

# Creative Mind Model of Assessment with Technology: A Digital Vista for Nigerian Senior Secondary School Students' Classroom Tests

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**Abstract:** *This study examined creative mind model of assessment with technology (CREMMAT). CREMMAT is a novel evaluation type that, more efficiently and more inclusively, assesses students' development and achievement in knowledge, ability and skill. It is a digital vista for Nigerian secondary school students which would put them ahead of their counterparts in the global village. Quasi experimental design was used to actualize the purpose of this research. 2000 students were selected through a multi-stage sampling procedure from 85 Senior Secondary Schools in Anambra State. 208 students (C = 104, E = 104) were randomly sampled from the selected 2000 for a possible effect-experiment on the studied intelligences with technology (Bodily-Kinaesthetic, Logical-Mathematics, Musical and Verbal-Linguistic Intels). The researchers developed two instruments termed creative mind model of assessment with technology (CREMMAT) and training for performance assessment (TPA). Observations and tests were also used. The result showed that there was significant mean score difference between participants' TPA pre-test and post-test ( $F_{(1,205)} = 953.56; p = .0005; \text{partial } \eta^2 = .244$ ). The output revealed that pre-existing ability had no impact on the treatment result of the students ( $p = .34_{\text{preTPA}}$ ). Also, it was found that gender had no part to play in the performance on the studied Intels. However, female students showed greater active participation in verbal-linguistic and musical Intels, while the male students showed greater active participation in logical-mathematical Intel. Gender difference did not show in bodily-kinaesthetic Intel. The researchers recommend that government would do better not to constrain teachers to use only subject-matter and analogue methods of assessment in the classrooms. Also the researchers recommend that government include CREMMAT in the assessment of students in order to enhance other digital intelligences inherent in Nigerian students.*

**Keywords:** creativity model, assessment, achievement, technology, digital vista, classroom

## 1. Introduction

Learning is a lifelong process. Humans learn for a purpose. Usually, it seems individuals learn so as to adapt to environments efficiently, and solve problems that present themselves as they adapt to the environment. Learning has become purposively structured in the school system and the assessment therein. In this 21<sup>st</sup> century, the learning that goes on in the classroom is supposed to be so structured and tailored towards solving the problems of the century's context and environment more efficiently. Hence, this study is seeking to present some ways of assessment that help the teacher anticipate that a student's classroom learning targets to help him/her solve problems outside the classroom. The implication of the above statements is that goals of classroom learning should be to help students solve their life problems, with the learning they achieve, while in school or out of school. It means that standards should be set, and these standards should be assessed periodically with the type of tools that models real life problems for the students. Through assessments and evaluations, means towards achieving the standards and the desired goals of learning should, from time to time, be reviewed in order to meet the test of time. In this 21<sup>st</sup> century problem solving, technology shapes what we are, how we behave and think, and with whom we interact. Our daily life is filled with the activities on computer, internet, video games, cell phones, iPods, social networking sites, tablets like iPad and the likes (Feist & Rosenberg, 2012). Technology therefore has serious influence in the holistic human development and life

adaptation. With technology, students can evaluate their abilities and skills, playing back and seeing their performance even before the detailed assessments of the classroom teachers or standard testing are done.

Learning implies teaching. If someone is learning, someone or something must be teaching. Following this assumption is that testing becomes sine qua non to learning in order to assess if teaching has been done properly and objectively. Academic assessment has to do with the overall evaluation of the products of teaching and learning process according to set standards. Generally, only the classroom learners are academically assessed, not necessarily every learner. For it to meet its real life goal, academic assessment should be quantitative and qualitative. Achievement is measured while performance is evaluated and these could be components of assessment with technology. The quantitative achievement of a learner can easily be measured and graded, while the performance that is almost qualitative in nature is normally evaluated in order to appreciate learning impact on processes and products of a student's life in the classroom learning.

For Miller and Linn, (2005), assessment should be broader than testing and measuring because it includes ways of sampling and observing students' skills, abilities and knowledge. Scholars agree that assessment should include much more than testing and grading. (Woolfolk, 2012; Popham, 2008; Miller & Linn, 2005 ). The scholars are of the opinion that assessment should involve all examination and judgment-based evaluations of students' performances,

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portfolios, projects and products. Testing and grading possibly measure achievement, and not necessarily creativity. A learner may be very poor in a particular subject but very creative in other intelligences. How else could these other intelligences be captured if not through technology? Technology captures other intelligences in and outside the classroom which the teachers in structured environment might not capture in the students.

A senior secondary school student may be very good in music but has little ability or none in mathematics. Another student may be very good in a psychomotor ability such as running or gymnastics, but demonstrates weak ability in English language. Different scholars such as Benjamin Bloom, Robert Sternberg, Daniel Coleman, and Howard Gardner have tried to sharpen out taxonomies and other intelligences suggesting that assessments should not end with just the cognitive understanding of the subject-matter (Bloom, Engelhart, Frost, Hill, & Krathwohl 1956; Gardner, 1993; Coleman, 1995; Sternberg, 2002; Sternberg, 2007). Since assessment has to do with much more than cognitive achievement on a subject-matter, there comes the need for evaluative processes that take care of other learner abilities and skills that could not be quantitatively tested and graded. There is need for a novel assessment model that would more efficiently and more inclusively take care to assess students' development and achievement in knowledge, abilities and skills. This novel academic assessment type is what is termed *creative-mind model* of assessment with technology (CREMMAT). Authentic assessments evaluate and assess students' mastery knowledge, proficiency in skills and development of abilities in contexts closely related to real life and real world (MindShift Series, 2013).

Nigerian boys and girls learn differently, not suggesting that they have better or worse intellectual capability or capacity among their gender divide (Halpern, 2002; Ndum, 2017). Their cognitive socio-cultural constructed contexts portray the mapping of their different abilities and skills which they bring to school. The researchers brought in the gender factor in their study of CREMMAT so as to understand if being a boy or girl has anything to do with the use of CREMMAT assessment.

The existing assessments have been reported to be flawed not because of the psychometric standards, but because of their failure in preparing students for the out-of-school real world living. Assessments can be gradable or non-gradable, and reportable or non-reportable (Santrock, 2004). Assessments can be gradable but not reportable, since a student's achievement can be appreciated without the public knowing about it. The teacher may tell the child kudos for answering or responding positively to the learning process yet not reported for public information. On the other hand, an assessment can be gradable as well as reportable. In light of this, it will be discovered that in the different types of assessments, some may not be gradable and not reportable at the same time. These assessments that may neither be gradable nor reportable may be what the student needs for real life problem-solving. The researchers wish to discover whether these non-gradable and non-reportable assessments could include those considered to be critical in the life of the

child if technology records of these are saved for the child for life after school.

Problems of assessments seem to be increasing in complexity since it seems that to pass a test or an examination could suggest being brilliant irrespective of how it is arrived at. *Magic centres* seem to be making the situation worse by providing the so called 'brilliance' needed to 'excel' (Iheonunekwu, 2015). Magic centres are learning centres where Nigerian students believe that quick and magical preparations could be obtained for any of such standard examinations. Students resort to magic centres to prepare for standard examinations such as WAEC and JAMB. Do magic centres truly prepare these students or do they in reality perform *abrakatabra* for the students so that all the so called learning is lost soon after the standard examinations are completed. May be the assessment models used in Nigerian education need to be reviewed to include creative-mind model with technology.

Assessment models used in Nigerian education mainly include examinations, tests and grading on knowledge of subject-matter topics covered in the classrooms. Creative mind model on the other hand is innovative, proposing a different form of assessment technique which involves ability and skill testing (Chukwuma, 2019). It covers wider range of capturing students' knowledge as well as his/her development in ability-based and gifted intelligences. Using creative-mind model of assessment agrees with Miller and Linn (2005) who assert that test-taking is a skill, and creativity is knowledge. Creative-mind model sees information gathered in light of the world around it and relates it to its experiences and existing knowledge in order to create or recreate a balanced situation or view for efficient problem solving (Chukwuma, 2019; Gardner, 1999, Udoye, 2007). It was Martin Luther King (jnr.) who said that nothing in the entire world is more dangerous than sincere ignorance and conscientious stupidity in the midst of knowledge. For him, to be knowledgeable, one needs to be able to view things in new and better ways or from different and better perspectives.

Creative-mind model with technology is proposed by the researchers to include the multiple intelligences developed by Gardner (1993), whose framework is used in this study. The original seven multiple intelligences (MIs) have been of great interest for educational psychologists with the intention to encourage those intelligences which the child brings to the classroom. Every learner brings certain number of MIs to the classroom learning. That presupposes that every learner has a creative mind. How does the teacher identify these multiple intelligences with 21<sup>st</sup> century accessories? This question is the main target of this study; and an effort to answer the questions urges the researchers to engage in evidence-based enquiries.

Chukwuma (2019) launched a new model of assessment termed creative mind model of assessment (CREMMA). This study added the technology piece to explore the possible effects of digital instructional materials in training and examining the studied Intels. This study on creative-mind model of assessment with technology does not assume that the assessment models used in Nigerian classrooms are

faulted. What the researchers are proposing is an additional model of assessment which is believed to include development of Gardner's Intelligences (Intels) depicted in multiple skills, knowledge and abilities.

The following research questions guided the researchers in the study.

- 1) How does creative mind model with technology show in secondary school assessments?
- 2) How do secondary school male and female students perceive creative-mind model of assessment with technology?
- 3) How does creative-mind model with technology function in academic assessment of secondary school students?

The following null hypothesis was tested at  $p < .05$  to further prove some probabilities. The hypothesis tested research question three.

$H_0$  There is no significant difference between the mean assessments score of the experimental group and that of the control group in the post-treatment-tests for subject-matter of studied Intels.

## 2. Method

This study employed a quasi-experimental design because the researchers desired to use intact classes of senior secondary (SS) school students. Four of Howard Gardner's original seven multiple intelligences (MIs) were used for this study. The four were *bodily-kinaesthetic*, *logical-mathematics*, *music* and *verbal-linguistic* intelligences. These intelligences were decided by the researchers for reason of their prominence in the subjects studied in Nigerian schools particularly at the Junior Secondary school level.

Multistage sampling was used for this study. The researchers sampled 85 senior secondary schools by way of simple ballot from 558 schools in Anambra state. All the selected senior secondary school students in the first level (SSI) of the schools participated in completing the CREMMAT questionnaires. To identify the prevalence of the studied Intels, 2000 students returned completed questionnaires out of 2050 distributed. 208 students, split into half for control and experiment grouping (C = 104, E = 104), were randomly sampled from the selected 2000 for a possible effect-experiment on the studied intelligences with technology. Bodily-Kinaesthetic (C = 26, E = 26), Logical-Mathematics (C = 26, E = 26), Musical (C = 26, E = 26), and Verbal-Linguistic (C = 26, E = 26). Four schools were conveniently chosen for training on the four Intels. These schools are located within the radius of one mile or less. SSI students were studied because they had just completed subject-matter examinations on the studied Intels: Physical and Health Education (bodily kinaesthetic Intel), Mathematics (logical-

mathematical Intel), Cultural and Creative Arts (musical Intel), and Igbo/English Language (verbal linguistic Intel). See *appendix A*.

## Procedure

The following procedures were followed in the method. Training and Performance Assessment kit (TPAkit) with technology was used only for the experimental group while the control group was trained and assessed with Training and Performance Assessment kit (TPAkit) without technology. Professionals and subject-matter teachers of the studied Intels were employed as research assistants. Researchers switched roles from participant to non-participant observers during the training. (See *appendix B*)

After-school lesson periods were used for the experiments. Block of 90minutes was used out of which 60minutes were dedicated to training and video-recording, and 30minutes dedicated to playing back recorded productions to the students. Students were given chance to assess and critique their work. Igbo and English languages were used during the training and testing. Students participated more actively, asked questions excitedly and more often discussed more freely when Igbo language was being used. Use of the two languages enabled participants to show active role in participation with regards to their domain specificity of identified intelligence. The goal for using Igbo as their first language ( $L_1$ ) was to provide psychological space for students who could not always express themselves efficiently in English language as their second language ( $L_2$ ).

## 3. Result

The computed results showed that the mean score of students who identified with Musical Intel as their domain intelligence was highest followed by mean score of students who showed domain Intel in Bodily-kinaesthetic (see *Figures 1 and II below*).

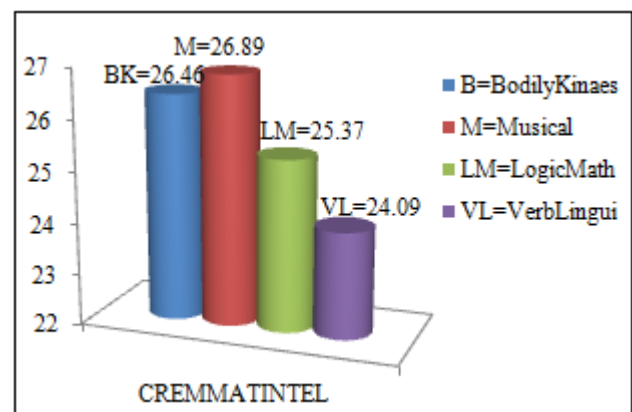


Figure I: Descriptive Statistics of CREMMAT Intelligences among Students

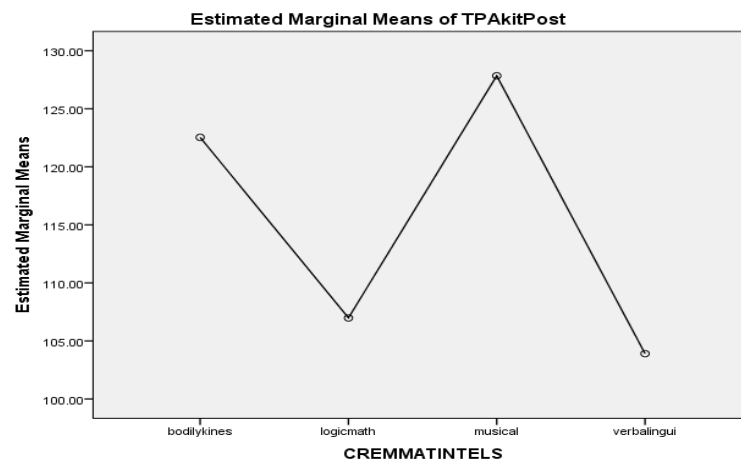


Figure II: Graphic Presentation of CREMMAT Assessment for the Studied Intels

In answer to research question two and from the descriptive statistics reported, the researchers deciphered that there are some differences across gender divides in the four Intels. The results of the CREMMAT of Musical Intel for female students (mean = 28.27, SD = 5.61) were higher than those of male students (mean = 24.60, SD = 4.95). The mean scores on the Verbal-linguistic were higher for female students (mean = 25.36, SD = 5.85) than for the male participants (mean = 22.82, SD = 4.52). The male student-participants on the other hand scored higher on the logical-mathematical Intel (mean = 26.19, SD = 5.62) than their female counterparts (mean = 24.56, SD = 4.28). The gender

groups showed no difference on their scores for bodily-kinaesthetic Intel.

In answer to research question three, the researchers discovered that participants in the experimental group ( $E_{tpakit}$ : N = 104, Mean = 125.192) outperformed those in the control group ( $C_{tpakit}$ : N = 104, Mean = 105.442). Also, the report in the table below shows that there is significant difference between the mean assessments score of the experimental group and that of the control group in the post-treatment-tests for subject-matter of studied Intels.

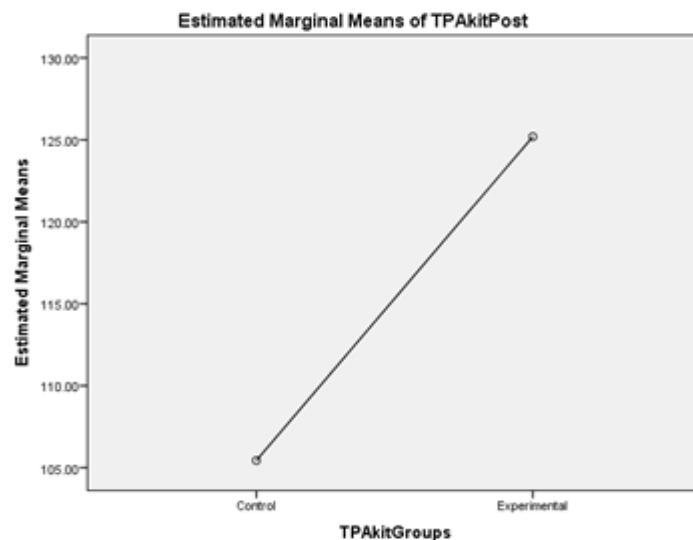


Figure III: Graphic Presentation of Post CREMMAT with TPAkit for  $C_2$  and  $E_2$

Table 1: ANCOVA Test of Between-Subjects Effects with CREMMAT Assessment  
Dependent Variable: TPAkitPost

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial $\eta^2$
Corrected Model	47557.689 <sup>a</sup>	2	23778.84	622.691	0	0.332
Intercept	11286.92	1	11286.92	295.568	0	0.451
TPAkitPre	34.92	1	34.92	0.914	0.34	0.104
TPAkitGroups	36413.81	1	36413.81	953.559	0	0.244
Error	7828.388	205	38.187			
Total	814300	208				
Corrected Total	55386.08	207				

a. R Squared = .332 (Adjusted R Squared = .325)

Significant mean score difference showed between participants' TPA pre-test and post-test ( $F_{(1,205)} = 953.56$ ;  $p = .0005$ ;  $\eta^2 = .244$ ). Pre-test result is  $p = .34_{preTPA}$ .

#### 4. Discussion

The researchers would like to disclaim at this point that they could not absolutely control the experiment because the students shared information across what happened with their separate groups. Nonetheless, the musical Intel in the study attracted the most points for the students in the study. This was followed by the bodily-kinaesthetic and the logical-mathematics in that order. At the beginning of the experiment analysis showed no significant difference between the control and experimental groups. Table above confirmed an analysis suggesting that pre-existing ability had no impact on the treatment result of the students until after the weeks of the experiment. This assured the researchers that CREMMAT assessment effected significant change on the performance of the experimental group.

Researchers observed that students were excited to view, listen and critique themselves as they examined their productions on the audio visuals. The researchers were surprised to observe that verbal-linguistic was least scored by the students. This Intel was not availed to the observed excitements in the use of technology as other Intels did.

Three of the Intels studied showed differences in the performances of the gender divide. Girls outperformed boys in verbal-linguistic and musical, while boys scored more in the show of logical-mathematics Intels. Bodily-kinaesthetic showed no difference among boys and girls. This agrees with the belief of Halpern (2002) and Ndum (2016) who maintained that cognitive abilities are not biological, but rather are socio-culturally constructed between boys and girls in schools.

Students found CREMMAT assessment with TPAkit training new and engaging. All the students participated actively. There was no dull moment during the experiment and students looked forward to the next-day after-school training and assessment with technology on the Intels. Students expressed that they understood in retrospect what they learned in JSS 3, suggesting that backward transfer took place many times during the training.

#### 5. Conclusion

Creative mind model of assessment with technology is an innovation adding to the existing body of assessment models being used in Nigerian secondary schools today. Students dread examinations. With CREMMAT, excitement and active participation replaced examination tensions and fear. Assessment models already in use seem not to be providing students with the modern day technology skills needed to address 21<sup>st</sup> century problems. Besides, today's technology seems to be requiring that assessments of psychomotor and affective domains be parts of the students' graded evaluative processes and product which should count towards their academic achievement. Cognitive domain tests run through all the models of assessment used in school while the domains of psychomotor and affective are particular to this proposed model. It also has self-evaluative and peer-evaluative advantages over others when participants sat to critique and assess their recorded performance. The experiment carried out showed that there was significant

improvement in assessment of the senior secondary school students when the creative-mind model of assessment with technology was applied. The researchers wish to conclude that if not considered as required model to be adopted, CREMMAT could be definitely an additional assessment method to complement the already existing body of assessment models in use.

#### 6. Recommendations

- 1) Government should not constrain teachers to subject-matter grading type of assessment. Teachers should be given time and freedom to conduct all-round assessment of their students since formation is not only on subject-matter. This will help to checkmate the Igbo adage '*oguru akwukwo agughi uche*' literally translated to *reading the book without reading sense*.
- 2) Also the researchers recommend that the government should include the idea of creativity in assessment in order to ensure that those who may not achieve in subject-matter are given chance to demonstrate other intelligences brought to the classrooms.
- 3) CREMMAT would give opportunities for processes rather than just products to be assessed. Hence, Nigerian government would do well to include this model of assessment so as to tap into some lost kids in school who might not be gifted in cognitive abilities assessed through paper and pen.

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## Appendix A

### Sample Items in Crenmat Identification Questionnaire

#### 1) Bodily-kinaesthetic Intel

- I like to dance
- I like to be an auto or a machine repairer
- I like to make beads
- I will like to end up in the Nollywood as an actor or actress
- I will like to be sports-man/sports-woman in the future

#### 2) Logical-mathematical Intel

- I like the game of puzzle
- It is good Mathematics is made a compulsory subject in WAEC
- I will be a scientist someday
- I am good with thinking and problem-solving
- I like it when people are logical in their presentations

#### 3) Musical Intel

- I like to learn music notes and songs
- I like singing and writing songs
- When I am with my friends, we sing
- I will like to be a singer someday
- Whenever I am down, I use music to lift up my spirit

#### 4) Verbal-linguistic Intel

- I like to learn different Nigerian languages
  - I like to compose poems
  - I will like to be a preacher someday
  - I will like to be a lawyer someday
  - Writing/Talking is one of my hobbies
- Source: Developed from Howard Gardner's Multiple Intelligence, 2019

## Appendix B

### Training and Performance Assessment (TPA) Check List

Student is	Excellent = 3	Very good = 2	Good = 1
Capable			
Clever			
Purposeful			
Egotistical			
Humorous			
Individualistic			
Informal			
Insightful			
Exceptional			
Wide in interests			
Inventive			
Original			
Reflective			
Resourceful			
Self-confident			
Fancy			
Proud in self/output			
Unconventional			

Gough's Adjective Checklist (GAC), 1960. Adapted from Lopez and Snyder's Positive Psychological Assessment. p. 163.