

# Impact of Prior Knowledge of Engineering Materials by Students of Metalwork Technology Education for Effective Practical Work

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## ABSTRACT

The purpose of this study was to evaluate the impact of prior knowledge of engineering material by students of metalwork technology education for effective practical work. To achieve this objective, a research question was used to guide the study and a hypothesis was formulated and test at 0.05 level of significance. Survey research design was considered suitable for this study. The study was carried out in Adekunle Ajasin University, Ondo State and Ekiti State University, Ado Ekiti. The population of this study comprised all 55 final year students and 13 lecturers in vocational and Technical Education Department. There was no sample all enter population of 68 was used. The instrument for data collection was a self-structured questionnaire, which contained seventeen items. The result from the analysis of data collected indicated that there was no significance difference between the mean ratings of the group of respondents on impact of prior knowledge of engineering material of lecturers and students in all the seventeen items on knowledge of engineering materials in university. The findings of the study showed that the respondents agreed that the metalwork students need all 17 knowledge of engineering material identified. Based on findings and discussion, conclusions were drawn and recommendations made, as the knowledge of engineering materials should be a one of core course in technical education in university.

**KEYWORDS:** Knowledge, Engineering Material, Practical Process, Metalwork

## INTRODUCTION

Many inventions, such as the telephone, the light bulb, the car, the chair, the table, the electronic appliance and the refrigerator, have made life easy. More also, other inventions, such as cigarettes, atomic bomb, gunpowder are dangerous to life. However, something is older than all of these, that is materials. Materials have impact in the development of human civilization. The main features between mankind and animals are the ability to develop and use materials in one's environment to satisfy one's need. One's ultimate goal is to provide solutions to the great societal challenges. Global economy is based on the development and provision of new products and services to humans in better, cheaper or faster ways. Materials underpin innovation and can yield a sustainable advantage in a competitive global economy (High Level Group on Key Enabling Technologies – Final Report, 2011). Material has been a fundamental for the development of our civilization through industrial development, thereby contributing in solving societal needs for quality life. Mikell, (2010) asserted that making things has been an essential activity of human civilizations. Modern life became possible by the use of material from the polymers, the metals, the ceramics and concrete that made a building. All various items are products of materials.

Today wealth can be created through accurate selection of engineering material. Innovation in engineering often means the clever use of a new material for a specific application. These materials makes life simpler, easier, safer, better, and more important. Obasi (2014) opines that materials have contributed to the advancement of a number of technologies, including medicine and health, information and communication, food science and the environment. Jari, Anni, Veijo, Annika, Ampuja, Kalle, and Jarkko (2006)

asserted that materials as substances that are used as input in production or manufacturing that could be wood as raw material for paper production, as well as cotton that can be processed into thread, and then be woven into cloth. This indicates that our world is all about materials, which virtually influenced our daily lives activity. Accessibility of suitable materials has made the development of many technologies such as nanotechnology, biotechnology and advanced electronics that makes our life comfortable.

Therefore, craftsmanship is a combination of knowledge of how to use tools, materials and skills. There is no magic shortcut to craftsmanship in production process without knowledge of the physical, mechanical and chemical properties of materials. Materials are an important aspect of engineer design. Materials form the stuff of any engineering application or product. In the world that dominated by customer driven competitive business environment, the product quality is imperative. The quality of the products is determined by the type of materials selected, the technology employed and the engineer structure/design. In today's world, the important of materials and their processing techniques cannot be underestimated. Jari etal (2006) opine that materials are exist in three phases Gas, Liquid, and Solid. Ahmet (2007) noted that each material has a property profile of physical and chemical properties. This showed wide variety of materials with their potential in various engineering field that can be used for different products ranging from aerospace to house hold applications. Their chemistries, mechanical and physical are different and these differences affect the processing techniques and selections. The engineering materials often primarily selected in line with their characteristics/properties; mechanical, physical, chemical and manufacturing properties. Other factors

include cost availability, appearance, service life/ durability and recyclability. Rajender (2006) opine that the properties of an engineering material determine the utility of the material that influence quantitative and qualitative of any products.

However, mostly, the challenges face by students of metalwork technology education is to select an optimal material suitable for the specific job or work according to the designer requirement. The technologists are entrusted to find suitable techniques that would lead to high quality products. All technologists whether mechanical, civil, chemical, or electrical, will at one time or another be exposed to a design problem involving materials. Indeed, selection of right materials is one key problem that will always face technologist. George (1997) opined that material selection is a step in the process of designing any physical object. The fundamental Knowledge and understanding of the existing materials and their processing techniques increase both wealth and well-being of students' metalwork in practical application.

Metalwork is a process of working with metals to create individual parts, assemblies, or large scale structures. The materials generally used in metalwork include ferrous materials, plastics and non-ferrous materials. Their usage depends largely on the knowledge of their properties. Knowledge is one of the most important assets for an organization or individuals to create values and hence, sustainable competitive advantage. According to Ikujiro (2006) knowledge is a dynamic human process of justifying personal belief towards the truth. Knowledge is not a given phenomenon, but something that we delineate by operating with a concept that we create in answer to certain needs, or in pursuit of certain ideals.

Indeed, materials technology education was introduced in universities at the undergraduate level in technical education to enable the student acquire basic knowledge in the selection and use of engineering materials. According to the prospectus, Department of Vocational and Technical Education, Adekunle Ajasin University (2017-2020) the knowledge will enable students understand the various sources and properties of ceramics, rubbers, metals and glass from their different source known the different constituents and their different functions. The application of materials in matching the right material to the intended purpose and use of a specific product, therefore technicians and technologists must consider weight, strength chemical ability, corrosion resistance and economy implication.

Furthermore, the knowledge will make students discover items like ductility, brittleness, conductivity, what makes these properties important in designing and producing stuff. In addition, why one class of material is preferred over another for certain products how they can change or improve. Obasi (2014) asserted that whether mechanical engineer, will at one time or another is exposed to a design problem involving materials. Furthermore stressed, material selection is one key problem that will always face engineers that must work with materials. This is also applicable to technical student therefore familiarized technical students with the various characteristics and structure-property relationship of materials as well as processing techniques will be to make judicious material choices. Understanding of a material type is the fore-runner of technological

advancement. Sophisticated high technical electronics and automobile vehicle solely rely on components that are made from what are quality materials.

### Statement of the problem

As the contributions of engineering materials to the development of productions for human comfort is increases, to have better understanding of use and functions of material to gain skills that will enable one's to master production processing become imperative. Rajender (2006) affirmed that technical staff must know the various manufacturing processes; materials begin processed, tools and equipments for manufacturing different products. This presentation represent of an attempt to identify the relatively impact of prior knowledge of engineering materials on effective practical work of students of metalwork technology education in present day world. Emphasis is thus, placed on the impact of prior knowledge of engineering materials by students of metalwork technology education for effective practical work.

### Purpose of the Study

The purpose of this study was to determine the extent to which the prior knowledge of engineering material by students of metalwork technology education for effective practical work. Specifically, the purpose was to find out: The impact of prior knowledge of engineering materials by students of metalwork technology education will assist in effective practical work.

### Research Question

One research question was formulated to guide the study: What are the impacts of prior knowledge of engineering materials by students of metalwork technology education for effective practical work?

### Hypothesis

One hypothesis was formulated.

**H<sub>01</sub>:** There is no significant difference between the mean responses of lecturers and students of technical education on the roles of prior knowledge of engineering material by students of metalwork technology education for effective practical work.

### Methodology

The study adopted a survey research design. Sofoluwe (2013) defined a survey research design as the one that describes parameters for statistics obtained from unbiased samples involving the use of questionnaire to obtain information from a sample of the respondents. Thus, a survey research design is considered suitable for this study, as it will elicit the opinions from the respondents using structured questionnaire. The study was carried out in Adekunle Ajasin University, Ondo State and Ekiti State University, Ado Ekiti. The population of this study comprised all 55 final year students and 13 lecturers in vocational and Technical Education Department. There was no sample all enter population of 68 was used. The Instrument for data collection in this study was a structured questionnaire. The instrument was validated. The responses to the items were based on a four-point scale, with numerical value of 4, 3, 2 and 1. Descriptive statistics was used to analyze the data collected from the study for answering the research question. While t-test statistics was used to test the hypothesis of no difference at 0.05 level of significance. The level of acceptance of each item was based on real limit of

number. Any item above mean rating of 2.50 was regarded as agreed while any item the mean is below 2.50 was regarded as not agreed.

## Results

**Research Question:** What are the impacts of prior knowledge of engineering materials by students of

metalwork technology education for effective practical work?

The responses of the respondents to the 17 items of the questionnaire were scored and the mean and standard deviation were computed. The result is showed in table 1.

**Table 1: Mean response of the impact of prior knowledge of engineering materials by students of metalwork technology education for effective practical work.**

S/N	Enable students to understand the:	X	SD	Remark
1	Mechanical properties of materials	3.30	0.91	Agreed
2	Physical properties of materials	3.25	0.78	Agreed
3	Chemical properties of materials	3.21	0.89	Agreed
4	Manufacturing properties of materials	3.18	0.70	Agreed
5	Process techniques in materials production	3.41	0.75	Agreed
6	Appearance of materials	3.33	0.81	Agreed
7	Service life materials	3.10	0.80	Agreed
8	Recyclability materials	3.15	0.79	Agreed
9	Cost of materials	3.22	0.90	Agreed
10	Limitation of materials	3.20	0.78	Agreed
11	Applications of materials	3.03	0.88	Agreed
12	Modifications in materials	3.08	0.92	Agreed
13	Classifications of materials	3.17	0.63	Agreed
14	Selection of materials for work	3.32	0.79	Agreed
15	Behavior of materials under used	3.39	0.73	Agreed
16	Advantages of materials	3.29	0.66	Agreed
17	Develop new materials	3.26	0.68	Agreed

The data presented in table 1 revealed that the 17 knowledge have their mean value ranged from 3.10 to 3.39. This indicated that the mean value of each item was above the cut-off point of 2.50, showing that all the knowledge were agreed on by metalwork students in engineering material. The table also showed that the standard deviations (SD) of the items are within the range of 0.63 to 0.92.

**H<sub>01</sub>** There is no significant difference between the mean responses of lecturer in technical education and students in the impact of prior knowledge of engineering materials by students of metalwork technology education for effective practical work.

**Table 2 The t-test analysis of the mean responses of the respondents on impact of prior knowledge of engineering materials by students of metalwork technology education for effective practical work.**

S/N	Enable students to understand the:	X <sub>1</sub>	S <sub>1</sub> <sup>2</sup>	X <sub>2</sub>	S <sub>2</sub> <sup>2</sup>	t-cal	t-tab	Remarks
1	Mechanical properties of materials	3.12	0.36	3.30	0.60	0.65	1.89	NS
2	Physical properties of materials	3.20	0.86	3.12	0.56	0.40	1.89	NS
3	Chemical properties of materials	3.19	0.88	3.23	0.82	0.36	1.89	NS
4	Manufacturing properties of materials	3.11	0.66	3.45	0.74	0.52	1.89	NS
5	Process techniques in materials production	3.23	0.82	3.25	0.82	0.70	1.89	NS
6	Appearance of materials	3.89	0.74	3.70	0.74	0.72	1.89	NS
7	Service life of materials	3.95	0.61	3.19	0.61	0.36	1.89	NS
8	Recyclability of materials	3.74	0.65	3.61	0.60	0.86	1.89	NS
9	Cost of materials	3.57	0.40	3.66	0.56	0.88	1.89	NS
10	Limitation of materials	3.63	0.36	3.55	0.82	0.66	1.89	NS
11	Applications of materials	3.58	0.52	3.57	0.74	0.82	1.89	NS
12	Modifications in materials	3.53	0.70	3.20	0.88	0.74	1.89	NS
13	Classifications of materials	3.80	0.72	3.24	0.66	0.61	1.89	NS
14	Selection of materials for work	3.84	0.82	3.50	0.82	0.60	1.89	NS
15	Behavior of materials under used	3.23	0.74	3.52	0.74	0.56	1.89	NS
16	Advantages of materials	3.64	0.61	3.35	0.61	0.63	1.89	NS
17	Develop new materials	3.58	0.60	3.46	0.88	0.78	1.89	NS

The hypothesis of no significant difference was upheld for item whose t-calculated is lower than the t-table value. Hypothesis of no significant difference was rejected for any item whose t-calculated value is greater than the t-table value at probability of 0.05 level of significance and 101 degrees of freedom.

**Table 2** data revealed that each of the 17 knowledge items had their calculated t-values ranged from 0.36 to 0.88, which were less than t-table of 1.89 at 0.05 levels of significance and 101 degree of freedom (df). This showed that there was no significant difference in the mean responses of the lecturers and students on the roles of prior knowledge of engineering material by students of metalwork technology educations for effective practical process. Therefore, the null hypothesis of no significant difference in the mean response of the lecturers and students on seventeen roles of prior knowledge of engineering material by students of metalwork technology education for effective practical work items was upheld.

### Discussion

The findings of the study showed that the respondents agreed that the students of metalwork needed all 17 knowledge of engineering material identified. This knowledge of engineering material includes mechanical properties of materials, physical properties of materials, chemical properties of materials, manufacturing properties of materials, process techniques in materials production, appearance of materials, service life materials, recyclability of the materials, cost of materials, limitation of materials, applications of materials, modifications in materials. more also, classifications of materials, classifications of materials, selection of materials for work, behavior of materials under used, advantages of materials and develop new materials. These findings were in consonant with opinion of Del (2009) that the designer not only make the best material selection for any work but also need to know the limitation of the materials. In addition, the findings agreed with opinion of Ashby (2005), who stated that material science involves investigating the relationships that exist between the structures and properties of materials. While Obassi (2014) asserted that materials selection is one key problem that will always face students or engineers that must work with materials. The better understand of the selection of engineering materials in relation to it elements, properties and classification is imperative.

There was no significant difference between the mean responses of technical education lecturers and technical students on the impact of prior knowledge of engineering materials on effective practical work of students of metalwork technology education.

### Conclusion

Based on the findings of the study, the following conclusions were made: For proper practical work to be done, students should be thought and expose to different type of engineering materials in the workshop. Acquisition of prior knowledge of engineering materials by the student will provide opportunity for effective practical work in the school and outside the school.

### Recommendations

Based on the findings of the study, the following recommendations were made: The knowledge of engineering materials should be a one of core course in technical education in university. Seminar and workshop should be organized for the lecturers, if possible inclusion of the students to build capacity on engineering material identification for effective practical work.

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