EVALUATION OF TEACHERS AND STUDENTS' PERCEPTION OF PROBLEMS ENCOUNTERED IN BIOLOGY LABORATORY CLASS IN SENIOR SECONDARY SCHOOLS IN NIGERIA

E. O. Babatunde
Institute of Education,
University of Ibadan
babatundeezekiel11@yahoo.com,
babatundezekiel11@gmail.com
+234 803 332 5661; +234 705 788 3139

Abstract

Science innovations and their uses in economic, industry, communication, agriculture and medicine have reconstructed the lives, attitude and habit of most mankind during the last century. In this scientific and technological age, no citizen can function effectively without basic scientific literacy and elementary skills as health of millions of people in Nigeria depends on medical practitioners who use their knowledge and attitude derived from the study of practical biology to save the lives of people suffering from diseases. Despite the importance of practical oriented subjects, little efforts had been made by researchers to evaluate the problems associated with teachers and student's perception of practical biology in secondary schools. This study evaluated teachers and student's perception of problems encountered in practical biology in senior secondary schools in Nigeria. Three hypotheses are formulated and tested in the study. This is a survey research. Fifty teachers and two hundred students are involved in the study. Two instruments: Teachers Problems Perception of Practical Biology Questionnaire and Students Problem Perception of Practical Biology Questionnaire with reliability coefficient of 0.96 and 0.89 respectively. Data collected were analysed using descriptive and inferential statistics at p<0.05 level of significance. Result revealed a significant difference in the perception of problems encountered in Practical Biology by male and female students ((t=~2.179, df = 198, P<.05) but there was no significant difference between male and female teachers' perception of problems encountered in practical Biology ((t=0.723, df = 48, P>.05). Moreover, the result

shows a significant difference in the perception of problems encountered in practical Biology by both teachers and students (t= 9.052, df = 248; P< 0.05) but no significant relationships between teachers' and students' perception of problems encountered in practical Biology (r=-0.031, P>0.05). It is recommended that each period of Biology class should be doubled to facilitate teaching-learning in theory and practical while seminars and workshop should be regularly organized for teachers to build their capacity.

Keywords: Perception, Practical Biology, Teachers, Students, Evaluation

Introduction

To date, many studies have been conducted on the importance of laboratory work while teaching science. Currently, science educators and teachers agree that laboratory work is indispensable to the understanding of science (Cardak, 2007; Ottander & Grelsson, 2006; Tan, 2008). The role of laboratory work in science education has been detailed by some researchers (Lazarowitz & Tamir, 1994; Lunetta, 1998). The main purpose of laboratory work in science education is to provide students with conceptual and theoretical knowledge to help them learn scientific concepts, and through scientific methods, to understand the nature of science. Laboratory work also gives the students the opportunity to experience science by using scientific research procedures. In order to achieve meaningful learning, scientific theories and their application methods should be experienced by students. Moreover, laboratory work should encourage the development of analytical and critical thinking skills and encourage interest in science (Ottander & Grelsson, 2006).

There are concerns about the effectiveness of laboratory work in helping the students understand the various aspects of scientific investigation (Lazarowitz & Tamir, 1994; Schwartz et al., 2004). Teachers usually want to develop students' higher order thinking skills, like critical thinking, through laboratory work; but to what extent they can achieve this is controversial (Bol & Strage, 1996; Ottander & Grelsson, 2006). Therefore, it is important to analyze the purposes related to laboratory work, as the purposes need to be well understood and defined by teachers and students alike for the practical work in the

laboratory to be effective. Johnstone and Mahmoud (1980) sought the views of students on the difficult content areas in biology. They focused on students because of their belief that a student's perception of a topic is more important in learning than a teacher's perception of it.

In spite of efforts to better define the purposes and role of laboratory work in science education, research has shown that teachers see laboratory activities as contrived (Tan, 2008; Tobin, 1986). In general, teachers cannot see laboratory activities as conceptually integrated with theoretical science lessons. In addition, teachers fail to understand that laboratory activities may provide opportunities for students to produce new knowledge through scientific investigations. According to a research conducted by Kang and Wallace (2005), teachers perceive laboratory work solely as an activity for the purpose of verification. Researchers have also uncovered that teachers do not think of the laboratory as an environment where scientific knowledge claims are discussed.

Different reasons have been shown for the problems relating to laboratory work (Tan, 2008). According to Bencze and Hodson (1999), problems in laboratory work arise when students blindly follow the instructions of the teachers. Some researchers, on the other hand, claim that the laboratory, instead of being a place for science and experiments, has become a place where tasks set by the teacher are carried out. No attention is given to the methods or purposes during laboratory work, only the set tasks are carried out (Hart et al., 2000; Jimenez-Aleixandre et al., 2000). Wilkinson and Ward (1997) have connected the problems with laboratory work to a poor evaluation of the purposes of the tasks undertaken in the laboratory.

The multiple purposes of laboratory work have been the subject of discussion worldwide for many years. Multiple lists of these purposes have been prepared for different levels of education. Many of these lists focus on carrying out experiments through scientific methods and technical skills. While some strongly emphasize effective objectives, others have dwelled on other purposes (Johnstone & Al-Shuaili, 2001; Reid & Shah, 2007). When secondaryschool biology laboratories are considered, the general purposes of laboratory work may be:

* Supporting or strengthening theoretical knowledge,
* Experiencing the pleasure of discovery and development of their psycho-motor skills,

* Teaching how scientific knowledge may be used in daily life,
* Increasing creative thinking skills,
* Gains in scientific working methods and higher order thinking skills
* Developing communication skills,
* Developing manual dexterity by using tools and equipment; allowing students to apply skills instead of memorizing (Bayraktar et al., 2006).

There are many factors affecting the attainment of the above targets. These factors are: the attitudes of the teacher and the students towards the laboratory, student communications, laboratory manuals and the approaches used in laboratory instructions. Many studies have shown that teachers are not aware that the different practical activities in the laboratory have different objectives (Nott & Wellington, 1997; Wilkinson & Ward, 1997). The teachers agree that carrying out a traditional laboratory work is a good thing without fully considering what the real purpose of the practical activity (Ergin et al., 2005). Abanikannda (2003) emphasized that over the years a lot had been said and written about how to teach and how student learn but in actual practice, many of these theories have not produced in the practicing teachers classroom performance, much change. Experience from observations has shown that most of the problems militating against effective teaching of biology practical is centered on the method of learning by biology teachers, the laboratory environment, lack of finance for laboratory equipment and lack of skilled teachers to handle practical.

Some teachers also prefer teaching the theoretical aspect hence they avoid the practical. Large class size is also a problem and this does not give room for effective teaching-learning process.

Hirvonen and Viiri (2002) have reported that as a result of learning practical skills and scientific learning methods, students experience an increase in motivation and teachers gain the opportunity to evaluate the knowledge of their students. When this occurs, the theory-practice connection in student-teachers was measured at the highest level. In addition, the researchers suggested that the nature of science and scientific knowledge requires a different approach to learning. Although

it offers a biased view of the nature of science, laboratory work gives the impression that research is the core domain of science.

Sahin-Pekmez et al. (2005) examined science teachers' thinking on the nature and purpose of practical work in the context of the National Curriculum for Science in England. Data was collected through individual interviews with science teachers about their classroom practice. The findings suggest that little attention is being given to procedural understanding in terms of ideas relating to the quality of data. It is argued that this is a key limiting factor in the development of pupils' ability to engage in genuine investigative work.

Ottander and Grelsson (2006) investigated the ideas of biology teachers on the role of laboratory work. According to the results of this study, teachers agree that laboratory work is an important part of biology and science lessons. However, teachers focus on the most common purposes of laboratory work, such as building the connection between theory and practice and increasing motivation. Furthermore, teachers do not consider the purposes of laboratory work as being concerned with scientific process skills. Moreover, the interpretation of the learning outcomes of experimental activities differs between students and teachers.

The importance of laboratory work in science education is well known. However, there is a lack of clarity regarding the problems encountered in laboratory work and the perceptions of the students do not conform to that of the teachers. Whereas, it is important that biology students and teachers perception about the problems encountered in laboratory work is understood in order for the expected outcomes to be acquired from laboratory work and for the proper planning of lessons. This study therefore evaluated biology teachers and students perception of problems encountered in practical biology in senior secondary schools in Nigeria. Three hypotheses that were formulated and tested in the study are:

Ho_1: There is no significant relationship between the perception of problems encountered by teachers and students in biology.

Ho_2: There is no significance difference between the perception of problems encountered by the male and female students in practical biology.

Ho_3: There is no significance difference between male and female teachers perception of problems encountered in practical biology.

This is a survey research. Fifty teachers and two hundred students participated in the study. Two instruments: Teachers Problem Perception of Practical Biology Questionnaire (TPPPBQ) and Students Problem Perception of Practical Biology Questionnaire (SPPPBQ) with reliability coefficient of 0.96 and 0.89 respectively were used to collect data in the study. Data collected were analysed using descriptive and inferential statistics at $p<0.05$ level of significance.

Results

Ho_1: There is no significant relationship between the perception of problems encountered by teachers and students in biology.

Table 1: Summary of Pearson Product-Moment Correlation (PPMC)

Variables	N	Mean	Std. D	R	P
Students' Perception	100	56.20	6.73		
Teachers' Perception	50	38.91	5.45	-.031	.919

Table 1 reveals that there is no significant relationships between teachers and students' perception of problems encountered in practical work in Biology ($r=-0.031, P>.05$). The finding revealed that the calculated correlation value (r) =-0.31 is less than 0.5 from the critical table value. This implies that there is no significant relationship between the teachers and students' perception of problems encountered in practical Biology. Therefore the null hypothesis is not rejected. This finding is in contrast to the findings of Ogundiran (2006) where it was revealed that there is significant relationship between teachers and students perceptions of problems encountered.

Ho_2: There is no significant difference between the perception of problems encountered by the male and female students in practical biology

Table 2: Summary of T-test Analysis of Students' Perceptions by Gender

Variables	N	Mean	Std. D	t	Df	P
Students' Perception						
Male	100	55.16	5.35	-2.179	198	.031
Female	100	57.22	0.75			

From table 2, the findings revealed that the calculated correlation value t-cal = 2.179 is greater than critical table value of 1.96. This implies that there is a significant difference of male and female students in their perception of problems encountered in practical Biology. Therefore the null hypothesis is rejected. The mean score show that female students perceived the problems more (57.22) than their male counterparts (55.16). The reason for this could be that most female students find practical work to be tedious than their male counterparts. This finding is in line with earlier findings of Wyatt, (2005), Lord. & Orkwiszewski (2006) and Babatunde & Elemide (2014) who established significant gender group difference in science education for boys,

Ho_3: There is no significant difference between male and female teachers perception of problems encountered in practical biology

Table 3: Summary of Analysis of Teachers' Perceptions by Gender

Variables	**N**	**Mean**	**Std. D**	**t**	**df**	**p**
Teachers' Perception						
Male	34	39.67	6.36	.723	48	.485
Female	16	37.25	2.36			

From Table 3, t-calculated 0.723 is lesser than t-critical = 2.20, therefore there is no significant difference between male and female teachers in their perception of problems encountered in practical work in Biology (t=0.723, degree of freedom = 48, P>.05).Therefore, Ho_3 is not rejected. This is in line with Fagbo (2002) in the findings that people's perceptions are not determined by gender but their personal values, varying experience, environment or culture.

Conclusions and Implications

One would have expected that students taking biology as one of the core subjects in senior secondary school should be interested in science and should be enthusiastic about the methods used by scientists in scientific research while teachers should be well disposed to facilitating teaching-learning process to enable students achieve this feat. However, review of studies conducted on biology teaching in the last two decades show that no matter how the curriculum programmes are changed, most of the students develop incorrect perceptions regarding biology and graduate with erroneous impressions about biological phenomena (Wandersee et al., 1994). Currently, new research is constantly being conducted to enable students t learn more efficiently. The importance of laboratory experience in learning biology and increasing students' interest in biology cannot be over-emphasized and this account for the need for our teacher training institutions to begin to search for suitable laboratory instruction approach that must be selected and implemented with a view to redirect the perception of teachers and students as there are many approaches related to laboratory instruction. The results of the present study show that the perception identified by biology student and teachers reflect the traditional, deductive or cook-book approaches. Therefore, alternative approaches such as inquiry-based laboratory must be brought to the foreground. For example, Domin (2007), in addition to the traditional expository instructional method, touches on the three instruction styles in common use: discovery (guided-inquiry), inquiry (open-inquiry) and problem-based. Although these alternative styles are generally gathered under the single rule of non-traditional instruction, each one is different and places the student in a unique learning environment. Students' efforts must be given a definite direction with closed- and open-ended experiments. However, in teaching biology, studies with

open-ended experiments (Bayraktar et al., 2006; Cepni & Ayvaci, 2006) are observed to be more useful, as in these experiments, the carrying out of the operations, the interpretation, the gleaning of results, the presentation of factual hypotheses and generalizations are entirely up to the student.

In conclusion, learning environments that make it necessary for students to take an active role in laboratory work and to make discoveries must be established by the school and government. In such environments, the role of the teacher is not just to transfer packaged knowledge directly to the students; the teacher's role is to encourage students in problem solving. During this process, realized under the supervision of the teacher, new knowledge is discovered in the laboratory. This knowledge can later be used in other lessons as a basic concept. Time must be set aside for discussions, both before and after the experimentations in laboratory implementations, as discussions aid in adding to incomplete knowledge and in discovering new knowledge.

References

Abimbola, I.O. (1984): A study to describe and explain the alternative conceptions related to human respiration held by selected Nigerian form four students. (Doctoral dissertation University of Wisconsin-Madison, Madison, Wisconsin 53706, U.S.A.) Dissertation
Abstracts International. 45 (05), 1357-A, No.DA8414218**.**

Babatunde, E.O,. & Elemide, B.O. (2014). Creative Approaches to Solving Problems Encountered by Teachers and Students in Secondary School Biology Class in Nigeria. *West African Jiournal of Education*, vol.XXXIV, pp 59-66.

Bayraktar, S., Erten, S. & Aydogdu, C. (2006). Fen ve teknoloji ogretiminde laboratuvarin onemive deneyler. M. Bahar (Ed.), *Fen ve teknoloji ogretimi (Science and Technology Instruction)* (pp. 219-248). Ankara, PegemA Yayincilik. [in Turkish].

Bencze, L. & Hodson, D. (1999). Changing practice by changing practice: Toward more authentic science and science curriculum development. *Journal of Research in Science Teaching*, *36*(5), 521–539.

Bol, L. & Strage, A. (1996). The contradiction between teachers' instructional goals and their assessment practices in high school biology courses. *Science Education, 80*(2), 145–163.

Cardak, O., Onder, K. & Dikmenli, M. (2007). Effect of the usage of laboratory method in primary school education for the achievement of the students' learning. *Asia-Pacific Forum on Science Learning and Teaching*, *8*(2), Article 3. [Online] http://www.ied.edu.hk/apfslt/v8_issue2/cardak/.

Cepni, S. & Ayvaci, H.S. (2006). Laboratuar destekli fen ogretimi yaklasimlari. S. Cepni (Ed.), *Fen ve teknoloji ogretimi (Science and technology instruction)* (pp. 167–195). Ankara, PegemA Yayincilik. [in Turkish].

Domin, D.S. (2007). Students' perceptions of when conceptual development occurs during laboratory instruction. *Chemistry Education Research and Practice*, *8*(2), 140–152.

Ergin, O., Sahin-Pekmez, E. & Ongel-Erdal, S. (2005). *Kuramdan uygulamaya deney yoluyla fen ogretimi*. Izmir, Dinazor Kitabevi. [in Turkish].

Fagbo, P.M. (2002). Relationship among laboratory instruction, attitude toward science, and achievement in science knowledge. *Journal of Research in Science Teaching*, *34*(4), 343–357.

Hart, C., Mulhall, P., Berry, A., Loughran, J., & Gunstone, R. (2000). What is the purpose of this experiment? Or can students learn something from doing experiments? *Journal of Research in Science Teaching*, *37*(7), 655–675.

Hirvonen, P.E. & Viiri, J. (2002). Physics student teachers' ideas about the objectives of practical work. *Science & Education*, *11*, 305–316.

Jimenez-Aleixandre, M.P., Rodriguez, A.B. & Duschl, R.A. (2000). 'Doing the lesson' or 'Doing science': Argument in high school genetics. *Science Education*, *84*(6), 757–792.

Johnstone, A.H. & Al-Shuaili, A. (2001). Learning in the laboratory: some thoughts from the literature. *University Chemistry Education*, *5*, 42–51.

Kang, N.H. & Wallace, C.S. (2005). Secondary science teachers' use of laboratory activities: Linking epistemological beliefs, goals, and practices. *Science Education*, *89*(1), 140–165.

Lazarowitz, R. & Tamir, P. (1994). Research on using laboratory instruction in science. In D.L. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 94–128). New York: Macmillan.

Lord, T. & Orkwiszewski, T. (2006). Moving from didactic to inquiry-based instruction in a science laboratory. *The American Biology Teacher*, *68*(6), 342–345.

Lunetta, V.N. (1998). The school science laboratory: Historical perspectives and centers for contemporary teaching. In: B.J. Fraser & K.G. Tobin (Eds), *International handbook of science education*. Dordrecht. Kluwer Academic Publishers.

Nott, M. & Wellington, J. (1997). Producing the evidence: Science teachers' initiations into practical work. *Research in Science Education*, *27*(3), 395–409.

Ottander, C. & Grelsson, G. (2006). Laboratory work: the teachers' perspective. *Journal of Biological Education*, *40*(3), 113–118.

Reid, N. & Shah, I. (2007). The role of laboratory work in university chemistry. *Chemistry Education Research and Practice*, *8*(2), 172–185.

Sahin-Pekmez, E., Johnson, P. & Gott, R. (2005). Teachers' understanding of the nature and purpose of practical work. *Research in Science & Technological Education*, *23*(1), 3–23.

Schwartz, R.S., Lederman, N.G. & Crawford, B.A. (2004). Developing views of nature of science in an authentic context: an explicit approach to bridging the gap between nature of science and scientific inquiry. *Science Education, 88*(4), 610–645.

Tan, A-L. (2008). Tensions in the biology laboratory: What are they? *International Journal of Science Education*, *30*(12), 1661–1676.

Tobin, K. (1986). Secondary school laboratory activities. *International Journal of Science Education*, *8*(2), 199–211.

Wandersee, J.H., Mintzes, J. J., & Novak, J.D. (1994). Research on alternative conceptions in science. In D.L. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 177–210). New York: Macmillan.

Wilkinson, J. & Ward, M. (1997a). A comparative study of students' and their teachers' perceptions of laboratory work in secondary schools. *Research in Science Education*, *27* (4), 599–610.

Wyatt, S. (2005). Extending inquiry-based learning to include original experimentation. *The Journal of General Education*, *54*(2), 83–89.