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CHALLENGES FACING LABORATORY PRACTICAL APPROACH IN PHYSICS INSTRUCTION IN KENYAN DISTRICT SECONDARY SCHOOLS

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ABSTRACT
Over the years, the Kenya National Examination Council's (KNEC) secondary school Newsletters have repeatedly pointed out that students need to be exposed to more and more laboratory practical activities in all sciences throughout their secondary school period in order to realize good performance. As such this study aimed at establishing the challenges facing laboratory practical approach in Physics instruction, in the district category of schools in Kenya; in that the newsletters have further shown that most schools in this category perform way below average in Physics examinations. The study was based on constructivist experiential learning theories which explain learning as being constructed through tangible activities. In secondary school Physics instruction these theories focus on laboratory practical activities. The findings of the study provide a bearing on how best to overcome the challenges.

Keywords:
*Challenges***:** shortcomings, problems encountered.
Constructivist experiential learning: an approach to instruction that focuses on practical activities.
*District schools***:** schools whose student catchment area is mainly from within the district where the school is located.
*Instruction***:** the teaching and learning process.

INTRODUCTION

Physics is a branch of natural science that deals with the study of matter, energy & motion and their interelatioship through space and time. The general goals of learning Physics include: to equipp leaners with basic knowledge on scientific enquiry methods, hence foster their problem solving skills and also to enhance their career development. Advancement in Physics particularly leads to effectiveness in communication, engineering, computing, amongst others. With the dynamic trends in science and technology, the Kenyan secondary school's Physics curriculum has been reviewed and revised from time to time to include more of practical activities in its instruction.

Importance of laboratory practical activities

Black, (1993) asserts that sciences (Physics inclusive) are practical subjects hence best learnt through experiments, observations, analysis and generalization of conclusion. Kulik, (1992) notes that, for Physics and other sciences to be understood better by all, there is need to emphasis its instruction in secondary schools through practical approach. Hickey et al, (2001) observes that the trend in educational reforms is to teach from a con-

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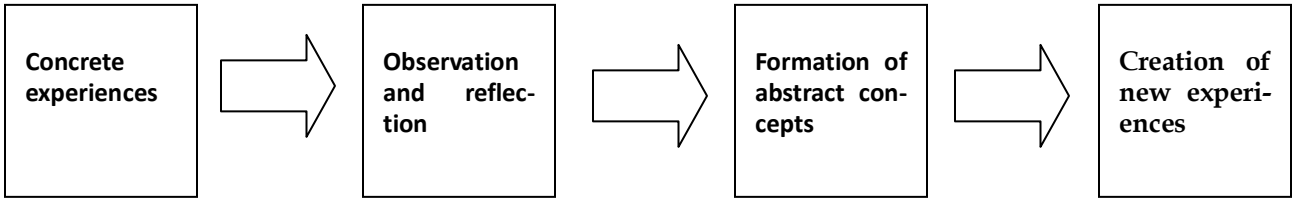
structivist perspective. As such teachers should focus more on practical activities during instruction. Gauvain, (2001) points out that constructivism include an emphasis on collaboration; this implies that learners should be allowed to interact during practical activities as much as possible. Martin et al, (1997) explains that rather than putting fully formed knowledge into the learners' minds, the teacher should guide them in constructing knowledge through scientifically valid approaches. Thus a teacher with a constructivist instructional philosophy would not have learners memorize rote information but give them opportunities to meaningfully construct knowledge through active participation and interaction.

Constructivist experiential instruction stem from constructivist learning theories. These theories explain knowledge as being constructed through effective and purposeful hands on materials instruction. An example of this learning theory is the Kurt Lewin's laboratory training approach explained in the model below.



In this model knowledge construction is conceived as a four stage process. *Concrete experiences* is the first stage, it represents the immediate tangible experiences (hands on materials) that learners are involved in. During this process they physically manipulate apparatus e.g. setting up a simple electric circuit. The experiences in the first stage lead to the second stage of *observation and reflection*, this stage basically entails the use of senses, which triggers sensory stimulus. The stimulus triggered lead to the third stage i.e. *formation of abstract concepts.* It is the stage where stimulus is assimilated into the learner's mind, as such concreteness turn out to abstractness. From the assimilation, new experiences and concepts are created leading to the fourth stage of *creation of new experiences.* These experiences generate new knowledge and represent the instructional objectives/expected learning outcomes. The four stages are interlinked as one leads to the other. In Physics instruction ineffectiveness in practical instruction can be traced ultimately to lack of adequate linking within the four stages.

CHALLENGES FACING LABORATORY PRACTICAL APPROACH IN PHYSICS INSTRUCTION

Despite the emphasis of laboratory practical approach in secondary school Physics instruction, the methodology still faces a number of challenges that render it ineffective in Kenyan district category of schools. From the study the following challenges were conspicuously noted.

- Poor understanding and grasp of practical concepts by learners: this was attributed to stem from student's entry behaviour. Jennings, (1998) in his statements on the goals of science education states that science and its processes should provide an opportunity for learners to develop thinking and process skills which include deductive, logical and hypothetical thinking. As such due to poor grasp and understanding of practical concepts by learners these goals are hardly achieved.
- Lack of laboratories in schools: from the findings it was established that at the time of the study some schools had no laboratories at all. Joan Solomon, (1993) observes that science teaching must take place in the laboratory, about that at least there is no controversy. Science simply belongs there as naturally

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as cooking belongs to the kitchen. From this it is evident that without a laboratory it is difficult for teachers to engage students in practical activities, impacting negatively on instruction.

- Limited space in the laboratory: from the study it was established that some schools had comparatively smaller laboratories that could not accommodate a standard class of up to forty students. Schools laboratories' should be big enough to allow practical activities to be done by all students at the same time other than doing it shifts in the case of smaller laboratories.
- No laboratory technicians in schools: at the time of the study some school had no laboratory technicians. In such situations teachers are forced to assume the role of technicians, as such laboratory practice and instruction is compromised due to time constraints in balancing between teaching and being a technician
- Single science laboratory: from the study it was established that all schools sampled had a single laboratory serving all the sciences. In such cases the time allocated for each science subject cannot sufficiently provide for the day to day practical activities. Some respondents noted that the single science laboratory system was better suited to the already phased out secondary school curriculum that incorporated Physical and Biological sciences.
- Untrained laboratory technicians: from the study it was established that, more than half of the technicians in the sampled schools were not trained in school's laboratory practice. Effective laboratory practice requires skills and professionalism that may not be achieved by untrained personnel as such instruction is compromised.
- Shortage of teachers: at the time the study it was established that some schools had no Physics teachers. This is further supported by the fact that an article *shortage of science teachers bite* carried in the Daily Nation Newspaper dated 1st, March 2011, pp: 5 points out a shortage of twelve thousand science and mathematics tutors in secondary schools. In the same article the Kenyan minister of Education observes this as being the biggest contributing factor to declining results in the disciplines.
- Inadequate textbooks/practical guides: the study established a shortage of Physics text books and practical guides. Effectiveness in Physics laboratory instruction requires that learners be provided with enough practical guides and textbooks. These resources give a wide range of practical activities together with detailed procedures to be followed hence boost practical instruction.
- Insufficient laboratory resources: the study established that more than seventy percent of the sampled schools had insufficient laboratory equipment, apparatus and chemicals. Tsuma, (1997) points out that a science laboratory is an indispensable facility in science education, if well equipped with the right kind of apparatus and chemicals then it should provide the best setting for teachers to assist students in acquiring scientific knowledge and skills. From this it is evident that inadequate laboratory resources jeopardize Physics practical instruction.
- Minimal or no funds allocated for purchase repair and maintenance of laboratory equipment: in a number of schools some apparatus in use were in very poor working conditions while others had been grounded, this impacts negatively on practical instruction.
- Time: it was established that due constraints emanating from other challenges e.g. inadequate laboratory equipment, single science laboratory and / or small laboratory space, time was wasted during shifts and in many cases practical activities wouldn't be as conclusive as required.

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- The study established that some teachers avoided practical instruction as they opted for other instructional methods. This trend is detrimental to Physics teaching and learning, being a science Physics instruction should be practical oriented.
- It was also established that low syllabus coverage contributed to ineffectiveness in practical instruction.

RECOMMENDATION

Basing on the findings the following recommendations were made.

- Improvisation: Tsuma, (1997) defines improvisation as the process of consciously searching the students' immediate environment for materials and their appropriate arrangement in order to generate familiar events for the students' sensory perceptual experience. These materials are used in place of conventional ones. Improvisation compensates for apparatus that may not be available in school's laboratories. Physics and other science teachers should strive to improvise apparatus. Improvisation also makes learners appreciate the relationship between classroom instruction and their day to day encounters due to the fact that improvised apparatus are mainly adopted from the learner's local environment.
- Teachers should engage students regularly in practical activities this will go a long way in developing their process skills, confidence, mastery and application of practical concepts. In the long run it leads to improved performance in Physics and all sciences in general. A number of Physics practical activities have been suggested in the Kenyan secondary school science and mathematics syllabus, other practical activities can be generated by teachers during instruction.
- Laboratory technicians serving in schools should be trained in science laboratory practice in order to enhance laboratory professionalism and effective execution of laboratory demands. It is not in order to have untrained or individuals trained in other unrelated fields serving as laboratory technicians as was the case in some schools.
- Schools should sufficiently budget for building laboratories (some schools had no laboratories at all), purchasing of laboratory equipment & Physics textbooks/practical guides. Without this practical instruction in Physics will be ineffective.
- Physics teachers, laboratory technicians and the school administration at large should always ensure that there is proper care, maintenance and constant repair of laboratory equipment / apparatus.
- In service training for laboratory technicians should be organized periodically in order to update them on current trends in laboratory practice, likewise Physics and other science teachers should at all times attend refresher courses, workshops and seminars e.g. Strengthening of Mathematics and Science in Secondary Schools (SMASSE) refresher courses. It will enable them update themselves on current issues and trends in science education. As such improve more on their instructional procedures.
- Teachers should also always encourage learners and explain to them the importance of Physics practical activities. It will make them accord practical activities the seriousness it deserves at all times.

CONCLUSION

The study sought to investigate the challenges facing laboratory practical approach in Physics instruction in Kenyan district category of secondary schools. The study established that Physics instruction was not as effec-

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tive as it should be due to the challenges facing laboratory practical instruction. In part this has contributed to poor performance in the subject. As such it calls for all educational stakeholders to join hands for the betterment of the subject. The government through the ministry of education and policy makers should ensure that secondary schools have required facilities & personnel at all times and that educational policies are implemented to the letter. This will go a long way in improving Physics instruction hence realization of curriculum objectives, aims and national goals of secondary school Physics education.

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