

OPTIMIZING LEARNING: MNEMONIC VISUALS FOR ENGINEERING OPERATIVE TASKS

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ABSTRACT

This study is on designated schoolwork's that have reconnoitered efforts to endorse visual/construal, writing/recording, and listening/speaking aspect of engineering component designing operatives in the universities, polytechnics and colleges of education particularly amongst the Agricultural Engineering learners using observation method. These schoolworks let slip enhancements in participants' abilities to use mnemonic visuals, static visuals and notebooks strategies approach to argue their findings, as well as statistically significant enhancement in their problem-solving skills. Optimistic findings of these schoolwork's, and the call for responsiveness to be remunerated to the crucial sense of engineering component designing operatives by an integer of international scientists, resulted in the development of a visual/construal (mnemonic visuals) learning strategies approach. This tactic not only unambiguously includes classroom/workshop dialogue, verifications and report writing strategies to learn engineering operatives, but also provides instructors with ideas and techniques to stimulate their learners to develop their own visual-memo's, inquiry queries, plan and execute some successful maniplo-spatial activities, investigable in the classroom, and present their findings to a reliable audience. It also revealed that in Nigeria, the use of instructional language (English) often results in conservative and teacher-centered teaching ways and means. It is recommended that the overlays influence of both language of instruction and the social resource need to be taken into account if we are to meet a goal of developing scientific literacy for all.

Keywords: Mnemonic visual; learning engineering, operatives; classroom dialogue

1 INTRODUCTION

In tutelage's enduring task of meeting the needs of the learners, seeming shift from orthodoxy methods are giving way to skills of exploration, current approach that are considered desirable in today's modern culture [1]. Proficiency with words and numbers is insufficient and must be appended with additional basic skills as new and promising technologies (Mnemonic visuals) permeate activities of run-of-the-mill living. As more visual elements are incorporated to achieve an optimum equilibrium between verbal and visual cues in education, interdependence between two modes of thought will be fostered. With the advance of technology that makes high-quality colored-printing as well as the electronic storage, transmission and reproduction of images ever simpler and cheaper, it has become the norm for instructional materials to be charitably illustrated. But how much instructional weight do the illustrations carry? As Jewitt and Kress [2] pointed out, while 'modes other than dissertation and writing' are generally acknowledged to be 'meaningful' the are 'often regarded by didactic scholarship as ancillary, and marginal with diminutive or no contribution to learning: "Mnemonic visuals" is often considered to be the core of visual communication where farsightedness resides' [2]. The impulse to make mnemonic visuals the center of attention is perhaps inevitable in the realm of 'engineering operative tasks' (EOT). On the other hand, a number of fashionable approaches (such as distributed cognition studies) with roots in various disciplines accent the roles of multiple and multimodal representations in communicating information, and seem to herald 'a deep change in the representational world' that raises queries about 'forms of cognition,

possibilities for learning, new shaping's of knowledge and the management of information-different from those around which current understandings are formed' [3]. To judge by research articles, a deep change of this nature is beginning to make itself felt in the design of materials for natural science and technology instruction, but in EOT the evidence of a 'mnemonic visual turn' is patchy at best. Nevertheless, there is little doubt that multimodal literacies are slowly starting to be acknowledged and utilized with greater awareness in the area of engineering operative tasks (EOT). This study attempts to make an explorative investigation of its effectiveness in engineering operative tasks.

2 BACKGROUND

Disquiet about the misleading inability of science and technology education to attend to current societal issues and the negative perceptions of and lack of interest in, 'maniplo-spatial' technology exist in developing countries [4, 5]. Erudite pointed out that the need to stimulate interest in operative (maniplo-spatial) science and prepare learners to be citizens who make informed decisions is imperative in all societies [6]. On the other hand, developing countries or countries in transition recurrently face the additional challenge of insufficient qualified educators to teach operative science (engineering operative tasks) using pioneering instructions [7, 8]. In addition, hitherto colonized societies, the teaching and learning of engineering operative often take place in a second language (instructional language) for in cooperation the teacher and the learner. Language in engineering operatives is not only the issues for learners and teachers and in recent years, there has been increasing agitations for productive engineering, research and recognition for pragmatisms [9, 10, 11]. These scholars, amongst others, believe that for big name to be judged technologically literate they must be proficient in the 'maniplo-spatiality' operatives, which include construal, and research reporting. Being proficient in the crucial sense is a pre-requisite for being able to operate within the derived sense; that is, being able to make informed judgements on engineering design issues [9, 12]. Teaching in our tertiary institutions are generally conformist methods and unremitting to be dominated by lecture/Notebooks methods, making It apathetic, "cookbook-type" then dull and dreary way by which engineering operative task are being taught in the engineering pedagogy. There is a requisite for a more effectual student-centered engineering method that matches specific idiosyncrasies and level of technology of the students'. Since the subject matter habits important place in the course curriculum, there is need to probe into the comparative efficacy of the three teaching strategies approach to promoting Engineering Operative Tasks.

3 METHODOLOGY

Mixed method approaches were adapted for the schoolworks which heralded and predisposed the development of the learning strategies approach to endorse technology literacy (engineering operative tasks). This schoolwork's focused on the effects of introducing techniques to promoting visuals/construal, writing/recording and listening/speaking (on disassembling and assemblage of motorized agricultural irrigation pump and others mechanisms), in engineering classes/workshop.

3.1 Static Visual/Narrative Strategies Approach

The sample in this schoolwork was similar to [13, 14]. Twelve (12) tutors in a diploma classes in Ramat polytechnic, Maiduguri were observed. Of four tutors identified in each; setting, one conservatoire (i e., the tutor pulses his/her class students) was randomly endorsed at the start of the schoolwork as control group in order of comparisons with the experimental group. Each of the other three tutors was skilled as facilitator of static visual/narrative approach, that is, they were acquainting with the doings and strategies aimed at stimulating or 'triggering static visual/narrative strategies between learners. The control group tutors play no part in the tutor's development activities and were unacquainted of the classroom static visual/narrative and strategies that were being endorsed in other schools. The classroom annotations technique and the opening measures of the participating learners' envisaging/cognitive skills were made. The instrument of exploration was based on *Standard Progressive Matrices* test [15, 16] used to size the envisaging/cognitive skills. The engendered data were statistically treated and evaluated to provide descriptive statistics and analyses of covariance (ANCOVA) were applied with pre-test scores providing the comparative co-variates. Cronbach's alpha coefficient was used as a pointer of test reliability. A classroom annotations' instrument was developed (a four-point scale) in order to enumerate the classroom activities that took place during a

PowerPoint classroom annotation session per tutor. The topic taught during this period was 'engineering component designing' by all the tutors. The measures used to plump whether classroom static/narrative approach had been sequentially deciphered, were the dexterousness of the learners to betroth a hands-on disassembling and assemblage of a motorized agricultural irrigation pumping contraption, use appropriate engineering terminologies (apply connectives), and engaged in narratives that included descriptions, extrapolations and explanations. All the visual resources, narratives and reporting's were reviewed by three scholars who made a mutual judgment as to whether the learning strategies approach had taken place in any particular lesson. The participating tutors (key informants) were interviewed at the end of each of classroom annotations session, in order to gain a sympathetic of their perspectives of the process.

3.2 Notebooks/Speaking Strategies Approach

The sample in this schoolwork was ten educational technologist tutors from Collages of Education in Borno State-Nigeria. The tutors came from dissimilar collages of education that were matched as institutions that were underprivileged from the state capital, are analogous in size and type. Although ten were invited to participate, only seven continued for the duration of the schoolwork consequential in four tutors serving in the control group and three tutors making the experimental group [17]. The engendered statistics include representative information (include group discussion interviews and classroom annotations), post-interposition classroom annotations with both the experimental and control group tutors, reciprocal feedback sessions with the experimental group of tutors. A duos of scholars piloted each classroom annotation using *Notebook Inquiry Observation Scale* and came to a compromise finding. Further quantifiable data were engendered by using the *Notebooks Checklist*. Although, the instruments were developed for British schools they were considered to be sufficiently general for use in this schoolwork context. These instruments were moderated and validated by scholars in the University of Maiduguri and used in number of technology inquiry and notebooks schoolwork's akin to [18, 19]. The experimental group of tutors participated in the investigations (Tasks) and the theoretical and practical aspects of using the Notebook/speaking strategies approach. The topics chosen were based on cohesive properties of electric current (disassembling and assemblage of socket plug/switchover). Each participating Edu-technologist tutor was observed as they carry out the Notebook/speaking approach in their classroom. Proximately succeeding their classroom annotation session, the tutors were interviewed. The learners discretely firm-up *notebook/speaking* records for two separate investigations and five notebooks from each class were randomly selected and debriefed against the *notebooks checklist*. During the course of the intervention process the Notebooks/speaking approach of the same five learners per class across the two tasks or investigations were evaluated. Tutors form the control group were also annotated, and interviewed three times after the initial standard data collection process. The Notebook Inquiry Observation Scale is premeditated to measure the degree of 'maniplo-spatial' instruction used by the tutors in their Edu-technologist lessons. The instrument assessed three areas in relation to engineering operative tasks or investigations process: constructing a testable query, designing the procedure, making working (technical drawing) drawings and interpretations. The data engendered from tutor's classroom practice were grounded on the annotator's assessment of the participating tutors' ability to carry out actives and comporments which enable leaners participate independently in the engineering operative tasks. Whether these comporments were translated in any way into learners' achievement was investigated by examining their spoken interpretations using the *Notebooks Checklist*. The *Notebook Checklist* instrument assesses the extent to which the work in the leaner's Notebooks/speaking approach replicates ideologies of engineering operative tasks [20, 21]. This checklist was used to assess learners' construction of a testable query, and designing the procedure, making workable drawings and interpretations [20].

3.3 Mnemonic Visuals/Adjacent Text Strategies Approach

This schoolwork 'Mnemonic visuals approach' (a graphic that can 'make available retrieval cues for factual information') and methods of schoolwork's described [21], but include scholarship on changes in general literateness unveiled by learners participating in the process. The general literacy aspect anaesthetizes the 'visual/construal' 'writing/recording' and 'listening/speaking' proficiencies of the learners before and after the putting into practice of the strategies approach over three weeks.

Three engineering related (science) departments in university of Maiduguri were randomly chosen to represent the experimental group which participated in the mnemonic visual approach while the remaining two were also engineering departments were drawn from Ramat polytechnic which constituted the control group. The learning standard that was used and post-test were initially designed for the British Department for International Development (BDID) initiative evaluation [22]. The instrument was eligible for these schoolworks to test the learners' visual/construal skills, ability to make extrapolations based on what they have projected, interpret and their ability to 'maniplo-spatially' accomplish the engineering operative tasks in terms of writing and recording frames based on their interpretation of visuals and textually resources were tested. Their listening/ speaking skills were tested requiring them to listening to and in words articulate by multiple choice queries of what they had heard. A four-point scale classroom annotation schedule was used to fix whether learners in these classrooms are giving openings visual/construal, listen/speak, and write /record during putting into practice of the mnemonic visual strategies approach. The data were used to determine whether the mnemonic visuals strategies approach had been efficaciously carry out and assess possible weakness in terms operation. The tutors and learners were (Key informant, group dialogue) interviewed to gain insight into their angles of general three R's aspects of the interposition.

4 RESULTS AND DISCUSSION

The domino effect of the classroom static/narrative, Notebook/speaking and Mnemonic/adjacent text strategies approach schoolwork's are reported correspondingly as reflected in Figure 1.

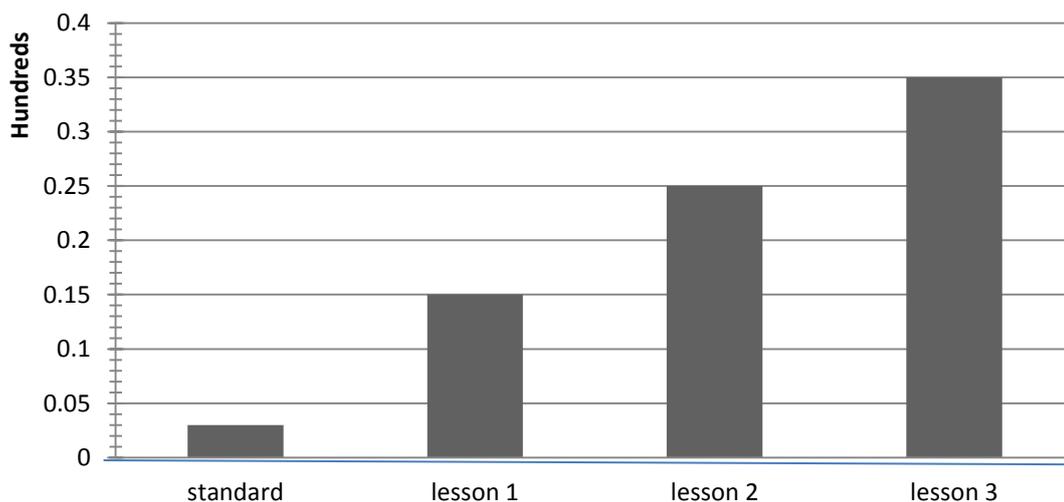


Figure 1. Aggregate Notebook /technical interpretation (classroom observation) approach workshop

Tautening of the sample of learners' notebooks/speaking revealed that in all but one of the records appraise, the learners had simply copied their tutor's investigable queries and that there was no quantifiable enhancement in the design (engineering) component of the notebooks/speaking approach over time. There were, however, quantifiable enhancements in terms of the learner's capability to successfully implement the design, collect data, construction engineering (technical) drawings and deduction. These enhancements are illustrated in Figure 2 where the percentages of the entries per sample (n=45) at bi-chart three and four (i.e., satisfactory achievement) are shown for each component being assessed. Bi-chart of four scores indicate that the learners were able to engender their own information in a substantially complete and satisfactorily accurate manner while bi-chart three symbolizes that some details were omitted and that the account was judged to be incomplete, but generally meeting requirements. These two bi-charts have been combined in Figure 2.

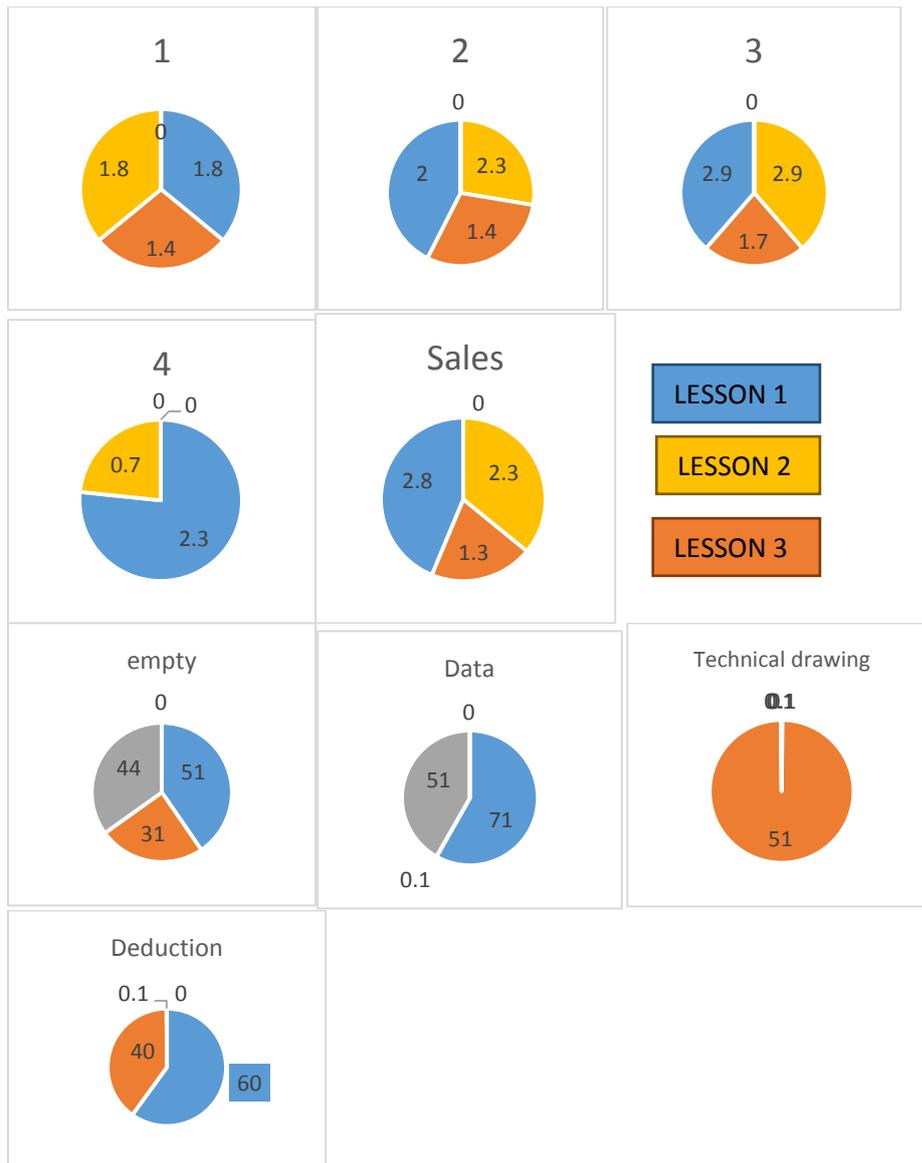


Figure 2. Percentage of entries (n=45) per component in the learner's notebooks/narration (levels three and four) for each three lessons.

4.1 Static visuals/Narrative Strategies Approach

Statistics from the classroom annotations in this schoolwork made known criteria for static/narrative approach used in this schoolwork, static/narrative approach did widely hold, but not all, of the experimental groups' post-interposition lessons observed. Classroom annotations also revealed that static/narrative approach exploratory setting had not betrothed in the control groups' lessons. Data from Raven's Standard Progressive Matrices (RSPM) pre- and post-tests of envisioning/cognitive (n=1092; = 0.74) indicated statistically significant difference (p=0.000) between the pre-and post-test scores, and between enhancements in the scores of the experimental and control groups. Analysis of variance the Raven's data indicated that the great difference between the experimental and comparison group's mean gain scores were sets A and B (p<0.001). There was also a statistically significant different (p<0.05) between the experimental and the comparison groups in Raven's set C. Statistically significant differences between overall RSPM pre-and post-test scores among undergraduate students of university, students of polytechnics and students of colleges of Education groups of institutions were recorded at the p<0.01 level. The main total gain was measured in the university groups (5.67) followed by polytechnics with gain of 3.82 and then by Colleges of Education.

4.2 Notebooks/speaking strategies approach

Notebooks/speaking approach with the experimental group teachers, the data engendered through classroom annotation revealed an overall increase in cumulative scores (five-point scale scores) for visual construal, designing an investigable query for data collection, interpreting technical drawings and deduction for the three tutors who had participated in the Notebooks approach workshops. This general conformation of increasing scores overtime was reflected in each separable teacher's case from the standard observation until the adjoining-up of the final lessons. During the same period, the control group demonstrated negligible to change in their teaching practices from the standard ratings through their three classroom annotations. They continued with conformist methods of expository instructions (engineering operative tasks), rote learning and the occasional remark type practical activity. Despite that all of these tutors were Edu- technologist trained on the learning outcomes and assessment standard of 'engineering operative tasks' as described in the course curriculum, learners did not write/record, construct technical drawings or deductions based on their tutor's observations or the tutor's lessons, as could be expected. The number of learners who used engineering design component tasks to support their reporting was initially very low and in the final sessions did the learner appear to fathom this was an appropriate and appreciated way of reporting. All the number of the learners who participated in the *Notebooks/speaking approach* revealed that they relied on their tutor's diktat deduction for their first investigation report. The second *Notebooks/Speaking* strategies entry on disassemble and assemblage of electric current plug, three learners managed to 'maniplo-spatially' complete the tasks and draw valid deductions in their own words (bi-chart four), while three wrote their deductions in their own words in a manner that was decidedly to be incomplete or not entirely accurate (bi-chart three). In the third and final investigation the *Notebooks/Speaking* strategies entries revealed that four learners clued draw valid deductions on their own and give a written report in their words (bi-chart four) and three were able to write a reasoning in their own words, but which were judged to be incomplete (bi-chart three). These statistics suggest that a headway was made through practice by both the tutors and their learners while engaging in the *Notebooks/Speaking* strategies to carryout engineering operative tasks.

4.3 Mnemonic Visuals/Adjacent text Approach Strategies

The pedagogic annotations revealed that in general the teachers cherry-picked to teach in their terminologies and instructional language (workshop learning and teaching jargon). It was also noted that the learners used the terminology exclusively during classroom/workshop discussion. All the lessons observed suggested that the teachers had an adequate understanding of the engineering design component strategy. But that they provide no planned actives to test their learners engineering operative tasks (disassemble and assemblage) skills. It was also apparent that learners struggled to share ideas when opportunities were provided for classroom discussion and that their notebooks were often incoherent and that they wriggled to visually construe. The data engendered by the general literateness schoolwork pre-and post-tests were computed using analysis of variance (ANOVA) techniques. This was done to interrogate differences between the experimental and control group mean scores for visual/construe, listening/recording, writing/speaking aspects of engineering component designing strategies tasks; gains made during operation of the strategy; and differences between the scores hooked on instructional terminological convention.

4.3.1 Visual/construal

The control group scored statistically higher in visual construal in (engineering design component) approaches in the pre-test but this figure fell in the post-test to the point where no longer statistically significant. The experimental group's mean scores for visual construal (engineering operative tasks) strategies enhanced statistically significantly more than the control groups did after the treatment. The mean differences between the engineering operative tasks, strategies and the use of terminology visual construal scores was significantly different in errand of the use of terminology in the pre-test, but there was no statistically differences in the post-test.

4.3.2 Listening/recording

The control group scored statistically significantly ($P < 0.50$) higher than experimental group in listening/recording (engineering design component) approach in the post-test. This figure fell in the post-test but endured statistically significantly better than the experimental groups mean score. The mean difference between the (engineering operative tasks) and the use terminology listening/recording scores was significantly different in favor of terminology usage in both pre-test and post-test.

4.3.3 Writing/speaking

The control group scored slightly better (but not statistically significantly) than the experimental in the writing/speaking pre-test in terminology usage, but this result was reversed in the post-test where the experimental group scored statistically significantly better than the terminologically boosted written/speaking test. There was no statistically significant change in the experimental group's writing/speaking expertise in (engineering operative tasks) over the control after the interposition but there was statistically significant enhancement of their scores over the control group's scores in writing/speaking in terminology. The mean differences between the use of terminology in writing/speaking scores was significantly different in favor (engineering operative tasks) in the pre-test, but changed to being statistically significantly different in favor of terminology in the post-test. There were no key differences between the writing/speaking pre-test and post-test scores in (engineering operative task) in the pre-test and post-tests. There were no statistically significant differences eminent between changes scores between the pre-test and post-tests scores of the experimental and control groups. There was on statistically significant mean differences between the (engineering operative tasks) and terminology writing/speaking scores in either the pre-or post-tests. The statistics engendered by the static visuals/narrative, Notebooks/speaking to learn engineering component designing and mnemonic visuals strategies approach schoolwork's suggested that tertiary institute teachers who participated were receptive and are able to implement, to varying degrees, the strategies presented to them.

4.3.4 Notebooks/Speaking Strategies Approach

The Notebooks/Speaking approach standard schoolwork suggests that it is more than likely that prior to the interposition the participating learner were seldom, if ever reinvigorated to ask queries or to communicate their thought in the classroom either through formal engineering terminology writing or oral undertakings. This endured the case for the control groups of students throughout the schoolwork. In contrast, there were enhancements in a number of learners' abilities to draw deductions and provide written reports in their own words in the experimental group over the period of the schoolwork. On the other hand, even after attempts at putting into practice, many learners remain dependent on their tutors for more clarifications on their investigable question, and many others on the operative tasks procedures, drawings and deductions. The challenges of getting the learners to articulate their own investigable query, to carry out 'maniplo-spatial' procedures are one which has been shown to be common internationally [23], and it should be reminisced that for many sciences related (technical) teachers providing learners with the opportunity to pursue flexible inquiry is unusually not part of their current practice. It is as a result important that the support given to teachers should explicitly focus on how they can engage learners in the approach so that they *do* ask questions, label bits and pieces (objects) and dealings, test their ideas with what is known, communicate what they are learning [24]., a paradigm shift in approach which in all probability requires a significant amount of support from governess development interventions [25]. Equally, some knowledgeable caution that without sufficient support Notebooks/Narration approach, writing/speaking may be approached automatically, a process which results in futile operation [26, 27]. In the light of the well acknowledged success of the approach in western culture, and the limited statistics engendered in this schoolwork it appears that further investigation of the applicability of the use of the Notebooks/Speaking approach in advanced learning context is justified.

4.3.5 Mnemonic visuals/ adjacent text Strategies Approach

The most thought-provoking findings of the general literateness aspect of the mnemonic visual strategies approach schoolwork were the statistically significant enhancements in the participating learner's 'workshop operative language' (terminologies) listening/recording and writing/speaking skills. These results are inquisitive as one might expect their exploited terminology' to be well developed, and not easily susceptible to relatively short-term interpositions such as (engineering operative tasks) learning strategy. Conversely, there are a number of schoolwork's which suggest that if the language of instruction is not properly developed in a child's home-language before introduced to second language, both will suffer [1, 28]. This seems to be the case in this schoolwork for the reason that both the experimental and control group mean scores in (engineering operative tasks) pre-tests reflected very low levels of learner's performance. Conceivably, a less surprising finding as the (engineering operative tasks) resources provided were in the language of instruction only, was that there was also an enhancement in the learners' visual construal skills. Nevertheless, what is of issue is that the learners were equally unfledged in both resources and the fact that, despite some statistically significant enhancements, they still performed below per after the interposition [29].

4.3.6 Mnemonic Visuals Strategies Model for Engineering Operative Task

The verdicts of the above schoolwork's, and those of [9, 10, 16, 22] call for receptiveness to be remunerated to the fundamental sagacity of 'engineering operative tasks literateness. As such approach was developed that not only specifically includes classroom visual/ construal, listening/recording and writing/speaking to learn 'engineering component designing' but which provides teachers with ideas and modus operandi (including construal) to stimulate their learners to develop own visual memos, investigable queries, procedures and execute an investigation in the pedagogical cycle, and present their findings. The approach models what engineers do; viz. envisioning, construal, talk, identify a challenge, plan an investigation, fix or prototypical an experiment, discuss their findings, and present them in a number of ways dependent on the audience. From Figure 4 shows that the stimulus (learning strategies approach) not only provides the prompt for visual construal, but can also support access to some of the prerequisite information needed for meaningful talk that will help to raise guesstimates and exploration queries. The talk that ensures and the investigable queries engendered, enables the design and execution of the (engineering operative tasks) exploration. Once the trajectory of learning is drawn in the learner's notebook/speaking, that is, they have drawn all conclusions that they can from their classroom notebooks interactions by using the data they engendered, further reading and exploration allows them to go afar the limit of their investigable query. This means that they can explore through other form information gathering the non-investigable but researchable queries that were raised as part of their dialogs. There are a number of implications and stoppages for teachers and for teacher education when introducing 'maniplo-spatial' learning strategies approach to endorse 'engineering component designing' literateness. First, for engineering teachers without intrinsic art appreciation background, there may be issues in term of visual construal's techniques to be considered, particularly if the learners are engineering concomitant (science) learners. Practicing Edu-technology tutors must be *au fait* with fashionable practices and science-teacher educators must ensures that they bring together their learners to effective engineering operative terminology (workshop instructional language) and three R's strategies. Secondly, teachers also need to become competent and ease in terms of promoting classroom visual construal among their learners and safeguard that there are ample of such resources available for their learners to use to endorse visual interpretive and researching to extend their line of learning.

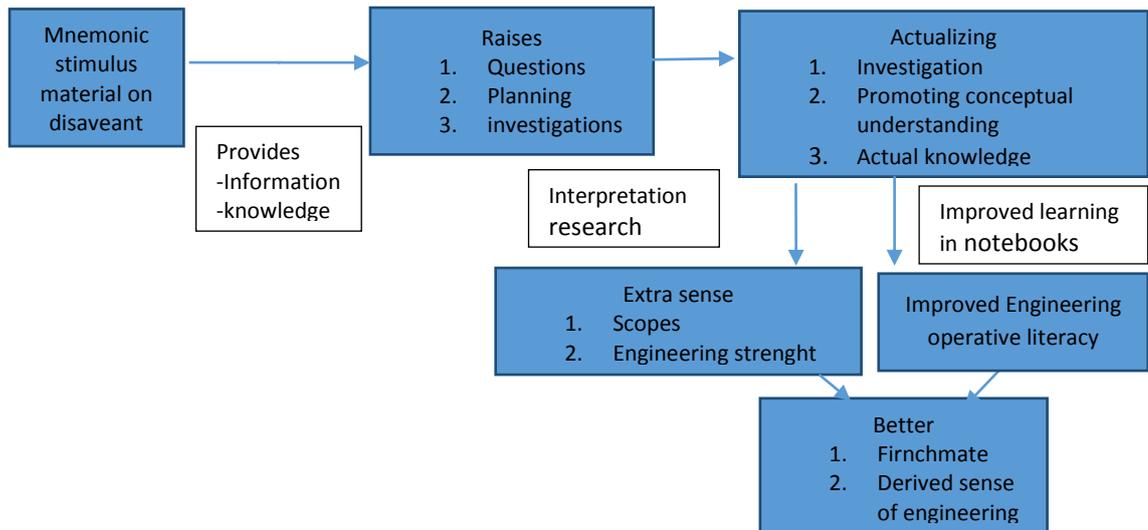


Figure 3. Key representation of the mnemonic visuals teaching strategies (isometric projection) model for improved engineering component designing

Educators have to appraise their learners’ levels of rendering engineering operative tasks in all facets by the strategy, that is, the learners’ skill to visual/construal, write/speak, doing/practical (demonstration) and present their findings. These facets can be measured both creatively throughout the process and collectively by measuring the products of the strategy as shown (Figure 4). What also must be hark-back to is that the model presented in Figure 3 seems to hint at the visual-interpretation, writing-discussion or speaking and doing-practical (demonstration) aspects of the strategy take place at disconnected interval, this is not the case. As shown in Figure 4 they take place at any time appropriate. This diagram also teases out the extrapolation, procedure, data collection and deduction aspects of the learning strategies techniques, as well as the important of teachers focused dialogue and teacher operation as ways of incorporating the line of learning. As proven in this version of this model is the importance of learner’s engendered idea and words, scientific (engineering) terminologies, new solicitations and queries raised during the process. This model also typifies that the findings can be collective in variety of ways, for paradigm, reports, publications, oral and theatric presentations etc. As a final point, in terms of records of learners’ work, each investigation with concomitant evidence of learner output and appraisal can be kept in a folder for presentation to other interested events.

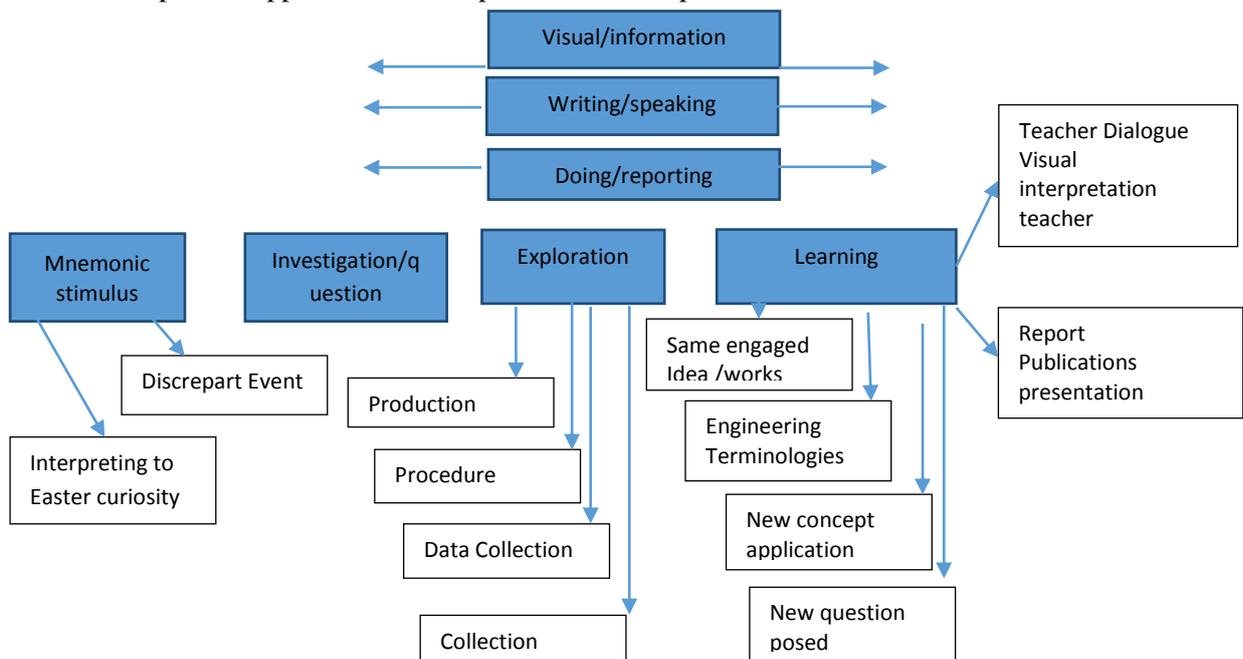


Figure 4. Representation of mnemonic visual strategies teaching model for improved engineering operative tasks.

5 CONCLUSIONS

Although it has been noted that learning to write/speak, visualize/interpret engineering operatives tasks is important as they enable learners to argue meaningfully about engineering component designing issues, in the sampled schools schoolwork it appears that an added challenge exists because learners are taught in a conformist language which is not their (workshop language) jargon, a challenge that has on a regular basis been reported in instructional literatures. It also revealed that the use of instructional language (English) especially in Nigeria often results in conservative and teacher-centered teaching ways and means. As such, the mnemonic visuals strategies approach to engineering operative tasks that was developed undoubtedly identified the role of workshop jargon in learning engineering component designing. These influences, although perhaps not as acute, are also pervasive. The statistically significant difference between overall Raven's pre- and post-test scores by learners in the Universities, Polytechnics and Collages of Education recorded in the classroom annotations schoolwork put forward that other collective resource may also play a role in the learner insight.

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