Chemistry Laboratory Signage and Identification of Design Guidelines: Challenges of Visual Literacy

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Abstract
This study x-rayed chemistry laboratory signage and identification of designed guidelines. Its investigation premised on the challenges of visual literacy in senior secondary schools in Rivers State. A total of sixty(60) chemistry students from twelve (12) selected secondary schools were obtained via purposive sampling technique and were administered Chemistry Students Laboratory Signage Structured Questionnaires (CSLSSQ). The reliability co-efficient of the instrument was 0.68. The results achieved from the study were analysed using simple percentage and the results underscored some problems occasioned by the inability of students to acknowledge and identify chemistry laboratory signage correctly. Consequent upon this, recommendations were made.
Keywords: Signage, Laboratory, Challenges, Visual Literacy.

Background of the Study

Chemistry is an indispensible science subject whose cruciality cannot be over emphasized. It is a central science in all the science disciplines. Today we are in the 21th century which is indeed driven by science and technology, thus, this perception of twenty first(21st century) is not unconnected with globalization and industrialization in which chemistry is chief (Zudonu 2011).

In the sciences, particularly chemistry, practical is extremely important and must be carried out in the laboratory. If this is not done,there will be huge hiatuses that cannot be filled. Farombi (1998) asserted that students tend to understand and recall what they see more than what they hear as a result of using laboratories in teaching and learning of science.In this study, symbol will be used interchangeably with signage.

Chemistry laboratory signage and identification of designed guidelines; here, we talk about different signs (symbols) that will be posted at different positions to each functional separate laboratory starting from the entrance(s). All entrances to laboratories from hallways will be posted with complete signs. Also, pressure-sensitive labels identifying the types of hazard will be affixed to the placard. The available hazard pictograms are shown next to the definitions of conditions warranting posting of these labels. If more than one hazard exists in an area the appropriate labels (up to a total of ten) should be displayed on one placard and copies of standard guidelines must be available in the laboratory.

This aspect of chemistry is tenaciously interwoven with fine and applied arts, thus, the combination of the three researchers is indeed most appropriate as it will give the necessary vinculum and synergy that this work deserves.This is because signage has to be drawn and designedwith apt colour to reflect the contextual or circumstantial state and this must be undertaken by experts.

Simblet (2005), views that “drawing is the immediate expression of seeing, thinking, and feeling. It is a tool for investigating ideas and recording knowledge, and is a reflector of experience”. We are surrounded by drawings in our own daily lives, not just chosen pictures on our walls but everywhere – maps, signs, graffiti, logos, packaging and patterns in our societies. He further explains that “drawing occupies a unique place in every artist’s and creator’s life, be it a child discovering its vision and dexterity, a chemist in the laboratory,a sculptor, fashion designer,architect, or engineer, a composer notating a musical score; a cartographer charting the land, or a quantum physicist trying to see the fluctuations of our universe. Uzoagba(2002) supports the above as he sees drawing as a “graphic language” and the language of industry”. Drawing is international, irrelevant to language barriers. Drawing develops constructive imagination and the habit of exact thinking. It provides an objective and scientific way of exploring and developing our sensitivity to physical relationships.Huntley (1994) opines that drawing is the art of representing by line without colour or with a single colour as in a monochrome sketch, but the world we see around us is in colour, and so drawing in colour is a natural extension of the definition.

Colour is the decomposition of white light, which comprises the seven colours of the spectrum: red, orange, yellow, green, blue indigo and violet (Uzoagba 2002). This is a pointer that it is impossible to imagine a life without colours. Sumathi (2010) opines that if the science of colour is knowing which colour to use, the art is knowing what order to put them in and what proportions of each.

Signage for 'no food or drink' where chemical substances are used, symbols for 'eye protection' – where there is a reasonable probability of exposure to hazardous chemical potentially-infectious agents or physical hazards which could result in injury if eye protection is not used are given.Symbolsfor 'radiation area'which radiation level could result in an individual receiving a dose-equivalent in excess of 0.05 millisievert (5-millirem) in one hour at 30 centimetres from the source of radiation or from any surface that the radiation penetrates are displayed and symbols for 'biohazards' where research laboratories are also given. Symbols for 'high voltage' for areas containing electrical equipment or cables operating at 600 volts or greater are presented. Symbols for 'electrical hazards in area' containing accessible equipment with exposed and unguarded electrical components operating at less than 600 volts are shown. Symbols for 'cancer hazards containing chemicals' that are specifically carcinogenic are indicated. Additionally, symbols for 'toxic gas in storage room' containing poisonous gases and symbols for 'chemical storage area' in chemical stockroom or storage rooms are evidently presented. Also, symbols for 'flammable materials'are given and etc.

Consequent upon this, all these symbols in the laboratory and its environment will be read and interpreted concisely and consistently by the chemistry students who are making use of the laboratory. It should be noted that without adequate and appropriate understanding and eventual usage of the signage, numerous accidents will be encountered and recorded in the laboratory by the students and this will subsequently discourage and deaden their interest. Therefore, they must be taught very well for them to function properly in the laboratory (Zudonu, 2013). Njelita (2008) opines that chemistry is essentially a practical oriented subject which demands proper exhibition of science process skills (practical skills) for effective interpretation of existing phenomena. We should realise that this can only come to pass if the students are well grounded with the signage.

Statement of the Problem

Practical chemistry is a crucial component in chemistry and for students to acquire the suitable skills required, they must be conversant with signage displayed in the environment (Iyang, 2005). Critical questions can be asked at this juncture – are students visually literate? Are students able to interpret signage in the laboratories? Are students able to identify the hazards associated with each signage? This is the gap that this study seeks to find empirically among senior secondary school students in Rivers State.

Objective of the Study

The objective of the study sorts to ascertain the challenges of visual literacy in the identification of chemistry laboratory signage in senior secondary schools 2. Precisely the researchers seek to:

- determine the extent of chemistry students' visual literacy
- determine the extent chemistry students can interpret signage in the laboratory
- investigate the extent chemistry students can identify the hazards associated with each signage.

Significance of the Study

The findings of this study will be of gigantic benefit to the government, chemistry teachers, laboratory technologists, laboratory technicians, curriculum planners, administrators and chemistry students. It will be a record of reference materials for further academic growth in academia.

Scope of the study

The researchers limited the study to the challenges of visual literacy in the identification of chemistry laboratory signage in SS2. The study was carried out in Rivers State. Content scope of the study is the identification of chemistry laboratory signage: challenges of visual literacy. This content is appropriate for SS2 chemistry students.

Research Questions

The following research questions were raised to guide this study.

1. To what extent are chemistry students taught visual literacy?
2. To what extent do chemistry students interpret signage in the laboratory?
3. To what extent do chemistry students identify the hazards associated with each signage?

Research Design

Descriptive survey design was used.

Area of the Study

The study was conducted in Rivers State, Nigeria.

Population of the Study

The Sample and Sampling Technique

The sample consists of sixty (60) students randomly selected from twelve secondary schools in the three educational zones in Rivers State. Five (5) students were drawn from each of the twelve (12) sampled schools, giving a sum of sixty(60) students.

Research Instrument

The instrument employed for data collection was chemistry students laboratory signage structured questionnaire (CSLSSQ). The questions were designed in the form of yes or no types.

Validity of Instrument

The Chemistry Students Laboratory Signage Structured Questionnaires (CSLSSQ) was face and content validated by two experts to check the appropriateness of content. Their observations, suggestions and corrections on the adequacy of the instruments were incorporated.

Reliability of the Instrument

The test-retest method was employed. Questionnaires were administered to selected schools and retrieved after completion. Two weeks later modified questionnaires (the same though, but numbering altered) were administered to the same set of students. The reliability co-efficient of 0.68 was obtained using Pearson Product Moment Correlation Co-efficient.

Data Collection

The chemistry students laboratory signage structured questionnaires administered by the researchers were collected back from the respondents after its completion.

Method of Data Analysis

The responses of the respondents to the items on chemistry students laboratory signage structured questionnaires (CSLSSQ) were analysed using simple percentage.

Result, Data Analysis and Discussion

Research question 1

To what extent are chemistry students taught on visual literacy?

Table 1

S/N	Items for students	respondents	Yes	%	No	%	Total %
1	Have you been taught visual literacy?	60	20	33	40	67	100
2	Have you come across laboratory signage?	60	38	63	22	37	100
3	Do you appreciate signage colours?	60	48	80	12	20	100

From table one above, item 1 indicates that 33% respondents said yes, while 67% said no. The students said they have not been taught on visual literacy. Item 2 of table1, shows that 63% respondents said yes, while, 37% said no. The students said that they have come across laboratory signage. Item 3 of table 1, underscores that 80% respondents said yes; while, 20% said no. The students said they appreciate signage colours. This implies that students appreciate signage colours.

Research question 2

To what extent do chemistry students interpret signage in the laboratory?

Table 2

S/N	Item for the students	Respondents	Yes	%	No	%	Total %
4	Do you understand what laboratory signage means?	60	18	30	42	70	100
5	Do you understand the meaning of different signage on chemical bottles?	60	16	27	44	73	100
6	Can you work in the laboratory safely with chemicals carrying signage on them?	60	15	25	45	75	100

From table 2 above, item 4 underscore that 30% respondents said yes; while, 70% said no. The students said they do not understand what laboratory signage meant. Item 5 of table 2, indicates that 27% respondents said yes; while, 73% said no. The students said that they do not understand the meaning of the different signage on chemical bottles. Item 6 of table2, shows that 25% of respondents said yes; while, 75% said no. The students said they cannot work in the laboratory safely with chemicals carrying signage on them. This implies that students cannot understand what laboratory signage meant.

Research question 3
To what extent do chemistry student identify the hazard associated with each signage?
Table 3

S/N	Item for the students	Respondents	Yes	%	No	%	Total %
7	Can you identify the hazards associated with each signage?	60	17	28	43	72	100
8	Is it easy to recognise hazards signage on chemical bottles?	60	19	32	41	68	100
9	Is there any signage on chemical bottles that shows that content is toxic?	60	35	58	25	42	100

From table 3 above, item 7 shows that 28% respondents said yes; while, 72% said no. Therefore, the students said that they cannot identify the hazards associated with each signage. Item 8 of table 3, shows that 32% respondents said yes; while, 68% said on. The students said that recognizing hazards signage on chemical bottles is not easy. Item 9 of table 3, indicates that 58% respondents said yes; while, 42% said no. The students said that there is signage on chemical bottles that shows that the contents are toxic. This implies that students cannot identify the hazards associated with signage.

Discussion
The findings underscored that, in table 1 analysis, item 1, 2 and 3 confirmed that students have come across laboratory signage. This is corroboratedby Shapiro and Schwartz (2002) who said students must be taught and familiarize with different signage to enable them function well in the laboratory. In table 2, analysis of items 4,5 and 6 buttressed that students cannot interpret signage in the laboratory. This is supported by Njelita (2008) who asserted that chemistry is essentially a practical oriented subjected which demands proper exhibition of science process skill for effective interpretation of existing phenomena. In table 3, analysis of items 7,8 and 9 corroborated that students cannot identify the hazards associated with signage. This is supported by forounbi (1998) who observed that students tend to understand and recall what they see more than what they hear as a result of using laboratories in teaching and learning of science.

Conclusion
The results of the study analysed using simple percentage indicated that students have come across laboratory signage, however, they cannot understand what laboratory signage meant. Also it underscored that students cannot identify the hazards associated with each signage.

Recommendations
Based on the findings of the study, the following recommendations were prescribed
1. School authorities should ensure that laboratory technicians properly enlighten the students before having any practical class in the laboratory.
2. Teachers should teach the students the meaning of different laboratory signage in order to guarantee their safety.
3. Designers of this signage should use appropriate colour(s) in designing them in order to create the required impacts.
4. Chemistry teachers, laboratory technicians should be given necessary training by experts in order to equip students with the right and recent information to enable them function well in the laboratory.
5. Students should be given adequate enlightenment on the numerous hazards associated with each laboratory material to ensure their safety.

References
Forounbi, M, (1998). *Resource concentration, utilization and management correlates of students' learning outcomes; a study of school quality on oyo state.* Unpublished Ph.D.
Thesis university of Ibadan, Ibadan.
Huntley, M. (1994).*The artist's drawing book.* Italy: David of Charles.
Inyang, E. (2005). *Logo for the typical client: Reflections on Theory and Practice of the Business Mark and Visual Identity,* Lagos: Awansca Books, 2005, pp 37.
Njehita, C.B. (2008). Enhancing science process skills acquisition in volumetric analysis using cooperative learning strategy. *A paper presented at the workshop organized by STAN Akwa Zone from 26th-28th September.*

Simblet, S. (2005).*The drawing book.*London: darling Kindersley limited.

Sumathi, G.J. (2010).*Elements of fashion and Apparel Design.*New Delhi: New Age International (p) Ltd

Uzuagba, I.N. (2002). Understanding Art in General Education. Nigeria: Africana – Fep publishers Ltd.

Wayne state, University. http//www.oehs.wayne.edu

Zudonu, O.C. (2011). Appraisal of the sociological basis for science of education. *Journal of contemporary issues in vocational and technology research (JOCIVOTER).*1 (L), 233 – 239.

Zudonu, O. C. (2013). *Effects of laboratory instructional methods on students' conceptual change, Achievement and Attitude to some Chemistry Concepts at Senior Secondary School level.* Unpublished Thesis, University of Nigeria, Nsukka.