## Assessment of Teaching Effectiveness of Science Ethical Issue Concepts in Basic Science and Technology Curriculum in Junior Secondary School, Gombe State

**[1]Samuel, O. Akinola, [1]Sani, A. Umar and [2]Oluwatosin, A. Veronica**
[1]Department of Science Education, Federal University of Kashere, Gombe State
samogundare91@gmail.com akinola.ogundare@fukashere.ed.ng +2348035808537
[2]Department of Integrated Science, School of Secondary Education Programmes
Federal College of Education (Special), Oyo
animasahunveronica@gmail.com +2348068058702

*Abstract*
*The study assessed the level of classroom conduciveness, appropriateness of stated performance objectives, teacher's instructional techniques and evaluation procedures for effective teaching of science ethical issues in Junior Secondary School (JSS) basic science and technology curriculum. Ex-post facto type of descriptive research design was adopted for this study. The study population comprised all the 286 public Junior Secondary Schools in Gombe State, Nigeria. One hundred and thirty-five schools were selected through simple random sampling techniques from three senatorial districts in Gombe State of which 45 JSS were selected from each district. Three hundred and fifty lessons on science ethical issues concepts in basic science and technology curriculum in Junior Secondary School in Gombe State were observed using Classroom Teaching Observation Schedule (r= 0.83) and adopting descriptive research. Findings indicated that classrooms were not conducive, instructional objectives not appropriate, ineffective instructional strategies and poor evaluation methods. It was recommended that basic science and technology teachers should pay more attention to ethical issues of science and technology in basic science and technology curriculum in Junior Secondary Schools in Nigeria to enhance students' good citizenship in the society.*
**Keywords:** Teaching Effectiveness, Science Ethical Issues, Basic Science and Technology Curriculum

### Introduction
There are various ways in which the practice of science can generate ethical issues in the society. For instance, the ethic nature of science points to two dimensional uses because the dual-use scenarios show that even the well purposed scientific research can lead to more difficulties. A scientist, for example may be working on how a particular disease is spread and with the intention of preventing the future outbreak, this does not mean that the same research cannot be used for harmful ends such as using it for biological weapons. Besides, the use of the computer is beneficial to nearly all areas of human endeavour, there is the tendency that frequent accessibility and utilization could promote the possibilities of

unethical use of computer and other related devices (Jamil & Shah, 2014). It has been observed that talented science students with high potentials can be lost if science ethical education is ignored (Hollander, 2019).
For the past years the wrong use of scientific researches continues to be on the increase in society, misuse of computer, internet to perpetrate evils, frauds, researches in living sciences turn to be used as biological weapons, among others (Mabawonku, 2020; Rappert, 2017). These scenarios have given science educators and other education stakeholders great concern who have made several attempts to improve teaching and learning processes in basic science and technology, particularly in

Samuel, S. A., Sani, A. U. and Oluwatosin, A. V.     ©2021 Federal University of Kashere

the junior secondary schools that is expected to lay concrete scientific basis.

Various efforts have been put forward to address unethical utilization of science thus: such as formulation of codes of conduct and ethics by World Medical Associations, International Ethical Guidelines for Biomedical Research Human Subjects regulations and laws (Clarkeburn, Downie & Mathew, 2012). In spite of the wonderful efforts to address science ethical issues in the use of science and technology, these strategies are inadequate because it has not addressed the totality of ethical challenges brought by science. For instance, some code of conducts and ethics may give appropriate and required rules for behavior, yet individual may not possess skills to use and apply them (Rappert, 2017).

Recognizing that scientists need of ethical education, it has been recommended that as a result of the needs of science students and learning outcomes expected from them, teaching activities should harness role play instructional strategies consisting of real cases stressing and emphasizing on those scenarios with implications of dual-use of science and technology (Rappert, 2018; Brummel, Gunsalus, Kristich, & Loui, 2008). It has been observed that role-play instructional strategies with dual-use cases are highly effective teaching endeavor to enhance the learning outcome of ethic education (Rappert, 2018; Brummel, Gunsalus, Kristich, & Loui, 2008). They argued that role play helps students develop their ethical radar and it also enable them to be aware of the issues and challenges generated from dual-use of scientific research. Doron (2017) noted that role-play exposes the students to the attitudes that they might not otherwise be conscious and aware. It has also been recommended that ethical issues in science and development be infused into all school curricula including basic science and technology in junior secondary school in Nigeria as contained Nigerian Educational Research and Development Council (Federal Republic of Nigeria, (NERDC, 2007).

Basic science and technology curriculum is the production of revised, re-aligned and restructured primary science and junior secondary school integrated science curricula in Nigeria (Nigerian Educational Research and Development Council, 2007). The overall objectives of this curriculum are well stated in Nigerian Educational Research and Development Council (NERDC, 2007) and National Policy on Education (NPE, 2014). Ethical issues in science and development concepts were infused into Basic Science and Technology to cater for science ethics education at junior secondary school level by the Nigerian Educational Research and Development Council (NERDC, 2013). Among the objectives are to: students to express their views on right and wrong application of science, discuss the implications of the application of science to the development of the society, among others. These skills are set to be the scientific ethics education for the students in junior secondary schools and beyond.

The organization of the curriculum contents is thematic. The ethical issues in science and development concepts are presented thematically. The topics are arranged into instructional units, sequence in spiral form while each unit is treated in more details as the course progresses. Each unit is organized thus: Teaching topics, Performance objectives, Contents, Activities (both teacher and students), Teaching and learning materials and Evaluation guide. The contents of the curriculum rest on the discussion, role-play, group projects on topics based on good and bad scientific practices and practical activities of the students to ascertain that students are equipped with ethical issues in the use and application of science and technology in the society. The question one may ask is to what extent is basic science and technology curriculum being effectively implemented in relation to ethical issues concepts by employing appropriate instructional strategies in both public and private junior secondary schools in Nigeria?

Studies abound on some likely constraints that hinder effective implementation of JSS curriculum. Factors identified for low awareness and perception of students' science ethical education are teachers' conventional instructional strategies (Brummel, Gunsalus, Kristich, & Loui, 2008), science teachers'

**Samuel, S. A., Sani, A. U. and Oluwatosin, A. V.**
                             

ineffectiveness (Rappert, 2018), inadequate supply of instructional resources (Ogundare, Abdullahi & Ogundiwin, 2019), poor economic situation in the country (Oyewole, 2017). To effectively implement any curriculum, Kolawole (2006) observed that professional teachers should carry out the followings before, during and after classroom activities, thus: study and analyse critically the learning contents, the learners and the personnel; design and develop the instructional strategies and material resources and Implementation of the programme/ lesson plan/notes of lesson.

Brummel, Gunsalus, Kristich, and Loui, (2008) observed that one of the militating factors for effective teaching of science ethical concepts in schools is lack of adequate and qualified trained personnel and few ones on ground found themselves teaching in unconducive classrooms. Similarly, Rappert, (2017) remarked in a study of codes of conduct and biological weapons: An in-process assessment biosecurity and biodefence strategy that science teachers only impart scientific concepts, facts and principles with poor behavioural objectives to the students with negligent of misuse of science researches and technology in the society. In a related study of Salenhnia, and Salenhnia, (2016) on ethical issues in computing; students' perceptive survey observed that most computer laboratories used for teaching computer were not appropriate for learning and extension demonstrating the dual-use of computer. Besides, Oyewole (2017) carried out a study on awareness and perception of computer ethics by undergraduates of a Nigerian university noted that students' perception and awareness of science ethical issues in term of misuse of science products was low as result of unqualified and uninformed science teachers not using appropriate instructional strategies to pass instructions to their learners. The main objectives of integrating ethical issues in science and development into basic science and technology in junior secondary school in Nigeria is to allow the students express their opinions and views on the right and wrong application of science and technology in the society, discuss the effects of the application of

science and technology to the development of the society (NERDC, 2013) among others.

**Statement of the Problem**
Recently, the wrong use of scientific researches continues to be on the increase in society, misuse of computer, internet to perpetrate evils, frauds, among others. Ethical issues in science and development have been infused into basic science and technology curriculum but the awareness of right and wrong application of science and technology by Nigerian teenagers is still low (Federal Minister of Science and Technology Report, 2019). The objectives of science ethics education concepts in the curriculum are clearly stated but the objectives are still far from being achieved because the implementers (teachers) seem to shy away with effectively teaching dual-use of science and technology but focus on science concepts, facts and principles (FRN, 2019). Stating the low level of junior secondary school students' awareness of the right and wrong application of science and technology in the society, the effectiveness of classroom instructional strategies impacting the concepts is in question. Therefore, this study examined teaching effectiveness of science ethical concepts in science and technology curriculum in junior secondary schools in Gombe State Nigeria.

**Objectives**
The purpose of the study was to examine the extent to which teaching of science ethical concepts in JSS Basic Science and Technology curriculum had been effectively implemented in in Gombe State Nigeria. Specifically, the objectives were to:
i. find out the extent to which classroom environment is conducive for using play-role for teaching science ethical issues.
ii. find out the extent to which instructional objectives stated reflect science ethical issues
iii. examine the appropriateness of instructional strategies in teaching science ethical issues in the schools.
iv. find out the appropriateness of teacher's evaluation procedures.

**Samuel, S. A., Sani, A. U. and Oluwatosin, A. V.    ©2021 Federal University of Kashere**

**Research Questions**
In an attempt to find answers to these problems, the following questions were raised:
i. What extent are classrooms environment conducive for teaching and learning of science ethical issues?
ii. To what extent do instructional objectives reflect science ethical issues in the teaching of science ethical issues in JSS?
iii. What extent do instructional strategies employed by teachers appropriate and effective for teaching science ethical issues?
iv. What extent do teachers' evaluation procedures of their lesson appropriate?

**Methodology**
Ex-post facto type of descriptive research was adopted in this study. This design employed the qualitative method of observation using rating scale to determine the teaching effectiveness of science ethical concepts in science and development in Basic Science and Technology curriculum in junior secondary school. The population of the study comprised 286 public junior secondary schools in Gombe State. Three hundred and fifty (350) Basic Science and Technology lessons were observed across Gombe State junior secondary school class three. Two hundred and seventeen (217) classes were observed from 135 schools. In some high populated schools, there are more than one arm of JSS III classes and all were observed since the teacher teaches ethical concepts in basic science and technology. In addition, some JSS III classes were observed more than one time and this is why the number of lessons (350) is higher than number of schools (135). The 135 schools were sampled through simple random sampling methods based on the three senatorial districts in Gombe State of which 45 JSS were selected from each district.

Classroom Instructional Observation Schedule (CIOS) was designed and developed around the five major area of instructional effectiveness. The instrument is a 22-item rating scale of 1 to 5 taking care of the various areas of classroom instructions of ethical issues in science and technology. The highest observed performance instructional skill is rated as 5 while 1 is scored as the least. This instrument was validated by peer experts review and it was subjected to reliability analysis giving the value of coefficient of 0.83 using Crombach analysis.

The observation sessions of classroom teaching effectiveness were done by the research team and with the aid of 8 Master of Education degree students. Every observation started right from the inception of the respective lessons to the end in order to be sure that no part of the lessons is not covered. The study lasted for ten weeks. Observed data were analyzed with frequency counts, percentages and mean since the observed skills have been scored (Sauro, 2012; Brace and Kemp, 2006). Hence, data collected were analyzed with the use of descriptive statistics frequent counts, percentage and mean.

**Results**
The findings of the study are summarized in Tables 1 to 4.
Research question 1: What extent are classrooms environment conducive for teaching and learning of science ethical issues?

**Table 1: Observation of Classroom Environment in Terms of Conduciveness and Organization**

| Item | Lesson Features | Frequency of Scores | | | | | Mean |
|------|-----------------|------|------|------|------|------|------|
| | | 5 | 4 | 3 | 2 | 1 | |
| 1 | Conduciveness of the classroom for teaching | - (0) | 2 (0.57) | 119 (34.00) | 181 (51.7) | 48 (13.7) | 1.23 |
| 2 | Organization of the classroom based on the topics taught and the methods used | 5 (1.4) | 15 (4.3) | 133 (38) | 169 (48.3) | 28 (8) | 1.61 |

Value in parentheses represent percentages

Table 1 shows that across the observed schools, classroom environment in terms of conduciveness to learning and teaching is poor (mean score = 1.23 out of 5.00) similarly classroom organization for the teaching of the topics taught and the methods used is not good

**Samuel, S. A., Sani, A. U. and Oluwatosin, A. V.** ©2021 Federal University of Kashere

(mean score = 1.61). This suggests that generally that the classroom environment is not conducive enough for effective learning and teaching of science ethics issues in in Basic Science and Technology. This phenomenon may mar the teaching and learning of science ethics concepts effectively in junior secondary schools.

**Research question 2:** To what extent do instructional objectives reflect science ethical issues in the teaching of science ethical issues in JSS?

**Table 2: Evaluation of Appropriateness of Behavioural Instructional Objectives**
N = 290

| Item | Lesson Features | Frequency of Scores | | | | | Mean |
|------|-----------------|----|----|----|----|----|------|
| | | 5 | 4 | 3 | 2 | 1 | |
| 3 | Clearly stated teaching objectives | 127 (36.3) | 183 (52.3) | 19 (5.4) | 15 (4.3) | 6 (1.7) | 3.9 |
| 4 | The objectives reflection of the science ethical issues in basic science and technology | 3 (0.9) | 12 (3.4) | 91 (26) | 153 (43.7) | 91 (26) | 1.83 |
| 5 | Objectives coverage of science ethical issues | 4 (1.1) | 31 (8.9) | 47 (13.4) | 141 (40.3) | 127 (36.3) | 1.7 |

Value in parentheses represent percentages

Table 2 indicates the evaluation of instructional objectives appropriateness across the schools surveyed. The behavioural instructional objectives were well stated (1tem 3 mean score =3.9), however most of the stated objectives did not reflect the science ethics' objectives incorporated into Basic Science and Technology curriculum (item 4: low mean score = 1.83) and the objectives coverage of ethical issues in science and development generally (item 5: low mean score of 1.7). This indicates that the teachers did not take into cognizance of knowledge of ethical issues, attitude and practices of the learners which negates the objectives of National Policy on Education (2013).

**Research question 3:** What extent do instructional strategies employed by teachers appropriate and effective for teaching science ethical issues?

**Table 3: Teachers' Instructional Strategies Employed in Basic Science and Technology Classes**

| Item | Lesson Features | Frequency of Scores | | | | | Mean |
|------|-----------------|----|----|----|----|----|------|
| | | 5 | 4 | 3 | 2 | 1 | |
| 6 | Proof of well-planned and consistent lesson | 135 (38.6) | 171 (48.9) | 37 (10.6) | 5 (1.4) | 2 (0.6) | 3.65 |
| 7 | Proof of subject mastery by the teacher | 7 (2) | 11 (3.1) | 63 (18) | 192 (54.9) | 77 (22) | 1.97 |
| 8 | Evidence of knowledge of science ethical issues by the teacher | 1 (0.3) | 13 (3.7) | 47 (13.4) | 182 (52) | 107 (30.6) | 1.21 |
| 9 | Teacher ability to vary instructional procedures and strategies and their effectiveness | - (0) | 10 (2.9) | 31 (8.9) | 142 (40.6) | 167 (47.7) | 1.67 |
| 10 | Use of lecture/role-play/project/concept mapping/demonstration/game-based/ combination of methods | - (0) | - (0) | 17 (4.9) | 93 (26.6) | 240 (68.6) | 1.31 |
| 11 | Questioning skills: frequency, relevance, distribution, challenging and positive response by the learners | 18 (5) | 29 (8.3) | 64 (18.3) | 176 (50.3) | 63 (18) | 2.3 |

| 12 | Potential of the lesson in developing good knowledge and attitude of science ethics in the society in learners | -<br>(0) | 2<br>(.6) | 39<br>(11.1) | 73<br>(20.9) | 236<br>(67.4) | 1.12 |
|----|----|----|----|----|----|----|----|
| 13 | Reflection of real-life right and wrong use of science and technology demonstration in classroom teaching | 2<br>(0.6) | 9<br>(2.6) | 58<br>(16.6) | 160<br>(45.7) | 122<br>(34.6) | 1.64 |
| 14 | Ability to recognize the implication of use of science to the development of the society by the learners | 3<br>(0.9) | 7<br>(2) | 26<br>(7.4) | 158<br>(44.6) | 156<br>(44.6) | 1.51 |
| 15 | Skills and language of communication of science ethics | -<br>(0) | 4<br>(1.1) | 23<br>(6.6) | 182<br>(52) | 141<br>(40.3) | 1.48 |
| 16 | Adequate provision and effective use of instructional materials | -<br>(0) | 3<br>(0.9) | 39<br>(11.1) | 121<br>(34.6) | 187<br>(53.4) | 1.21 |
| 17 | Participation of learners in the classroom discussion | 80<br>(22.9) | 107<br>(30.6) | 77<br>(22) | 64<br>(18.3) | 22<br>(6.3) | 2.85 |
| 18 | Ability of the students carry out projects on topics of ethical issues in science and development | -<br>(0) | -<br>(0) | 5<br>(1.4) | 92<br>(26.3) | 253<br>(72.3) | 1.04 |

Value in parentheses represent percentages

Table 3 reveals the instructional strategies employed by Basic Science and Technology teachers across the schools observed for this study. The result reveals that only evidence of well-planned and consistent lesson and participation of learners in the classroom discussions score above average (mean scores of 3.65 and 2.85 respectively). Others aspects of teaching methods namely:  proof of subject mastery by the teacher, evidence of knowledge of science ethical issues by the teacher, ability to vary instructional procedures and strategies and their effectiveness, use of lecture/project/concept mapping/demonstration/role-play/combination of methods, questioning skills: frequency, relevance, distribution,  challenging and positive response by the learners, potential of the lesson in developing good  science ethics attitude and practice in learners, reflection of real-life right and wrong use of science and

technology demonstration in classroom teaching, ability to recognize the implication of use of science to the development of the society by the learners, skills and language of communication of science ethics, adequate provision and effective use of instructional materials and ability of the students to carry out projects on topics of ethical issues in science and technology all score below mean scores of between 1.04 and 1,97 out of 5.00. The result suggests that teaching is not effective with respect to teaching and inculcating science ethical issues in society, knowledge, attitude and practices in Basic Science and Technology class. One is not surprise because most of the teachers examined exhibited no mastery of the concepts.

**Research question 4:** What extent do teachers' evaluation procedures of their lesson appropriate?

**Table 4: Assessment of Lesson Evaluation and Assignment**

| Item | Lesson Features | Frequency of Scores | | | | | Mean |
|----|----|----|----|----|----|----|----|
| | | 5 | 4 | 3 | 2 | 1 | |
| 19 | Adequate evaluation of lesson objectives attainment | 161<br>(46) | 126<br>(36) | 25<br>(7.1) | 22<br>(6.3) | 16<br>(4.6) | 2.78 |
| 20 | Coverage of knowledge, attitude and problem solving in the lesson evaluation | 24<br>(6.9) | 55<br>(15.7) | 79<br>(22.6) | 160<br>(45.7) | 32<br>(9.1) | 1.72 |

| 21 | Relevant and appropriate class assignment on the topic discussed | - (0) | 2 (0.6) | - (0) | 189 (54) | 159 (45.4) | 1.33 |
| 21 | Relevant and appropriate home/out of class project/or assignment based on the science ethics concepts taught | - (0) | - (0) | 17 (4.9) | 196 (56) | 137 (39.1) | 1.36 |
| 22 | Ability of learners to submit group project reports for assessment | - | - | 29 (8.3) | 127 (36.3) | 194 (55.4) | 1.1 |

Value in parentheses represent percentages

Table 4 reveals the assessment of lesson evaluation and assignment in the schools observed. Only item 19 has a moderate mean score of 2.78 out of maximum of 5.00. Other items have low mean scores ranges between 1.1 and 1.72. This implies that there was no proper evaluation based on knowledge, attitude and practices in the lesson evaluation, there was no coverage of the three domains in the evaluation and inadequate homework, out of class project and assignment based on science ethic concepts.

## Discussion of findings

The finding of this study reveals that classroom teaching effectiveness of ethical issues of science and technology in basic science and technology is poor. On the basis of classroom environment, the result indicates that the classroom is not well conducive for effective teaching and learning of science ethical issues concepts in basic science and technology lessons especially with role-play instructional strategy. This finding aligns with the findings of Gunsalus, Kristich, and Loui, (2008) and Rappert, (2018) that observed differently that one of the militating factors for effective teaching of science ethical concepts in schools is teachers teaching in unconducive classrooms, among other factors. Results from the study shows that teachers did not take into cognizance of knowledge of ethical issues, attitude and practices of the learners with dual-use of science and technology in their stated objectives. This negates the objectives of National Policy on Education (2014) on science ethical issues in basic science and technology. Added to this, the finding indicates that teaching of science issues concept in basic science and technology is not effective as a result of teachers employing inappropriate instructional strategies, such as common conventional lecture method which may not be effective to enhance knowledge, attitude and practices of dual-use of science in the society in learners. The finding was supported by Oyewole (2017), Rappert (2017), and Salenhnia, and Salenhnia, (2016) who observed that students' perception and awareness of science ethical issues in term of misuse of science products was low as result of unqualified and uninformed science teachers not using appropriate instructional strategies to pass instructions to their learners. The finding suggests that there was no proper evaluation based on knowledge, attitude and practices in the lesson evaluation. This finding is in variance with the objectives of NERDC (2013) that clearly stated that evaluation of science ethical issues concepts should examine learners' opinions and views on knowledge, attitude, practices and the right and wrong application of science and technology in the society, among others.

## Conclusion

Basic science and technology curriculum implementation in Junior Secondary Schools as regards to science ethical issues integrated into the document is not effective as stated in National Policy of Education. The instructional effectiveness was impaired in most areas of classroom instructions of science ethics concepts. This is in contrast with the objectives of science ethical issues infused into basic science and technology curriculum in Nigerian junior secondary schools.

## Recommendations

The following recommendations were made based on the findings:

1. Basic science and technology teachers should focus more attention on knowledge acquisition, attitude and practices of science ethics in the content or topics when preparing their instructional objectives.

**Samuel, S. A., Sani, A. U. and Oluwatosin, A. V.**      **©2021 Federal University of Kashere**

2. Basic science and technology teachers in JSS should be familiar with new innovative instructional strategies in teaching science ethics and the society, such as role-play and others through conferences, workshops and seminars attendance.

3. Teachers should employ appropriate and challenging method of evaluation in basic science and technology classroom instructions.

4. Government and school management should provide essential instructional facilities such as charts showing good and wrong use of science and technology in the society, chairs, tables, electricity supply, amongst others to create more awareness among the learners.

## References

Brace, N., Kemp, R., & Snelgar, R. (2006). *SPSS Psychologists. A Guide to Data Analysis using SPSS for Windows.* 3rd edition. Palgrave Macmilian Ltd.

Brummel, B. T., Gunsalus, C. K., Kristich, K. L. & Loui, M. C. (2008). *Development of role-play Scenarios for teaching responsible conduct of research*: http://netfiles.uiuc.edu//oui/wwn/RCRR oleplays.pdf.

Clarkeburn, H., Downie, J. R., & Mathew, B. (2012). Impact of an ethic programme in a life science curriculum. *Teaching in Higher Education,* 7 (1), 65-79.

Doron, I. (2017). Court of ethics: Teaching ethics and ageing by means of role-playing. *Educational Gerontology,* 33 (9), 737-758.

Federal Government of Nigeria, (2019). *Federal Minister of Science and Technology Report on Science, Technology and Society (Nigeria).*

Federal Government of Nigeria. (2014). *National policy on education, Abuja:* NERDC press

Federal Government of Nigeria. (2007). *Nigerian Education Research and Development Council.* Basic Science curriculum for junior secondary schools 1-3

Federal Government of Nigeria. (2013). *Nigerian Education Research and Development Council.* Basic Science and Technology curriculum for lower basic education.

Hollander, R. (2019). Ethics education and scientific and engineering Research: What's been learned? What should be done? In Arenber, R. A. (Eds). *Dual use of Science and Technological Research in the Society.* Washington, D. C: The National Academic Press. Pp. 197-212

Jamir, M., & Shah, J. H. (2014). Perception of Undergraduates about Computer and Internet ethics in Parkistan. *Nigerian Journal of Technology (NIJOTECH), 33(4), 512-522*. Doi10.4314/nit.v33i4,12

Kolawole, C. O. O. (2006). *Curriculum design implementation and innovations.* Ibadan press

Mabawonku, I. (2020). *Teaching information ethics in library schools: overview, challenges and Prospects.* http://www.up.ac.za/.../teaching-of-information

Ogundare, S. A., Abdullahi, B. U. & Ogundiwin O. A. (2019). Assessment of the availability and utilization of basic science laboratory resources for instruction in junior secondary schools in Adamawa State for sustainable national development. *Academic Journal of Research and Development,* 11(1), 49-63.

Oyewole, O. (2017). Awareness and perception of computer ethics by undergraduates of a Nigerian university. *Journal of Information Science Theory and Practice,* 5(4), 68-80.

**Samuel, S. A., Sani, A. U. and Oluwatosin, A. V.        ©2021 Federal University of Kashere**

Rappert, B. (2017). Codes of conduct and biological weapons: An in-process assessment biosecurity and biodefence strategy. *Practice and science,* 5(2), 145-154.

Rappert, B. (2018). *The life sciences, biosecurity and dual-use research.* http://projects.exerter.Ac.uk(codesofconduct/Biosecurityseminar/Education/Index.htm.

Salehnia, A. & Salehnia, S. (2016). Ethical Issues in computing; students' perceptive survey. *American Society for Engineering Education. 123$^{rd}$ Annual conference and Exposition*, New Orlean, L A June, 26-29.

Sauro, J. (2012). Five examples of quantifying qualitative data in research. https://measuringu.com