**ADEQUACY OF STUDENT – ACTIVITY COMPONENT OF INTRODUCTORY TECHNOLOGY CURRICULUM FOR STUDENTS’ ACQUISITION OF TECHNOLOGICAL LITERACY**

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**Abstract**

*The aim of this paper was to investigate the adequacy of student’s Introductory Technology activity for the acquisition of technological literacy. The study which was guided by five research questions was conducted in the six educational zones in Enugu State, Nigeria. The population comprised all the Introductory Technology teachers in the 267 secondary schools in the State. A questionnaire containing 25 items was used. The major finding was that the students were neither involved in designing and building solutions to problems nor in considering and testing various solutions to problems. These findings show that the curriculum is not adequate for the acquisition of problem solving skills. Among the recommendations was that the teachers should learn and practice technology integration of curriculum to enable them help learners relate technology to the solution of real life problems.*

**Introduction**

The present century is a technology – dominated era. Since technology is far from being static, there is need to ensure that the curriculum used by schools is dynamic enough to prepare learners to function effectively in and contribute to a technologically advanced society and global economy. While supporting this view, D’ Apolito (1997) remarks that:

Because of the fast-moving, never – ending, dynamic nature of technology, we will always be making adjustments to technology education. Technology never stands still. Therefore, if technology education is to interpret technology, it will forever change in concert with the world around us (p. 2).

The traditional technology education is more or less a tools technology education with emphasis on industrial arts. Emphasis is on the teaching of skill-based programs such as woodwork and craftwork. Reid (2000:38) opines that “craft work has serious limitations as a foundation for modern technological activity. It may give experience in designing and making, but it falls short of modern industrial activity, intellectual concepts, modern cultures and realistic working environment. This inability of the industrial arts curriculum to prepare learners to live effectively in a technology dominated era has made educational technologists in the past half of a century to make a shift from industrial arts to technology education. Sanders (2001 p. 45) notes that “there has been a noticeable shift in the perceived purposes of the field, from tools skills (industrial arts) to problem solving (technological education).” In this regard, William’s (2000) while explaining that technological knowledge can either be procedural or conceptual laments that:

While the traditional focus of technology education has been on activity, i.e. on doing and making things, this has represented a narrow interpretation of procedural knowledge. This focus has not been accompanied by an emphasis on all aspects of procedural knowledge, but has typically been concerned with those procedures most closely aligned with the development of manipulative skills and how to use tools effectively and safely, for example (p. 48).

While stressing the need for Technology teachers to move away from industrial arts to technology education, Engstrom (2001 p. 1) observes that “the release of Standards for Technological Literacy: Content for the Study of Technology (ITEA, 2000) has increased the need for technology teachers who have not done so to make the change, from industrial arts to technology education”. Even the Technology, for all American Project as presented in Dugger (1997) has produced a document “Technology for All Americans: A Rationale and Structure for the Study of Technology”. In that document, the structure developed for the study of technology focuses on the universals of technology namely knowledge, processes and contextual systems.

 As a result of all these attempts at encouraging teachers to adopt technology education instead of industrial arts programme, Engstrom (2000) conducted a survey to identify which components of technology education activities were perceived as essential and desirable by teachers and leaders in the profession. For the study, Engstrom developed the Technology Education Content Rating Matrix (TECRM) survey which contained 32 technology education and 20 industrial arts activity component descriptors. The sample for the study comprised all the 488 members of the Council of Technology Teacher Association (CTTA) and 512 members of the International Technology Education Association (ITEA). From that study, “ten essential items for a technology education activity were identified. All but one of the ten essential components was categorized as a technology education, rather than an industrial arts activity” (Engstrom, 2001 p. 2). A modified version of these ten items as contained in the checklist produced by Engstrom was used for the present study to identify the extent to which teachers of Introductory Technology in Nigerian Secondary Schools have moved from industrial arts to technology education.

 Introductory Technology is one of the core subjects offered to students at the Junior Secondary School (JSS) level. Consequently, it is one of the basic subjects “which will enable pupils to acquire further knowledge and skills (National Policy on Education – NPE, 2004 p. 19). According to the NPE (2004) at the end of JSS education, students proceed to senior secondary school, technical college, out-of-school vocational training center or an apprenticeship scheme. The direction of movement is based on each student’s academic ability, aptitude and vocational interest (NPE, 2004). It is therefore expected that at the completion of JSS, the students should demonstrate the possession of basic technological literacy. In this line Ivowi (1999) reiterates that the programme “is designed to sensitize the students with the content and wide applications of technology with a view to enabling a good number of them to choose one of the fields of technology as an area of specialization in future.” However, the researcher has observed that after being exposed to the programme at the JSS level, a good number of these students manifest low level of technological literacy and they do not choose to continue with the programme either in school or in an apprenticeship programme. This raises doubt regarding the adequacy of technology education students receive in Introductory Technology learning experiences. How much technology education is in the student – activity component of Introductory Technology curriculum? This is in fact the problem that necessitated the present study. With regards to the significant of the study, Wright (1997 p. 6) notes that “less emotion and more critical analysis of the technology education curriculum and methods are needed”. This is the only way to ensure that technology education actually prepares learners for the effective life in a technology – dominated society. Engstrom (2001:1) notes that “few research studies have examined what students should be doing in technology education activities”. It is in this regard that the present study is concerned with the student-activity component of Introductory Technology curriculum. Akudolu (1996 p. 2) presents curriculum as “all the learning experiences and intended learning outcomes systematically planned and guided by the school through the reconstruction of knowledge for the cognitive, affective, and psychomotor development of learner”. Therefore the adequacy (for technological literacy) of what students do through which they gain learning experiences in Introductory Technology is the scope of this study.

**Research Questions**

The study was guided by the following research questions:

1. To what extent do the students safely use tools and machines?
2. To what extent do students consider and test various solutions?
3. To what extent do the students design and build a solution to a problem?
4. To what extent do the students integrate knowledge from other academic studies and real life?
5. To what extent do the students make use of computers?

**Methodology**

*Design:* A survey design was adopted for the study.

*Area of the study and population:* The study covered the six educational zones in Enugu State, Nigeria. The population comprised all the Introductory Technology teachers in 267 Secondary Schools in the State.

*Sample and Sampling Technique:* The systematic random sampling technique was used for the study. 50% of the schools in the area of the study were systematically selected and one teacher was sampled from each of the selected schools. This gave a sample size of 133.

*Instrument:* A questionnaire containing 25 items was used. 19 of these items were modified from Engrom’s (2001) technology education checklist while 6 items covering the use of computers were added. The items were structured on a four point scale ranging from strongly agree to strongly disagree. Validation of the instrument was done by two lecturers in Educational Technology. To establish reliability, 10 copies of the questionnaire were administered to Introductory Technology teachers in Anambra State. Using the odd and even numbered items technique, scores on the items were pooled and correlated using the Pearson Product Moment correlation coefficient. This yielded a coefficient of internal consistency of 0.84. The application of the Spearman-Brown prophecy formula yielded a corrected value of 0.91. The obtained data were analyzed using percentages.

**Results**

**Table 1: The Extent to Which Students Safely Use Tools and Machines**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Items** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** |
|  | Students are required to: | F | % | F | % | F | % | F | % |
| 1. | Take an exam before using a new tool |  |  |  |  | 63 | 47 | 70 | 53 |
| 2 | Demonstrate to the teacher how to safely use a tool or machine before using it. |  |  |  |  | 80 | 60 | 53 | 40 |
| 3 | Show understanding of the accident procedure to follow if one occurs | 30 | 23 | 76 | 57 | 27 | 20 |  |  |

Table 1 shows that adequate procedures are not followed before students make use of tools and machines.

**Table 2: The Extent to Which Students Consider and Test Various Solutions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Items** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** |
|  | Students are required to: | F | % | F | % | F | % | F | % |
| 1 | Brainstorm for solutions before building a potential solution. | 40 | 30 | 78 | 59 | 12 | 9 | 3 | 2 |
| 2 | Conduct research |  |  |  |  | 73 | 55 | 60 | 45 |
| 3 | Explain their ideas in written format. |  |  | 66 | 50 | 67 | 50 |  |  |
| 4 | Explain their ideas in oral format. | 5 | 4 | 49 | 37 | 65 | 49 | 14 | 10 |
| 5 | Illustrate potential solutions with a variety of sketches. |  |  |  |  | 85 | 64 | 50 | 36 |
| 6 | Perform tests on their products. |  |  |  |  | 100 | 75 | 33 | 45 |
| 7 | Compare their initial product with the result. |  |  |  |  | 100 | 75 | 33 | 45 |
| 8 | Document test results |  |  |  |  | 35 | 26 | 98 | 74 |

Apart from item number one, all the items show that students do not consider and test various solutions.

**Table 3: The Extent to Which Students Design and Build a Solution to a Problem**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Items** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** |
|  | Students are required to: | F | % | F | % | F | % | F | % |
| 1 | Create their own original designs |  |  | 13 | 10 | 44 | 33 | 76 | 57 |
| 2 | Modify their designs during production. |  |  | 26 | 20 | 88 | 66 | 19 | 14 |
| 3 | Create a technological product or system. |  |  |  |  | 73 | 55 | 60 | 45 |
| 4 | Use actual tools, materials and machines in building a solution to a problem. |  |  | 30 | 22 | 33 | 25 | 70 | 53 |
| 5 | Use a variety of materials to create their solutions. |  |  |  |  | 60 | 45 | 73 | 55 |

All the items show that students do not design and build solutions to problems.

**Table 4: The Extent to Which Students Integrate Knowledge from Other Academic Studies and Real Life**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Items** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** |
|  | Students are required to: | F | % | F | % | F | % | F | % |
| 1 | Perform mathematical calculations during production. | 46 | 35 | 53 | 40 | 14 | 10 | 20 | 15 |
| 2 | Use Knowledge from different subject areas during the production process. | 12 | 9 | 94 | 71 | 9 | 7 | 18 | 13 |
| 3 | Relate their products to the solution of real-life problems. | 10 | 7 | 13 | 10 | 44 | 33 | 66 | 50 |

Items 1 and 2 registered high percentage scores indicating that students integrate knowledge from other academic studies. The low score for item 3 shows that students do not relate their products to the solution of real life problems.

**Table 5: The Extent to Which Students Make use of Computer**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Items** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly Disagree** |
|  | Students are required to: | F | % | F | % | F | % | F | % |
| 1 | Use computers for learning other subjects. |  |  |  |  | 97 | 73 | 36 | 27 |
| 2 | Use word processing software in the class. |  |  |  |  | 60 | 45 | 73 | 55 |
| 3 | Use other types of software. |  |  |  |  | 80 | 60 | 53 | 40 |
| 4 | Use the Internet |  |  | 45 | 34 | 88 | 66 |  |  |
| 5 | Use the computer for research. |  |  |  |  |  |  | 133 | 100 |
| 6 | Use the computer for games. |  |  | 34 | 25 | 45 | 34 | 54 | 41 |

Table 5 shows that apart from item 6 on the use of computer for games the respondents do not make adequate use of computers.

**Discussion**

The findings of this study reveal that the student – activity component of Introductory Technology curriculum is far from being adequate. The findings show that adequate measure is not taken to ensure that the students safely make use of tools and machines. During discussions with some of the respondents, they told the researcher that they thought it unnecessary because the students were familiar with the few tools available in the school. It was also discovered that the students do not consider and test various solutions in the attempt to find solutions to problems. The implication is that these students will find it difficult to develop problem – solving abilities. Custer, Valesey and Burke (2001:5) consider the development of problem solving skills as “pivotal to technological literacy”. The students used in this study neither design nor build solutions to problems. In the absence of these and similar problem solving activities, these students cannot “become critical thinkers and problem solvers” (Pullias, 1997 p. 29).

Though the students perform Mathematical Calculations as well as use knowledge from different subject areas during the production process, they do not relate their products to the solution of real-life problems. Twyford and Jarvinen (2000:46) opine that technology is not bound by subject boundaries and consequently “the authenticity of technological problems or issues demands a multi-disciplinary approach”. It was also revealed in this study that the respondents do not make use of computer. This is very unfortunate because computer literacy is indispensable to effective life in the present technology dominated era.

The findings of this study clearly indicate problems in the student – activity component of the Introductory Technology curriculum. Some of these problems must have made Nwachukwu (1999:109) to remark that “it is sad to observe that no significant impact has been made in terms of achieving the overall objectives of the programme”. In a study on the standard of workshops for teaching Introductory Technology in Secondary Schools in Delta State, Olisa (1999) found that workshops, tools and equipment are grossly inadequate. Without the provision of workshops, tools and other facilities, teachers will find it difficult to implement a technology – based curriculum for the programme. This implies that at least one of the aims of the programme which is “to provide basic technology literacy for everyday living” cannot be achieved.

**Recommendations and Conclusion**

The fast rate of technology development is exacting tremendous impact on human activities. Consequently technological literacy is critical to the development of the individual and that of the society. The acquisition of this technological literacy should be one of the aims of instructional endeavors at the various stages of education. To ensure that the curriculum of Introductory Technology presents to the learners adequate student – activity component that is necessary for the acquisition of technological skill, the following recommendations are made.

1. Every secondary school should have a well-equipped Introductory Technology workshop.
2. The State Education Commission should organize seminars for Introductory Technology teachers to enable them learn new skills and strategies necessary for the implementation of technology curriculum.
3. In addition to the other aims of the programme, the teachers should aim at helping the students develop problem-solving abilities.
4. The teachers should learn and practice technology integration of curriculum to enable them help the learners relate technology to the solution of real-life problems.

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