AN APPRAISAL OF THE NIGERIAN JUNIOR SECONDARY SCHOOL BASIC SCIENCE AND BASIC TECHNOLOGY CURRICULAR FOR ENTREPRENEURIAL SKILLS

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Abstract

This study appraised the contents of the Junior Secondary School (JSS) basic science and basic technology curricula for entrepreneurial education provision in terms of topics, contents, leaning objectives, learning activities and specific entrepreneurial skills and competences. An adapted content analysis procedure used by Mustapha (2005) was used for this study. First, each of the curriculums was analysed to identify the major topics and sub-topics, the content units, the stated objectives and the learning objectives. Second, the topics, the contents units, the objectives and learning activities that are entrepreneurial in context were identified in each of the curriculum. Using simple percentage, the percentages of each of the elements of analyses in context of entrepreneurial education and the specific skills and competences that are fused into the curricula were determined. The findings from the analyses revealed among others that about 21% and 30% of topics in the basic science and basic technology curricular respectively are entrepreneurial in nature; and the entrepreneurial skills and competences infused into the relevant contents of the basic science and basic technology are predominantly basic skills and few complex entrepreneurial skills/competences. It is adjudged that the Nigerian JSS basic science and basic technology curricula can provide the JSS students contain basic entrepreneurial skills and competences as foundation for entrepreneurial education but not for entrepreneurial endeavor or self employment after JSS. On the basis of the findings appropriate recommendations were made.

Introduction

The Nigeria on going national reforms, the pursuit of the Millennium Development Goals (MDGs), Education for All (EFA) goals, the Nigeria vision 20:20:20, the Government seven Point Agenda, and National Economic Empowerment and Development Strategies (NEEDS) are focused on revamping socio-economic, educational, science and technological developments of the country. The critical elements of MDGs and EFA goals relating to education among others are:

(i) Improving every aspect of education at all levels and ensuring their excellence;
(ii) Improving quality of life through skill acquisition and poverty reduction;
(iii) Meeting the learning needs of all young people and adults through equitable access to appropriate learning and skill programmes, etc

The NEEDS is aimed at wealth creation, employment generation, poverty reduction and socio-economic empowerment of people through education (National Planning Commission, 2004). Education in general and science and technology education have important role to play in the context of realizing the MDGs, EFA goals and NEEDS agenda. Essentially, science and technology education are expected to provide individuals with appropriate knowledge, skills, competencies and attributes that will enhance the individual self actualization, self enhancement, independence and possible self employment, (Akale, 2004; Mustapha,2004). A functional science and technology education should focus on skills such as creativity, critical thinking, problem solving, life coping and entrepreneurial skills that are essential for attainment of self reliance and self employment.

Contrary, science and technology education at all levels of our education have remained ineffective, non-functional and in effect non-productive to provide learners with necessary life coping and entrepreneurial skills for world of work (Obong, 2002; Mustapha; 2004). The way our science curricular are being implemented does not expose learners to relevant hands-on and minds-on experiences necessary to equip learners with entrepreneurial skills that will lead them to self employment in the present economic state of the country. Literature has revealed that products of our science and technology education at all levels do not possess the skills for self employment and self reliance (Ubong, 2002; Mustapha, 2004; Mohammed, 2006; Laghara & Mbah, 2009; Okoli & Onwuachu, 2009). One of the challenges of education and science and technology education in particular is to develop entrepreneurial skills in science and technology students through effective teaching and learning of science and technological subjects. As part of Nigeria education reforms, the context of MDGs, EFA, NEEDS and the concern to make Nigeria education more responsive to national needs, the Nigeria Educational and Research Development Council (NERDC) was directed by government to review, restructure and re-align existing curricula for primary and junior secondary school (JSS) into a -9- year basic education programme. One of the curricula developed by NERDC based on the directive is the 9-year basic science and technology (1-6) at primary school level and as basic science, (JSS 1-3) and basic technology (JSS 1-3), at JSS level. In these developed curricular NERDC revealed that emerging issues that include entrepreneurial skills are included in their contents. This inclusion implies that any student exposed to these curricula will acquire appropriate entrepreneurial skills among other skills and competence for self employment and for over all national economic development. An entrepreneur curriculum should create creativity and creative thought processes, nurture the sprit of innovation within students (Nwokenna & Agu-Dan, 2009; Omoifo, 2009).There is a relationship between science, technology and entrepreneurship. Science as a field of inquiry helps to develop enquiring mind, technology helps in creativity and innovation. Inquiry, creative and innovative minds are needed in entrepreneurship (Olagungu & Akanbi, 2009).

The essence of mainstreaming entrepreneurship based science and technology education at the primary and JSS level is to ensure functional and productive education. Entrepreneurship inclined science and technology education has potential to equip learner with general and specific skills and knowledge that are needed to develop entrepreneurial skills which will enable them at the end of their education to stand on their own economically and to function in a business environment.

Thus, the graduates of JSS basic science and the basic technology curricula are expected to come out with skills capable of marking them to engage in various enterprises that science and technology are their foundation. By extension, it is expected that the content of these curricula already being implemented in our schools should contain topics, contents, stated or implied objectives, learning experiences and activities that can lead to acquisition of entrepreneurial skills as part of outcomes of using the curriculum. The specific entrepreneurial skills should include innovativeness, creativity, productivity, problem solving, resourcefulness, resource management, goal setting, planning etc and those physical and mental science process skills.

In the context of above, objective of an entrepreneurial oriented science and technology curricular would include to;

(i) prepare students for productive adulthood;

(ii) acquire skills, competences and knowledge needed to make successful transition from school to self employment.
(iii) promote development of positive attitude toward business and some level of confidence towards business environment.
(iv) promote development of skills needed to start business or be gainfully employment.

Entrepreneurial skills and competencies which entrepreneurship education programmes should focus on as identified by U.S. Department of commerce (2000) are classified below;

The skills are:
(i) Basic skills: - they include reading, writing, reporting, speaking, arithmetic and mathematical operation skills.
(ii) Thinking skills;- these include creativity, decision making, problem solving, rationalizing, etc.
(iii) Personal quality skills:- these include displaying responsibility, self-esteem, sociability, self- management, integrity and honest.

The competencies are:
(i) Ability to identify, organize, plan, allocate resources e.g time, money, facilities and materials including human resources.
(ii) Abilities to work with others e.g leadership, work with diversity, etc
(iii) Ability to use information e.g to acquire and evaluate information, organize and monitor information.
(iv) Ability to understand complex relationship e.g. to monitor and correct performance.
(v) Ability to work with a variety of technologies e.g selecting appropriate technologies and apply technology to task.

Honolulu (1977) in Agomou (2002) identified certain characteristics or traits that should be acquired, through entrepreneurship education. The traits are nineteen in number and are sub classified under five characteristic groups.

Group	Characteristics	Traits
1	self-confidence	(1) confidence (2) independence and individuality (3) optimum (4) leadership dynamism
2	originality	(5) innovative and creative (6) resourceful (7) initiative (8) versatile and knowledgeable
3	people-oriented	(9) get along with others (10) flexible (11) responsive to suggestion/ criticism
4	result-oriented	(12) need for achievement (13) profit oriented (14) persistence, perseverance (15) hard work
5	future-oriented	(16) foresight (17) perception (18) risk taking (19) like challenges.

Similarly, some entrepreneurial traits that can be acquired early in life through systematic education have been identified (Nnaka & Ezekannagha, 2010; Inegbenebor, 2009). These traits include, discipline, diligence, handwork, dedication, courage, foresight, preference, team. Work,

setting achievable goals, positive self concepts, self confidence, initiative, independence, high expectation etc

Considering all the above i.e. the objectives, skills, competencies and classified traits as fundamental of any entrepreneurial oriented curriculum, it should be expected that the basic science and basic technology curricular of the Nigeria JSS contain relevant entrepreneurial education contents, learning experiences and activities through which appropriate entrepreneurial skills, competencies and personal entrepreneurial characteristics can be acquired by the students.

This study is conceived in the context of above and was under taken to find out what elements of entrepreneurial education in terms of topics, learning objectives, contents, activities and the entrepreneurial skill and competencies are contained in JSS (1-3) Basic Science and Basic Technology curricula. This study will help to validate the submission or claim by NERDC that entrepreneurial skills are infused into the relevant contents of the 9- year basic education curricula, which basic science and technology are inclusive.

Research Question

This study was guided by the following research questions and to which answers were sought...

1. What topics, prescribed contents, stated/implied objectives and the prescribed learning activities that are contained in the (1-3) Basic Science and Basic Technology curricula are entrepreneurial in nature?
2. What entrepreneurial skills and competences are identifiable from the contents of the JSS (1-3) Basic Science and Basic Technology curricula?
3. What specific entrepreneurial skills and competences infused into the relevant content of the Basic Science and Basic Technology curricula?

Research Type

This is a descriptive research which employed content analysis as a method for data scouring. A descriptive research which has document or content analysis as its focus concerns with the explanation of a phenomenon as it is at a particular time or its development over a period of time, serves useful purposes in adding knowledge to fields of enquiry, in explaining certain events and in yielding information helpful in evaluating or explaining educational practices (Best and Kahn, 2006). The descriptive content analysis method employed for the analysis of the JSS basic science and basic technology curricula enables an appraisal of the curricula to be undertaken on the basis of which useful information in improving the contents of the existing JSS basic science and basic curricula are given

Data Collection

Based on the nature of this research, the following content analysis procedure for data collection was used. The procedure followed Mustapha (2005) content analysis procedure of Senior Secondary School biology curriculum. The procedure here involves;

(i) Page to page content analysis of the contents of each of the curriculum to identify the topics, content units, objectives and learning activities as elements of the analysis and the number of each of the elements respectively was counted.

(ii) Identifying topics, content units, objectives and learning activities from each of the curriculum that are entrepreneurial inclined. The number of each of the elements was counted

(iii) Identifying specific skills and competences that can be acquired through the activities and in context of objectives stated in the each curriculum and the number of each was counted

Reliability of Data Collection

The following reliability procedure was employed to ensure reliability of data collected:

(i) The number of topics, content units, stated objectives and the learning activities which are the element of the analysis were counted in each of the curriculum until constant numbers were obtained thrice consecutively and then recorded

(ii) The number of each of the elements of analysis that are entrepreneurial inclined were marked out and counted in each curriculum until constant number was obtained thrice consecutively and then recorded.

(iii) The date obtained in (i) and (ii) was presented along with each of the curriculum to a university Senior Lecturer, a specialist in technology education and teaches entrepreneurial studies to validate the procedure following through steps (i) and (ii) above. On the basis of what the expert did and data obtained, the procedure and data collected were okayed.

The entrepreneurial content of for each of the element of analysis are shown in appendices I and II.

Data Analysis

Using simple percentages, the following were determined and summary of the analyses are presented in tables 1, 2 and3.

(i) The number and percentage of science and technology topics in the basic science and technology JSS (1-3) curricula that, are entrepreneurial in context.

(ii) The content load or percentage weight of contents that cover issues on entrepreneurial education in the Basic Science and Basic Technology JSS (1-3) curricula.

(iii) The numbers of objectives stated in context of developing entrepreneurial skills, competencies and traits by users of the Basic Science and Basic Technology curricula.

(iv) The number and percentage of stated or implied entrepreneurial activities in both curricula that can lead to the development of entrepreneurial skills and competencies.

Table 1: Content analysis of JSS (1-3) basic science curriculum for entrepreneurship features

Elements of analysis	No. stated & % of each element JSS I JSS I I I				JSS I I		Tota l	% JSS-1-3
Total	No	%	No	%	No	%	256	
1(i) total learning objectives	84	5.9	84	3.6	88	6.8		
(ii) entrepreneurial implied Objectives	05		03		6		14	5.5
2 (i) total listed topics	19	26.3	26	11.	22	27.3	67	
(ii) entrepreneurial implied Topics	05		3	5	6		14	20.9
3(i) total prescribed contents	61	8.2	84	3.6	77	7.8	222	
(ii) entrepreneurial implied Contents	05		03		6		14	6.3
4(I) total activities	72	8.3	87	1.1	78	6.4	237	
(ii) entrepreneurial implied Activities	6		01		5		12	5.0

The analyses reveal that 5.5% of stated objectives, 20.9% listed topics, 6.3% of prescribed content and 5.0% of learning activities in the basic science curriculum are entrepreneurial inclined in context.

Table 2: Content analysis of JSS (1-3) basic technology curriculum for entrepreneurship features

Elements of Analysis	No. stated and % of each element						Total	% JSS 1-3
	JSS I		JSS II		JSS III			
Total	No	%	No	%	No	%	256	%
1 i. total learning objectives	43	18.6	43	51.1	36	47.2	122	
ii. entrepreneurial implied objectives	8		12	28.0	17		37	30.3
2 i. total listed topics	15	60	10	90	27	44.4	52	
ii. entrepreneurial implied topics	9		9		12		30	57.7
3i. total prescribed contents	35	22.8	42	21.4	87	16.1	164	
ii. entrepreneurial implied contents	8		9		14		31	18.9
4i. total activities	32	28.1	44	27.3	65	21.5	141	
ii. entrepreneurial implied activities	9		12		14		35	24.8

The table 2 reveals that 30.3% objectives; 57.7% topics, 18.9% contents and 24.8% learning activities prescribed in the basic technology curriculum are entrepreneurial inclined in context.

Table 3: Identifiable entrepreneurial skills and competencies from prescribed learning activities of the basic science (BS) technology (BT) curricula

Skills/ Competencies	No.JSS1		No. JSSII		No. JSSIII		Total	%	
	BS	BT	BS	BT	BS	BT			
Manipulation	3	6	1	7	2	6	25		
Reading Reporting	-	1	-	1	-	1	3	51.0	basic
								6.1	skills=57.1%
Productivity/ creativity	3	-	1	-	1	4	9	18.4	thinking
Problem solving	-	-	-	1	-	2	3	6.1	skills =24.5%
Career/entrepreneurial Awareness	1	-	-	4	2	2	9	18.4	Affective skills = 18.4%
Total No. of Skills	14		15		20		49	100%	

The table above reveals the specific entrepreneurial skills/ competencies that are infused into the relevant contents of the BS and BT curriculum 57% entrepreneurial are basic skills 24.5% thinking skills and 18.4% affective skills

Findings of the study

1. In the JSS Basic Science curriculum about 21% of the total topics are inclined towards entrepreneurship education. However, only 5.5%,6.3% and 5.0% of objectives, subject

matter knowledge and learning activities respectively are prescribed to provide entrepreneurship learning experiences

2. In the JSS Basic Technology curriculum about 58% of the topic are vocational entrepreneurial inclined. From the identified topics about 30% objectives, 19% subject matter knowledge and 25% learning activities are inclined toward entrepreneurship learning experiences.
3. The identifiable entrepreneurial skills infused into the curricula of the Basic Science, and Basic Technology, (JSS 1-3) are:
4. Basic skill predominantly manipulative skill involving manipulation of tools, equipment and materials and skills involving reading and reporting. The basic skills in the basic science and basic technology curricula constitute 57.1% (average).
5. Higher competency skills involving creativity, productivity and problem solving constitute 24.5% in both the basic science and basic technology curriculum.
6. Attitudinal skill involving career and entrepreneurial awareness constitute 18.4%

Highlights

The following can be highlighted based on the above finding:

1. Although appreciable number of topics in both the basic science and basic technology curricula can be described as vocational/entrepreneurial in nature, the learning experiences in terms of learning objectives, subject matter knowledge and learning activities infused into the curricula are rather low.
2. The entrepreneurial skills infused in to the relevant content of the JSS basic technology and basic science curricula are predominantly basic skills and few complex entrepreneurial skills/competencies (creativity, productivity and problem solving) but lack those other skills such as resourcefulness, innovativeness, organization and other personal quality skills and traits such as self confidence, self esteem, self management, sociability, risk taking etc that are necessary for wealth creation, independence, self-employment and productive adulthood.

Conclusion

Based on the above it can be inferred that the JSS basic science and basic technology curricula being implemented in Nigerian schools can provide the students who could continue beyond JSS education certain basic entrepreneurial skills as foundation on which future entrepreneurship education but not adequately equip Nigerian students with the fundamental entrepreneurial skills and competencies needed for entrepreneurship endeavour and self-employment upon graduation for those who cannot continue schooling.

Recommendations

1. NERDC should in its next curricula review consider further inclusion or infusion of relevant objectives, contents and learning activities that can lead to development of other appropriate entrepreneurial skills, competencies and traits that have been identified in the literature. In this context, the content of the JSS Basic Science and Basic Technology curricula should include topics and learning experiences that have potential for economic value and bear relevance to productivity, creativity, business endeavour and industrial processes.
2. To achieve the entrepreneurial objectives and development of entrepreneurial skills inherent in the present JSS (1-3) science and technology curricula the following actions are necessary:

i. The junior secondary science and technology teachers should tailor their teaching towards development of entrepreneurial skills and to accordingly relate contents that have entrepreneurial potential to individual and society's economic needs
ii. Teaching and learning activities should lead to creativity and productivity necessary to enable the learners develop the sense of entrepreneurship.
iii. The Science and technology lessons should be presented using hands-on and mind-on learning activities, and learning experiences should link classroom learning to industries, small scale ventures and career prospects in context of relevant science and technology subject matter.
iv. Laboratories and workshops should be provided and adequately equipped to enhance practical work and the integration of theory with practical to promote meaningful learning, functional knowledge and development of entrepreneurial skills
v. The present science and technology teachers should be given training through workshops in the skill of entrepreneurship which they are to teach their students and also be trained in appropriate teaching strategies/approaches that can facilitate the attainment of the objectives of entrepreneurship education.

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Appendix 1: Entrepreneurial content of the basic science curriculum

Topic	Content	Objectives	Activities/Skill
JSS 1 Family Health (Nutrition)	Types/composition of adequate diet	Plan adequate diet for home	Prepare adequate diet for home (productivity)
Environmental conservation and safety	Sewage/refuse disposed	List ways in which community/school can depose waste	Collection of refuse (manipulation)
Dieses prevention (clean water)	Water treatment processes	List the advantages of pipe borne water	Visit water treatment station (career/entrepreneur awareness)
The earth in space	The solar system	Illustrate the eclipse of the sun and the moon	Drawing and labeling the solar system (Drawing; manipulation)
Living things	Uses/importance of plants and animals	i. Collect and identify samples of plant and animal ii. Prepare a plant album	Press plant materials to prepare plant album (manipulation and productivity)
JSS II Living things (Habitat)	Adaptation of living things to the habitat	Identify living things found in different habitat	Collect and preserve some living organisms (manipulation and productivity)
ICT	Components of ICT	Identify compound of ICT	No appropriate activity
Efficiency of simple machine	Efficiency of machine	State ways of maintaining machine	No appropriate activity
JSS III Environmental hazard	Control erosion	Described method of controlling erosion	Visit erosion site and suggest measures of control (problem solving)
Deforestation	Regulation on deforestation	Recapitulate government regulations against deforestation	No activity
Desertification	Control of desertification	Identify various methods of the control of desertification	Participate in tree planting (productivity)
Resources from living things	Resources from plants and animals sources	Identity resources from living things	Visit factories where plants and animal produce are processed for commercial purposes. (entrepreneur awareness)
Resources from non living things solid minerals	Solid minerals examples and uses	List importance and uses of solid minerals	Collect samples of solid minerals (manipulation)
Skills acquisition	Types of skills	List types of skills	Visit to different types of professional (career awareness)

APPENDIX II: Entrepreneurial Content of JSS basic technology.

Topic	Content	Objectives	Activates
JSS 1 Concept of technology	No appropriate content	No appropriate objectives	Male and female models in technology (career awareness)
Workshop society	Accident prevention technique, safety devices	Observe safety rules and regulation	Practice use of safety devices (manipulation)
Drawing instruments and materials	Drawing instruments and materials	Identify, list and use drawing instruments	Demonstrate and practice appropriate drawing techniques. (manipulation)
Freehand sketching	Basic freehand techniques	Make net free hand sketches	Practice free hand sketching (manipulation)
Scale and scale drawing	Scale drawing full size 1:1 reduction scale, 1:5, 1: 10 etc. enlarged scale 2:1, 3: 1 etc.	Drawing given dimension to given scale	Demonstrate and practice drawing different objects to given scale (measurement manipulation/drawing)
Hand Tools	Types of hand tools	Identify and use appropriate tools for specific purpose	Dismantle and reassemble tools (maintenance of tools: manipulation)
Types of building and materials	Types of building	No appropriate objectives	No appropriate activity
Simple blue print reaching	Plan reading and inter pretation	Interpret building plans	Participate in blue print reading (reading)
Concept of maintenance	Types of maintenance	List and describe types of maintenance practices	Undertake simple maintenance (maintenance/manipulation)
JSS II ICT	Schematic diagram of G.S.M transmission process. Internet equipment and transmission process	Analyze graphically the working of G.S.M state the meaning of internet and explain its process.	Practice with computer and G.S.M (manipulation)
First aid and first aid materials	Application of simple first aid	Apply first aid measures	Practice giving simple first aid (manipulation)
Uses of materials	Materials and their common uses wood, ferrous, non-ferrous metals, ceramics, glass plastics and rubber	State common uses of materials	Visit workshops, industries, building sites (career/entrepreneur awareness)
Geometrical construction lines, angles, circles, triangle, plane figures, polygons etc	Definition and construction of different geometrical shapes	Define, identify and construct various geometrical shapes	Construction of various geometric shapes. (manipulation)
Metal work hand tools	Types of metal work hand tools: marking	Identify, describe sketch and use various metal	Practice the use of various hand tools (manipulation)

	measuring, driving and cutting	work hand tools	
Energy based technological appliances	Working principles of various energy based technological appliances pressing irons, electric cooker, water heater, electric fan, grinder, generators etc	Identify, and explain principle of operation of various energy based appliances	Dismantle appliances and observe their parts undertake excursion to power station, dam (manipulation career awareness)
Transmission of electricity	Transmission, distribution and utilization, electrical materials and equipment use in transmission of the solution	Transmission, distribution used in transmission and distribution. Draw schematic diagrams of simple transmission and distribution systems	Draw schematic diagrams (manipulation) visit an electrical sub-station or power station (career sensitization)
Site: I Preparation	Setting out materials: Building plans, pegs line, builders square	Describe techniques of site preparation	Visit on going building sites, observe work in progress and write report. (career awareness and reporting)
II Setting out	plumb, hammer, profile etc	Carry out simple setting out exercises	
Simple maintenance	Simple maintenance methods, care of common goods: domestic appliances and furniture	Carry out basic maintenance of domestic appliances and furniture	Dismantle assemble applieance practice cleaning, repairing and replacement of common domestic appliance (manipulation and problem solving)
JSS III Career prospect and opportunities in technology	Technology related career employment prospects	Make tentative career choice	Undertake industrial visits (career awareness)
Wood, clay, ceramics, glass	Types and manufacture of laminated boards method of making clay stage in producing ceramics and glass material	Explain manufacturing of man made boards identify various types and sizes of laminated board: state the stages in processing ceramics and glass. Describe method of making clay product. Design and produce clay, ceramics and glass products	Undergo exclusion to saw mills, timber market etc (entrepreneur awareness) use clay to make bricks and potteries use raw glass to make products (creativity, and productivity)
Drawing Practice	Isometric, Oblique, Orthographic one point perspective drawings	Describe and draw the different types of drawings	Practice drawing of the different types of drawing (manipulation/drawing)

Woodwork machine	Portable power tools and machines	Demonstrate safe use of portable power tools and machine	Practice safe use of portable power tools and their maintenance (safety/maintenance manipulation)
Simple woodwork projects	Woodwork projects: boxes photo-frames	Construct simple woodwork product	Produce projects (creativity problem solving)
Metalwork machine	Types of metalwork machines and their functions	Carryout simple operations with cutting and drilling machines	Practice cutting and drilling (manipulation) Demonstrate a keen sense of orderliness, tidiness, and safety in the workshop (safety/orderliness)
Simple metalwork projects	Principles of measurement and measuring. Tools and cutting files and filing drills and drilling bending and folding	Measure, mark and cut file to size and finish. Produce various shapes Produce accurate holes by drilling. Bend and fold sheet metal using hand tools	Design project involving the use of tools (creativity manipulation)
Soldering and brazing	Metal joining, soft soldering and hard soldering	Join metals by soldering and brazing	Practice soldering and brazing(manipulation)
Simple electrical wiring	Electrical circuits	Identify, select and use appropriate tools and materials to wire simple electric circuits	Carry out simple wiring project (manipulation)
Periodic maintenance	Simple maintenance method	Demonstrate basic maintenance exercise using domestic appliance and furniture	Practice periodic maintenance technique (manipulation)/ maintenance)
Fault detection	Types of objects that require fault detection process, radio, electronic game gadget, torch light, clock etc. Understanding operational process	Name instruments and specifications for faults detection Describe the operational instruction	Practice simple fault detection exercise (problem solving)