a project document which specifies programme goals, objectives, activities, outcomes and other components necessary for programme description.

Programme delivery

Major programme activities

The question on major activities was posed to facilitators to build a rapport and direct attention of the interview to the programme. Facilitators reported that a major activity in the programme is performing of experiments. However, they also mentioned other additional activities such as exhibitions, outreach activities, puppet and science shows that they perform at shopping malls and community centres throughout the province. This was indicative that multiple functions are performed by facilitators at the Science Centre and beyond.

Methods of engaging learners during lessons

In terms of methods of engaging learners, facilitators mentioned that learners are engaged through group discussions whereby they are assigned topics to analyse, to discuss via class discussions, teaching and revising topics (chapters), and as well as presentations.

“During tutoring, we are using the discussion method, we ask the kids and they give us answers so that we can know the level of understanding they are in, and now we are going to emphasize. Usually we start with a presentation where we only going to focus on the most important points which are going to be useful in the experiment then after we allow them to ask questions, we are also asking them questions, then elaborate where we think they are lacking, then after, we allow them to start with the experiment with the facilitation from our fellow interns” (Facilitator 2)

Observational data proved that facilitators use different methods to engage with learners during lessons. Facilitators greet learners and introduced themselves before lessons begin. They welcome learners and encourage maximum participation. The methods of engagement proved to be effective as the level of participation was high among learners.

Programme specific training received by facilitators

In terms of training received by facilitators for the programme, they reported that they were trained on how to facilitate lessons and other programmes at the Centre. Part of the training included observing older interns during presentations, conducting experiments and exhibits. Furthermore, facilitators mentioned that they are graduates with qualifications in various STEM disciplines. One facilitator also mentioned that he holds a BSc in Molecular and Life Sciences. In that case, the evidence provided by facilitators regarding training they have received was enough to prove that the programme is delivered by qualified staff.

Aspects of implementation facilitating the success of the programme

On aspects implementation facilitating the success of the programme, different features such as affordability, experiments and information sharing were mentioned by facilitators. One facilitator indicated that lessons are affordable at the centre hence apparatus and chemicals are expensive. Schools are charged only R15 per learner. Learners are exposed to a number of subject specific experiments as requested by schools. Another facilitator pointed out that the Centre utilizes the few apparatus it has to prepare learners for examinations. Aspects mentioned by facilitators are indicative of how the programme was successful towards achieving its goal.

Aspects of implementation acting as stumbling blocks to the success of the programme

Despite the programme succeeding in certain aspects, factors impeding on its success were reported by facilitators. Facilitators reported that lack of space in the labs causes overcrowding during busy periods. This was a challenge for facilitators as it restricted their movements around classes and limited their engagements with all the learners. Another aspect raised by facilitators was that the apparatus and other essential equipment used for experiments are not sufficient. One facilitator also complained about teachers not preparing learners for the programme. This according to the facilitator is impeding on the success of the programme since they [facilitators] must do the teaching so that learners understand the whole topic and experiment. As a result, more time is spent on revision than on the experiments.

Physical Science and Life Sciences challenges for learners

A question on challenging Physical Science and Life Science topics for learners was posed to the teachers. The purpose of the question was to generate data on the most challenging topics for learners in both subjects. Different responses were provided by the teachers. Teacher 1 mentioned Magnetic Radio Laws, Intermolecular Forces, Ideal Gas and Electrostatics. In addition, Newton's Law and Inclined Plains were mentioned by Teacher 4 and Work, Energy and Power, Vertical Projectile Motion, Organic Molecules and Chemical Change were mentioned by Teacher 3. Doppler Effect and Electrostatic were also mentioned by Teacher 5. Three topics mentioned by Teacher 6 were: Chemical Change; Electrostatics and Organic Molecules. These responses demonstrated teachers' concerns about the topics and how they were hoping the programme would assist learners by focusing more on the topics.

In order to understand why learners were struggling with the above mentioned topics, a question on factors hindering the mastery of the subject was posed to the teachers. Two important

perspectives were provided by Teacher 4 as indicated in the quote below are overcrowding and language barrier. Overcrowding makes learning difficult as classes are not manageable while language barrier is a barrier to subject topic mastery as learners were taught in English which is the second language. Their native language is Sepedi.

“Basically at our school, the challenge that we are experiencing is no 1, we are having overcrowded classes because Grade 11 they are 90 in one class for Physical Science only. So it’s difficult to them...” (Teacher 4).

Other crucial perspectives generated included the inability of the learners to study on their own and peer pressure. Teachers pointed out that most of the learners are unable to study on their own without supervision, and that some learners choose subjects because of their peers and the social networks they associate with.

How the programme relate to the needs of learners

Data obtained from the teachers consistently demonstrated strong evidence on how the programme was related to the needs of the learners. A question on how the programme was related to the needs of the learners was posed to the teachers. Different views were provided by the teachers as indicated by the quotes below. Teacher 3 and 4 (see quotes below) remarked that they impart theory at school and organise a day to visit the Centre to perform experiments. Teachers 6 pointed out that it is related to the needs of learners as it’s aligned to their syllabus.

“It plays a very (very) big role in that the school in which I teach do not have a lab neither do we have the science equipment for chemicals and other science...so most of these experiments during the year, we do them theoretically...uh...and we organize a day to come here, that’s when they do the practical part of the experiments” (Teacher 3).

“Ehh...this programme...let me start by first saying eh...its good because we are one of the under resourced schools, we don’t have the resources like the laboratories for example, we don’t have the chemicals to show them the experiments and stuff like that, so what we do is uh...we only do the theoretical part...so this programme it is useful because ehrr...you know in a classroom we can’t learn the same way some they need the experiment others when it comes to theory they are alright” (Teacher 4).

To further understand how the programme was related to the needs of the learners, a question on how the programme was benefiting the learners was posed to the teachers. The programme was described by teachers as beneficial to their learners because: (1) SLAP worksheets provide learners with a step-by-step guide for conducting experiments, (2) learners perform experiments and see chemical reactions, and (3) it sparked learners’ attention, which improved learner participation.

The above mentioned reasons were further substantiated by analysis from observations as data showed performing experiments and using worksheets provided during lessons to record experimentation results. The extracts below (Figure 1) are reasons provided by teachers on how SLAP was benefiting learners.

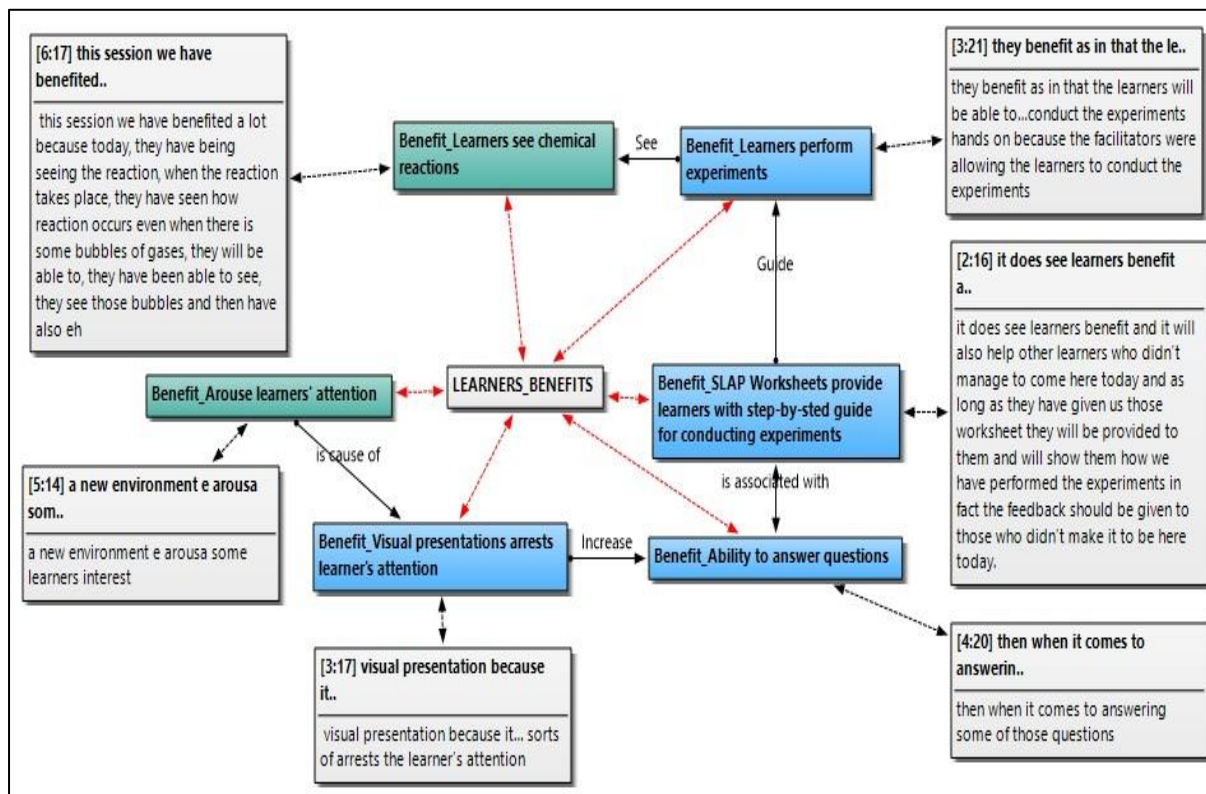


Figure 1. Reasons provided by teachers on how SLAP were benefiting learners.

Key findings on the how the programme's relations to the needs of learners were also obtained from the facilitators. A question on how the programme was addressing the needs of learners was directed to the facilitators. Different perspectives were provided by the facilitators. Facilitator 1 mentioned that the programme was helpful as learners were exposed to the practical part of the experiments. Facilitator 2 mentioned that learners learn to prepare apparatus and interact with the facilitators, thereby, allowing the application of theory into practice. The programme is also seen as a continuous learning by Facilitator 2. Facilitator 3 indicated that the programme is very helpful as learners perform experiments.

How the programme assists teachers (educators)

The Science Learner Assisted Programme was described by educators as important and of great assistance. Responses obtained from teachers indicated the significance of the programme on their approach to teaching. The selected quotes below illustrate how the programme assists teachers.

"...it assists me a lot because some of the experiments will be set during final examination and as long as they have performed those experiments with the assistant labs then everything will be much simpler to them..." (Teacher 2)

"...like I know how can I summarize a big topic and then one other thing is sometimes as new teacher, what you do is teach word by word then programmes like this you will be lightened, you know, whenever you are teaching, teach the important things like the Inter Molecular Forces, you know what is the important thing" (Teacher 4).

"I needed it to assist me with experiments because we don't have the apparatus; sometimes I'm not able to connect what I must connect or to mix these chemicals correctly" (Teacher 6).

As much as the programme was assisting teachers, formal workshops according to one

teacher should be conducted to deepen educators understanding of the experiments. Teacher 2 summed this by mentioning that: “...*They should sometimes organize workshops especially for the teachers ... those teachers who brought their learners they must be called so that they will be used again; it’s been long since I performed an experiment*”.

Sufficiency, relevancy and appropriateness of materials and resources

In terms of relevancy and appropriateness of the materials used in the programme, facilitators had different views and feelings. Facilitator 1 was satisfied with the materials but reiterated on the issue of resources as the following quote illustrates. “*Yes, they are, they are except the part of saying that we are short staffed...the labs, we don’t have enough of the labs*”.

Facilitator 2 also felt that they are sufficient and relevant as summed by the quote “*Yes, we are having our manual. Usually we call them the SLAPs, which we are going to guide them and also they are having, at the end they are having questions which the learner, they are supposed to answer relating to the experiment they have performed. We usually encourage them to write the answers they have seen rather than going to the internet to take them because we want their observation not the answers at the end of their manual is the observation they had in the experiment and they have to submit it to their teachers...*”.

Facilitator 3 had a different view and feeling. The facilitator asserted that the materials are not sufficient as sometimes apparatus had to be divided for the Science Learner Assisted Program and Outreach activities. The following quote below sums up this facilitator’s views. “*I don’t think so, when we came here, they were having troubles with...uhm...apparatus but they recently bought new apparatus because when we first came here, we had outreaches and there were still schools coming here so we had to divide the apparatus for outreaches and for the ones remaining here...*”.

Although the facilitators were satisfied with learning materials, they were concerned about shortage of resources such as apparatus, and small labs. However, Facilitator 3 also mentioned that the Science Centre recently bought new apparatus, which was an indication of the Centre’s intentions to improve programme delivery. Observational data also showed that flip charts, writing board, laptops and overhead projectors are used during programme delivery which also indicates the relevancy of materials and resources used in the programme.

Important topics or experiments offered in the programme learners should master

Responses generated in this question indicated that teachers were expecting learners to master different topics. Interestingly, Electricity was mentioned by all teachers as the most important topic that learners should master for class tests and examinations. Intermolecular Forces and Newton’s 2nd Law of Motion were also mentioned by teachers.

When probed on the methods they were going to use to test if learners have mastered the topics, teachers indicated that they first do revision through class discussions, questioning and group discussions to recap on all topics offered in the programme during lessons. That is then followed by class tests to properly examine whether learners have mastered the topics or experiments performed.

How the programme is serving the intended beneficiaries

Findings in this section are presented according to evaluation questions as outlined in the learner pre- and post-lesson evaluation questionnaires.

What are the main problems in Physical Science and Life Sciences subjects at your school?

The purpose of this pre-lesson question was to gain insights about problems encountered by learners in Physical Science and Life Sciences. Problems such as lack of labs, shortage of science teachers and shortage of textbooks/study guides were mentioned by learners.

Which Physical Science and Life Sciences topics or experiments you would like the lessons to cover?

A number of topics were mentioned by learners. Analysis revealed that each learner had their own expectations as their level of understanding of the topics was not the same. However, almost all topics mentioned by the learners were covered during the lessons.

Which Physical Science and Life Sciences topics or experiments were offered in the lessons?

Responses obtained clearly showed that learners could recall topics or experiments after attending the lessons.

Which of the topics or experiments offered in the lessons are important to your studies?

A question about which of the topics or experiments offered during the lessons were important to their studies was posed to the learners. This post-lesson question was aimed at generating data on topics or experiments which were regarded as important by the learners. Responses generated illustrated that most of the topics or experiments offered in the programme were important to the learners. In Grade 12, fifteen learners indicated that all topics or experiments were important while five learners mentioned different topics. Photosynthesis and Intermolecular Forces were regarded as important topics or experiments by (%) Grade 11 learners. Grade 10 learners (%) indicated that all of the topics or experiments offered were important to their studies, while other topics were mentioned as well.

Which of the topics or experiments offered in the lessons are least important to your studies?

Learners (n=45) were asked about topics or experiments which they felt were least important to their studies. This question was aimed at generating data about least important topics or experiments offered in the programme. Different views were expressed by learners. Twenty nine (64%) learners in all grades felt that none of the topics offered in the programme were least important. However, Titration, Momentum and Internal Resistance were mentioned as least important topics or experiments by some learners in Grade 12. In Grade 11, Momentum and Intermolecular Forces were mentioned by few learners as least important topics or experiments. Few learners in Grade 10 felt that Ripple Tank, Phases of Matter, Heating and Cooling, and OHM's Law were also least important topics or experiments to their studies.

Facilitator competencies, opportunities provided by the programme, relevancy of the experiments and length of lessons

In terms of facilitator competencies, many learners strongly agreed and agreed that the facilitators were competent. Data gathered indicated that learners were of the opinion that facilitators were prepared (69%), used relevant examples (45%) and also had sufficient knowledge about the topics (58%).

With regard to opportunities provided to learners by the programme, 49% of learners strongly agreed and 62% agreed that the programme has provided them with opportunities to apply theory into practice, and have seen the apparatus used when performing experiments.

In terms of relevancy of experiments, data collected indicated a high degree (51%) of satisfaction amongst learners, and 54% of them strongly agreed, whereas 38% and 33% agreed that the experiments performed were relevant and setting was also relevant.

Learners in each grade were asked to rate the length of the lessons. Three options provided on the questionnaire included adequate, too long and too short. The majority (62%) of the learners across three grades (Grades 10-12, n=45) felt that programme lessons were adequate. Some learners felt that it was too long (24%) or too short (13%). Overall, 62% of learners felt that the length of the lessons was adequate, 24% rated them as too long, while and 13% rated them as too short.

Programme value

Forty five learners were asked to rank the programme in terms of value. Three options provided to learners on the questionnaire were “Of great value”, “Of value”, and “Of no value”. 69% ranked the programme “Of great value”, 29% of learners thought that it was “Of value”, and only one learner (2%) felt the programme was “Of no value”.

Discussion, conclusion and recommendations

Programme design

Alignment of SLAP to the vision and goals of the Science Centre

Results indicate that the programme is aligned to the following two goals of the UL Science Centre, namely: (1) Contribute to the enhancement of learner participation and performance in STEM subjects and careers; and (2) Enhance quality STEM education. These two goals take their cue from the Goals of the University of Limpopo (<https://www.ul.ac.za/>), which in turn are informed by the Higher Education Qualifications Framework (2007) and the Higher Education Act, 1997 (Act No. 101 of 1997), to which all South African universities are aligned.

Alignment of the programme to the National Curriculum

Data obtained during engagements with management and programme staff revealed that the programme is aligned to the National Curriculum. Science centres in South Africa plays an important role in national education. In terms of their role to education and learning, the centres focus on Science, Technology, Engineering, and Mathematics. This is in accordance with the National Norms and Standards for a Network of Science Centres in South Africa which encourages STEM participation through the following four key goals, namely: To identify and, nurture youth talent and potential in STEM; to promote science literacy among youth and the population in general; to enhance learner participation and performance in STEM; and to provide career education in general and STEM in particular to the youth [5].

Alignment of STEM education in Science Centres to the National Curriculum

The Department of Education, and Science and Technology collaborated to develop a National Strategy for Mathematics, Science and Technology Education in General and Further Education and Training in 2001. The strategy was a response to poor output of Mathematics and Science graduates in Grade 12 [20]. To address this challenge, Alignment of STEM education in science centres to the National Education Curriculum was considered. Thus the Department of Education, and Department of Science and Technology agreed to collaborate on

(1) educator development to upgrade their knowledge and skills, (2) enhancing learner participation and performance, (3) identifying and nurturing talent and potential, (4) placing and supporting learners in higher education and key strategic economic sectors, and (5) supporting curriculum delivery.

Conclusions

Article II. While it is true that few if any evaluation studies have been done in South African science centres, it must be emphasized that these studies are needed to improve the educational programmes happening in science centres. Although science centres in South Africa's main functions were not to teach school subjects, the reality is that many rural school depend on this teaching of STEM subject and even relying on science centres to provide a much needed laboratory component in their teaching practises. It is then also appropriate that science centres do need to ensure that their teaching practises will converse into successful learning environments. This can only be done if these programmes are evaluated and subsequently improved.

The University of Limpopo Science Centre is the Limpopo Province's premier science facility. Through SLAP, it is clear that the Centre is contributing to the advancement of Science, Technology, Engineering and Mathematics education. However, this function is negated by the needs of the schools, which is education support, where the centre is clearly succeeding at.

The relevance of the Science Learner Assisted Program to the needs of learners and schools is justifiable. The programme has demonstrated its ability to provide rural schools and disadvantaged learners with an opportunity to access a laboratory and perform subject related experiments. Furthermore, the programme is contributing to skills development by providing STEM graduates with opportunities to acquire work related skills and experience.

Despite the programme playing a significant role in advancing science education, there remain challenges that needs to be addressed as pointed out in the recommendations section. Since the Science Learner Assisted Program is one of the core programmes at the Centre, management should ensure that evaluation findings and recommendations are utilized for programme improvement.

Recommendations

Recommendations from evaluators

- The University of Limpopo Science Centre should develop an operational plan for the Science Learner Assisted Program based on programme description with a plausible logic model and clear theory of change. The plan will enable the Science Centre to clearly articulate the impact it seeks to achieve with the Science Learner Assisted Program since it's one of the core programmes. Moreover, the logic model and theory of change will demonstrate how programme objectives, activities, outputs, outcomes, and indicators for measuring progress will lead to the attainment of overall programme goal.

- Utilize evaluation findings to develop a monitoring and evaluation framework for the entire Science Centre. The framework will inform and assist the organisation in developing an on-going monitoring and evaluation plans for the Science Learner Assisted Program and other programmes.

- Consider engaging schools that participated in the programme to assess the impact of the programme on learners' performance in science subjects and career development. This will strengthen and enhance the relationship between the Science Centre and schools in the province.

- Undertake school visits to promulgate the Science Learner Assisted Programme and services offered at the Science Centre. More schools will be aware of what the Science Centre is

about and what kinds of services available to their learners.

- Consider improving classroom settings. This can be done by putting more science related wall- stickers, improving ventilation system and increasing space to accommodate more learners.

Recommendations from Facilitators and Teachers

- The Science Centre should consider selling presentations to schools at an affordable price since it is the province's premier science destination.
- More Life Sciences lessons should also be offered in the programme.
- The Science Centre should consider increasing space in the labs to curb overcrowding.
- Alternative venues should be considered to accommodate as many learners and schools as possible.
- Pre-engagements should be made with schools to prepare learners for the programme. This will avoid delays in spending more time on revision and focus on the experiments.

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